

Scale interactions in transboundary water governance of Indus river

Syed, Tahira

*Interdisciplinary Doctorate Program in Water Diplomacy,
Tufts University, Boston, Massachusetts, USA.*
Email: Tahira.syed@tufts.edu

Choudhury, Enamul

*School of Public and International Affairs,
Wright State University, Dayton, Ohio, USA.*
Email: Enamul.choudhury@wright.edu

Abstract

Rivers cross political boundaries where water issues cut across national, subnational, and sector boundaries. We hold that addressing the scaled nature of interactions between stakeholders is a helpful way to account for the complexity of transboundary water governance and the design of governing institutions. We argue that identifying stakeholder interactions at different scales of governance is a key to understand the shifts in the nature and degrees of cooperation and conflict. Using the TWINS framework, this shifting pattern is studied in the part of Indus basin that is within Pakistan. We use historical event data from the Pakistan side of the Indus basin to show the key events of cooperation and conflict at regional, national and sub-national scales. We find varying degrees of cooperation and conflict at different scales. We show that without recognizing scale-based interactions among riparians, the nature and depth of conflict and cooperation among all stakeholders remains obscured in the superficial understanding of cooperation as the official version holds. We argue that a contingent approach to study cooperation and conflict at multiple scales and among multiple stakeholders is needed to assess the true nature and degree of cooperation and the ensuing effectiveness of transboundary governance structures.

Keywords: scale, transboundary water governance, cooperation, conflict, TWINS

1. Introduction

Issues of scale in transboundary water governance (TWG hereon) have gained incremental importance for understanding not only the hydrological characteristics of a river basin, but also the social and political scope of water as a common pool resource. Increasingly researchers highlight scale interactions as a general topic (Cohen & McCarthy, 2015; Feitelson & Fischhendler, 2009; Gibson, Ostrom, & Anh, 2000; Moss & Newig, 2010;

Norman & Bakker, 2015; Saruchera & Lautze, 2015; Speed, Li, Le Quesne, Pegram, & Zhiwei, 2013). On the other hand, scholars in environmental and human geography and in studies of socio-ecological-systems have explored the multi-scalar characteristics of cooperation and conflict in TWG. For instance, Norman, Cohen, and Bakker (2013) examined how water governance has reconfigured through the inclusion of multiple actors involved in upwards, downwards and outwards relationship in a watershed, while Reed and Bruyneel (2010) show how both state and non-state actors impacted policy and decision making.

There is growing acknowledgement that addressing scale interactions is essential to understand the political processes involved in water governance decision making (Lebel, Garden, & Imamura, 2005; Norman & Bakker, 2015; Swyngedouw, 2004; Vincent, 2007). However, traditionally, scholars of TWG have focused on formal state-to-state governance structures (Furlong, 2010) or the importance of state security and environmental security as the primary reason for forming these structures (Akamani & Wilson, 2011; Hirsch & Jensen, 2006). The issue of scale disaggregates the securitization construct, when decisions related to water security for a nation-state are deconstructed to reflect the decisions and actions of relevant actors at lower scales. For instance, Norman et al. (2013), refer to scale as the relationship between geographic and political units of all sizes and then identified trends in relations between United States and Canada that point to scale-sensitive shifts in TWG. TWG thus constitutes of interconnected processes that function across scales, which in turn, structure the shifting nature and degree of cooperation and conflict that characterizes the governance process. If this is the case, a key question is – how TWG at one scale is linked to governance issues at and across other scales?

We argue that to operationalize the understanding of how scaled interactions play out in TWG, a contingent approach is needed to study cooperation and conflict at multiple scales and among multiple stakeholders. We maintain that national level treaty which dominates as the focal mechanism of effective TWG is insufficient to account for meaningful governance of the basin. Stakeholders at the subnational levels also need to be included in the process. Furthermore, the governance process is generally depicted to be based primarily on the means of cooperation, where conflict is often viewed as antithetical to effective cooperation. We use the Transboundary Water Interaction NexuS (TWINS) framework proposed by Mirumachi (2007) and further developed by Zeitoun and Mirumachi (2008) and Allan and Mirumachi (2013) for a systematic analysis of shared water resources to show the co-existence of cooperation and conflict over time. The TWINS framework is used to illustrate the shifting degrees of cooperation and conflict over time in the Indus River basin at different scales of governance – international or global, regional, national, and sub-national or local level. Thus, by addressing multiple scales of interaction, riparian relations based on cooperation *or* conflict, as well as cooperation *and* conflict can be accounted for in the governance process (Mirumachi, 2015; Moss & Newig, 2010; Norman et al., 2013).

The Indus River case is used in this paper to illustrate the value of addressing the dynamic pattern of stakeholder interactions at multiple scales in a particular context. We seek to: (a) expand the scope of traditional TWG in order to address the issues and interests that remain marginalized and subsumed under the concept of national governance; and

(b) through the use of scale, operationalize TWG to account for scale-specific conflict and cooperation. The choice of Indus River is based on three interrelated events.

1. An evolutionary trajectory of cooperation and conflict in governing the river, in which the 1960 treaty is an instance of a TWG agreement.
2. The continuing validation of the utility of the treaty despite political disputes, and even wars between India and Pakistan.
3. The interaction between the national and provincial governments, and the institutionalization of agreement as the means of resolving disputes between the national and provincial governments.

There is good coverage of historical events in the governance of Indus River that led to the 1960 Indus Water Treaty as well as events transpiring at national levels within Pakistan and India and at sub-national levels within these countries (Biswas, 1992; Choudhury & Islam, 2015; Salman & Uperty, 2002). We rely on this literature to document historical events at multiple scales – international, national and sub-national. For national and sub-national levels, we use historical data from Pakistan on governance of Indus waters.

In the paper, we provide a brief background and the geo-physical characteristics of the Indus River to highlight the contentious nature of the Basin and the geo-political history of Indus Water Treaty. We then present the conceptualization of scale issues in TWG, followed by an analysis of the riparian relations in Indus River. Next, we plot cooperation and conflict as well as the nature of cross-scale interactions using the TWINS framework. Finally, we provide a summary of observations from the scaled plots of TWINS framework and map the scale-based interactions of TWG processes and structures.

2. Scale issues in transboundary water governance: Framework for cross-scale interactions of TWG structures

The literature on the state of global water governance presents a complex and multifaceted scenario of competing interests among multiple actors with little understanding of what characterizes best management arrangements when it comes to water governance (Groenfeldt & Schmidt, 2013; Gupta & Pahl-Wostl, 2013; Lebel et al., 2005). While the meaning of governance is not yet settled, a concise understanding is provided by the United Nations Development Program that describes governance as the “exercise of economic, political and administrative authority to manage a country’s affairs at all levels . . . (including) the mechanisms, processes and institutions through which citizens and groups articulate their interests, exercise their legal rights, meet their obligations and mediate their differences” (UNDP in Rogers & Hall, 2003, p. 7). In the context of water governance, the Global Water Partnership similarly addressed the process to include the “range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services at different levels of society” (GWP in Rogers & Hall, 2003, p. 7). Given this meaning of governance, the TWG structures thus constitute of the mechanisms that arise from the norms that are set within treaties, agreements, institutions,

organizations and agencies operating at various levels. In this paper, we refer to such TWG structures as agreements and institutions linking the riparians of a shared river basin.

We use the term ‘scale’ in relation to geographic or spatial sense. However, in the literature, scale refers to various dimensions including spatial, temporal, systems, governance, political boundaries, economic scale, etc. Gibson et al. (2000, p. 219) defines scale as: [. . .] “the spatial, temporal, quantitative, or analytical dimensions used by scientists to measure and study objects and processes. The term levels, on the other hand refer to locations along a scale”. While Norman and Bakker (2015) explore the socio-ecological-systems perspective in negotiating water governance and emphasize the need for critical thinking on the ‘politics of scale’ as an important element to evaluate water governance decisions and structures; the work done by Padt, Opdam, Polman, and Termeer (2014) provides an explanation of different analytical approaches to study scale issues. One such approach is to distinguish between physical characteristics (spatial and temporal) and relational characteristics (between riparians situated at different locations in a watershed). It is this approach that the paper adopts by focusing on the relational aspects of scale, while using the physical aspects to show how cooperation and conflict have shifted over time and in space at the international or global, regional, national, and sub-national or local level (see Figure 1). In the context of TWG, the meaning of scale includes both the scale of systems of cooperation and conflict as well as their effect on other levels. Thus, the governance process is subjected to cross-scale effects.

Cross-scale interactions refer to processes at one spatial or temporal scale interacting with processes at another scale, often leading to nonlinear dynamics (Peters, Bestelmeyer, & Turner, 2007). For example, environmental assessments are subject to biases arising from choice of scales (Lebel et al., 2005). Similarly, Ostrom (1992) describes the relationships and interactions among actors (institutions and individuals) to directly affect their ability to engage in collective action in governing common pool resources. Thus, it is the scale of operation that mediates the ability of actors to decide on the effective forms of cooperative or non-cooperative actions.

The interactions between riparians within a transboundary context are based on ensuring water security in terms of the availability and benefits derived by each riparian state. For example, scholars have referred to the costs and benefits of trade-offs (Grey & Sadoff, 2007); virtual water trade (Hoekstra & Hung, 2002); ecological services and socio-ecological systems (Norman & Bakker, 2015); water as a human right (UN Water Reports, 2012); and

Levels of Authority In a River Basin	Scale of Governance in a River Basin			
	International	Regional	National	Local
International				
National				
Local				
Civic				

Figure 1. Map of Cross-scale Linkages between scale and TWG Structures

sharing water as a basis of avoiding political conflicts and initiating cooperative relation to address other contentious issues (Allan, 2003; Cascão & Zeitoun, 2010). The characterization of transboundary water interactions as a political process is embedded in the securitization theory which addresses how certain issues become linked to 'existential threats' that merits 'emergency measures' to safeguard the interests of the state and justify actions that may otherwise be considered 'outside the normal bounds of political procedure' (Buzan & Hansen, 2009; Buzan, Waeber, & de Wilde, 1998). Thus, issues concerning water security become linked to wider national security concerns, as nation-states choose to act unilaterally to 'ensure water security for their state' in order to secure and promote larger 'national-interests' (Zeitoun, Mirumachi, & Warner, 2010). A growing body of literature have taken the discourse on water security beyond the availability of acceptable water quantity and quality issues to the consideration of benefit sharing, mutual challenges and interdependence. For instance, Grey and Sadoff (2007) state that achieving water security is never without costs and benefits that derive from the trade-offs in negotiating water and require the balancing and sequencing of investments in water infrastructure and institutions. Similarly, the mutual challenges faced by water-insecure countries include – among others – consistently increasing food demands for growing populations, an enhanced understanding of socially and environmentally sound practices for water management and the acceptance of climate change impacts on hydrological balance (Cosens & Williams, 2012; Furlong, 2010; Groenfeldt & Schmidt, 2013). These challenges have increased an appreciation of interdependencies among riparians and managing water resources as an essential resource for the common good of society. This expanded view suggests that action in one part of the basin impacts other parts, and thus, water sharing decisions need to include the *perceived* costs and benefits of all the affected parties involved (Dinar, Dinar, McCaffrey, & McKinney, 2007; Priscolli & Wolf, 2009; Wolf, 2010).

Despite the salience of this governance discourse, the securitization theory of TWG provides only a partial understanding of the effectiveness of the governance structure and process. This is because, it is bound within pre-established national scale where agreements are specific to signatory parties, with national level institutions given specific mandates to implement the agreement. In contrast, addressing scale issues in TWG expands the understanding of governance as a political process within and across riparian states (Norman & Bakker, 2015). Thus, the issue of scale in TWG structures extends the securitization construct by linking decisions related to water security for a nation-state to the decisions and actions of other actors operating at subnational or international scale. While there is no set way of forming the best TWG structures, the functions of promoting cooperation and/or reducing conflict both need to be accounted for. We maintain that effective TWG structures arise from scale and cross-scale interactions that occur over spatial and temporal scales involving different stakeholders and institutional arrangements. Furthermore, the effectiveness of the TWG structures also depends on factors like the ability of these structures to adapt to emergent problems such as climate change that impacts a river system, political transitions within riparian countries; and the quality and extent of cooperation between riparians. To track the shifting degrees of cooperation and conflict in relation to changes in exogenous or endogenous factors operating at different scales, we have used the TWINS framework.

3. TWINS analysis of cooperation-conflict intensities in the Indus basin

To track how scale and cross-scale interactions have shaped the legal, policy and institutional arrangements over time, the TWINS matrix is used to capture key events from the 1900s to the current period. For an in-depth understanding of the national and sub-national interactions of the governance process, the analysis here addresses only the cross-scale interactions within Pakistan. First, we provide a brief introduction to the TWINS framework followed by the description of the study region – the Indus River Basin. We then present the cooperative and conflictive nature of riparian relations by creating timelines based on key historic events since 1940s to date. The timelines are created at regional and national scales where regional scale shows the interactions between India and Pakistan and national scale shows interactions between Sindh and Punjab provinces in Pakistan.

3.1. An introduction to the TWINS framework

The Transboundary Waters Interaction Nexus (TWINS) framework emerged from Mirumachi’s (2007) conceptualization of cooperation and conflict as dual nature of all interactions on water use. Adding to the argument, Zeitoun and Mirumachi (2008) state that conflict and cooperation not only co-exist, but examining only conflict or only cooperation contradicts the true nature of interactions among riparians where most of interactions point to a state of cooperation coexisting with conflict. In dismissing the paradigm that any conflict is ‘bad’, and that all forms of cooperation are ‘good’. The TWINS framework is based on considering event positions on a two-dimensional matrix rather than at discrete locations in a spectrum of conflict to cooperation. The framework is founded on Craig’s (1993) argument that there are high and low levels of both cooperation and conflict, showing them on a 2 × 2 matrix, Mirumachi (2007) expanded this to a 5 × 4 matrix to provide a more robust framework for examining the co-existence of cooperation and conflict. The 5 × 4 matrix (Figure 2) is built on multiple levels of intensity in order to highlight the degrees of cooperation and conflict at any given point – thus depicting a more nuanced description of interactions than simply classifying them as cooperative or conflictive. Mirumachi’s

	Low High	← Cooperation Intensity →				
Low ↑		Confrontation on Issues	Ad-hoc Joint Action	Common Goal Formation	Common Norm Formation	Collective Identity Formation
Conflict Intensity	Non-Politicization					
↓	Securitization					
	Opportunism					
High	Violence					

Figure 2. TWINS Matrix of Interactions (Source: Adapted from Mirumachi, 2015)

TWINS framework does not place conflict or cooperation at the center of analysis, rather, it focuses on the process through which actors engage over (real and constructed) issues of water scarcity, abundance and watershed degradation (Mirumachi, 2015¹).

In describing the transboundary water interactions, the TWINS framework utilizes the concepts of hydrocracy (hydro-bureaucracy) and speech acts. Hydrocracy refers to the institutional structures deployed for managing the water resources such as ministries and departments responsible for agriculture, irrigation, hydropower, etc. whereas speech acts are verbal acts that create social facts, establish relations between actors and construct the rules of relationships (Mirumachi, 2015). In this paper, while we do not explicitly use the term hydrocracy, the intent is to refer to the various TWG structures such as agreements and institutions in the same context. At the regional scale, these TWG structures include the Indus Water Treaty (IWT) and the Permanent Indus Commission between India and Pakistan, while at the national scale, the TWG structures include the provinces of Punjab and Sindh through the Water Apportionment Act (WAA) and the Indus River System Authority (IRSA).

3.2. *The Indus river basin: Geo-physical characteristics and riparian interactions*

The Indus River ranks 22nd among the world's large rivers with its length at 3180 km (1976 miles). The Indus originates from the Himalayan mountains in the Tibetan Plateau in China and flows southwards through the Ladakh Region in Kashmir, Gilgit-Baltistan and almost the entire length of Pakistan draining into the Arabian Sea. The Indus Basin area is approximately 1.12 million km², comprising of nearly 65% of Pakistan's total area (520,000 km²) and with only 14% in India (440,000 km²), 11% in Afghanistan (72,000 km²) and just 1% in China (88,000 km²). The total water withdrawal in the Basin is estimated at 299 km³, with irrigation water withdrawal being the most significant at 93% of total withdrawal. The Indus Basin is primarily agricultural. Although only the twelfth-largest drainage basin in the world, its irrigation network - the IBIS - is by far the largest contiguous irrigation system in the world (Condon, Kriens, Lohani, & Sattar, 2014). The irrigation withdrawal account at 63% for Pakistan, 36% for India, just about 1% for Afghanistan, and a mere 0.04% for China. The importance of Indus River is amplified by the nearly quarter of a million people that depend on its waters in a largely semi-arid environment (FAO, 2011; Mustafa, 2010). The disproportionate distribution of the Basin among its riparians has geo-political implications for each country, but more importantly for Pakistan, given the country's near existential dependence on the Indus River for its economy and food security (Mustafa, 2010; Zafar & Wirsing, 2017). The Indus River Basin comprises of six major tributaries – Sutlej, Ravi, Beas (originating in India), Kabul (originating in Afghanistan) and Jhelum and Chenab (originating in Pakistan). During the bilateral negotiations after the 1947 partition of the sub-continent into India and Pakistan, the three tributaries of Sutlej, Ravi, and Beas were designated as the Eastern rivers belonging to India, while the Jhelum and Chenab along with the Indus main-stream, were designated as the Western rivers belonging to Pakistan (Zafar & Wirsing, 2017).

¹A comprehensive account of TWINS framework and description of key concepts can be found in Mirumachi, 2015.

Tensions over sharing the Indus waters are more than hundred years old since with the British rulers undertaking infrastructure development in the 1900s to provide irrigation for increasing agricultural production. After August 1947, with the division of the British India into present day India and Pakistan, the dialogue over Indus waters became international. The turn of events during the early 1952 led to the involvement of the World Bank transpiring into 8 years of negotiations before signing of the Indus Water Treaty (IWT) in September 1960. The treaty allocated the “eastern rivers” to India (Beas, Sutlej, and Ravi) and “western rivers” to Pakistan (Chenab, Jhelum, and Indus) (Briscoe & Qamar, 2006; Wolf & Newton, 2008). The IWT prescribed arrangements for jointly administering the implementation of the agreement thus establishing the Permanent Indus Commission between India and Pakistan.

Within Pakistan, at the national level, the ensuing disputes between two provinces (Sindh and Punjab), gave rise to a series of events and discussions that led to the signing of the Water Apportionment Accord (WAA) in March 1991. The objective of this Accord was to provide overarching guidelines for water allocation (Briscoe & Qamar, 2006). To regulate the implementation of these guidelines, the Indus River System Authority (IRSA) was established in 1992. While the 1991 WAA is an attempt to address the inter-provincial water allocation problem, other approaches such as better water use planning, demand management, and participatory irrigation management were also at play in Pakistan (Briscoe & Qamar, 2006). The late 1990s and early 2000s witnessed an increased interest in Indus management reforms – leading to participatory irrigation management and transfer of the management of minor infrastructure through the Area Water Boards (AWBs). The existence and level of functionality of the AWBs is most advanced in the province of Sindh, which has passed the Sindh Water Management Ordinance (SWMO) of 2002, and formed AWBs in three main canal areas on the left bank of Indus covering about 1.8 million hectares of land or 30% of the irrigated area in Sindh (World Bank, 2007).

These developments have led to a TWG structure operating at two scales: (i) regional scale structures and their interactions through the IWT and the Permanent Indus Commission between India and Pakistan; and (ii) national scale structures and interactions over time between two provinces of Pakistan – Punjab and Sindh through the WAA and the IRSA. For the regional scale, this paper uses the historical data of documented events that led to the signing of IWT and the formation of Permanent Commission. For the national scale, the documentation relating to events that led to the formulation and promulgation of WAA and establishment of IRSA are used as data points for the scaled analysis of TWG interactions.

3.3. Regional scale interactions between India and Pakistan

At the regional (basin) level, the interaction between the riparian countries of India and Pakistan forms the basis of the TWG of Indus water. The interactions can be tracked through the chronology of a temporal scale based on the evolution of interactions. The temporal scale utilized in this analysis is based on time-periods that mark off important events indicating significant shifts in riparian interactions. Each period is identified with a pointer number in the TWINS matrix in Figure 3, which plots the nature of the evolution. The periods used are: (1) 1941–1947; (2) 1948–1950; (3) 1951–1956; (4) 1956–1960; and (5) 1961–present.

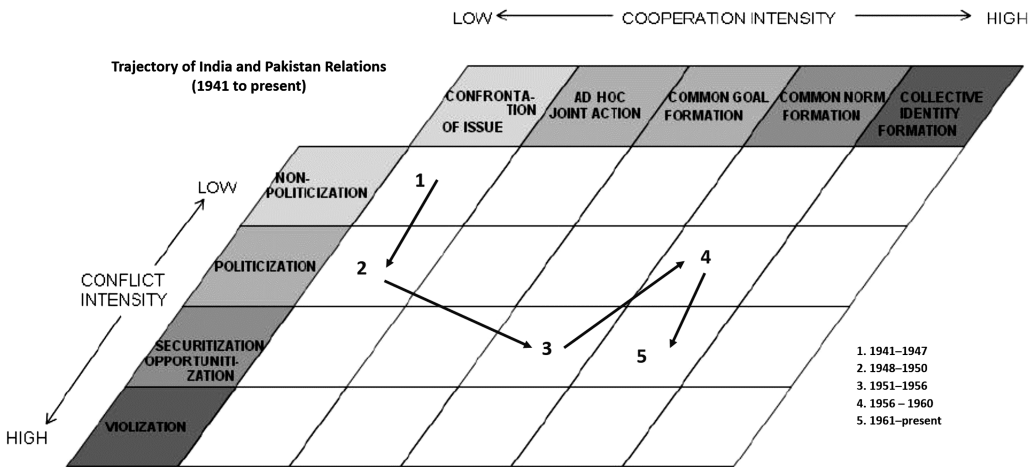


Figure 3. Trajectory of India-Pakistan Relations (1941- present)

1941 to 1947 The most significant event in the history of the Indus Basin is the partition of Indian Sub-continent into present date India and Pakistan in August of 1947. After 1947, the chief engineers of eastern Punjab (in the newly formed India) and the western Punjab and Sindh (in the newly formed Pakistan), jointly re-evaluated their water needs and arrived at a “standstill agreement” to freeze water allocations until March 31, 1948. This agreement was indeed a stand-still mechanism for the newly formed nations. While it delayed the decision making to another day, it did nothing to address the challenges that the post-independence water allocation created. This became a matter of critical importance especially for Pakistan as the new downstream riparian. Thus, pointer number 1 in the left quadrant of the matrix classifies the “standstill agreement” as an example of emergence of issue confrontation through the de-politicization of the water allocation problem.

1948 to 1950 At the end of the agreed period, on April 1, 1948, India discontinued the flow to Dipalpur Canal and the main branches of Upper Bari Doab Canal for over a month, before resuming water delivery as negotiated in the standstill agreement. By May 1948, India and Pakistan reached an ad hoc agreement where India assured that Pakistan will be allowed to develop alternate sources before India withdraws water delivery (Salman & Uprety, 2002). Concerns were expressed by national authorities in Pakistan over this arrangement calling for a joint conference on “equitable apportionment of all common waters” while proposing third party mediation through the World Court. India objected to third party involvement and suggested that the judiciary from each country review the dispute first. This resulted in a stalemate lasting throughout 1950. Although, the interaction between the two countries became characterized by increased conflict intensity by moving to a politicized domain, confrontation on issues continued. This event is plotted with pointer number 2 in the second to top box on the left quadrant of the matrix.

1951 to 1956 A significant turn of events marks this decade. In 1951, the former chairman of the Tennessee Valley Authority, David Lilienthal, published an article with the proposal for resolving the on-going dispute between the two nation states. Lilienthal's initial diplomatic efforts and recommendations were taken up by the then President of the World Bank, Eugene Black, who invited both parties (India and Pakistan) to Washington. A series of meetings were held in early 1952, where the World Bank noted that a "common understanding" can be reached, where at the least, "neither side will diminish supplies for existing uses" to the detriment of the other (Wolf & Newton, 2008).

The working party consisting of engineers from India and Pakistan agreed to: (i) establish projected supply and demand; (ii) estimate available and desired data; and (iii) prepare cost estimates for necessary infrastructure with proposed construction schedule. In 1953, each side submitted its plan with proposed allocations and sources, and in early 1954, the World Bank put forth its own proposal of dividing Indus water with western tributaries going to Pakistan and the eastern ones going to India, with the condition that, Pakistan will receive continued deliveries during the transition period. While India quickly accepted the proposal, Pakistan remained less enthusiastic because it would now have to replace existing facilities. In 1956, in response to this qualification, the World Bank proposed that India finances the replacement facilities in Pakistan. The events during 1951–1956 plotted with pointer number 3, shows a noticeable shift in riparian interactions from lower to higher conflict intensity over water allocation.

1956–1960 After a long back and forth, at the end of 1958, the disagreement continued over identifying the "replacement" storage facilities for which India would pay, from those that will be considered "new developments," to be financed by Pakistan. The stalemate ended with a visit of the World Bank President to India and Pakistan in 1959, when he suggested that India's share should be based upon fixed amount instead by facility, while the Bank would arrange the remaining finances for Pakistan. With this milestone of cooperation achieved, in September 1960, the World Bank established the Indus Basin Development Fund Agreement, mobilizing approximately US\$900 million. This paved the way for signing of the Indus Water Treaty in Karachi on September 19, 1960, calling upon engineers from India and Pakistan to constitute the Permanent Indus Commission.

The events during 1956–60, as plotted with pointer number 4, shows a movement towards greater cooperation in riparian relations with common goal formation. At the same time, the relation also remained relatively high on the conflict intensity dimension with the securitization of water issues in both countries.

1961 to present Over time, while the Indus Waters Treaty prevailed, more disagreements emerged between India and Pakistan, including the 1965–66 non-delivery of waters by India; the Wular Barrage and the Baglihar dam disputes (Salman & Uprety, 2002). Other major water related tensions in the recent past include the desire by both countries to have control over Siachen Glacier, which is a key watershed in the Himalayas feeding into rivers of both India and Pakistan. This has been an on-going dispute since 1984 which erupted into brief episodes of armed conflicts with most recent being in 1999 (Gokhale, 2014). While the overall characterization of interactions between India and Pakistan remains in

the high conflict intensity quadrant with the continuation of securitization, the IWT through the functioning of the Permanent Commission moved to even higher cooperation intensity with the common norm formation that remains operational despite new events of conflicts and giving higher weight to cooperation intensity. This set of interaction is plotted with pointer number 5 in the bottom right quadrant on the TWINS matrix.

The TWINS plot for the Indus Basin, as depicted in Figure 3, does not cover all types of transboundary relations between the two riparian states. For instance, sharing of data and technical cooperation for flood management is a recent area where some joint action for sharing hydro-met data has happened between the two countries. Moench and Dixit (2004) cite India’s work on watershed development in drought-prone areas as an initial tangible mechanism for linking development with disaster mitigation. Wilby (2010) has cited several cooperative programmes for joint flood management in the context of climate observation and data sharing for improved accuracy and lead-times to forecast floods. What is noticeable here is that very little progress on drawing joint agreements has happened between the two countries, while much of the cooperation for flood management has remained outside bilateral government relations, hence, not plotted on the TWINS matrix.

3.4. National scale interactions between provinces within Pakistan

As in the scale of the regional basin, so too at the national scale within Pakistan, the interaction between the riparian sub-national provinces of Sindh and Punjab forms a component of TWG of Indus. The TWG at this scale can be plotted with the temporal chronology of interactions between the provincial and national level governance. The temporal scale utilized in this analysis is based on time-periods that mark off important shifts in interactions. Each period is identified with a pointer number in the TWINS matrix in Figure 4, which plots the nature of the evolution of governance.

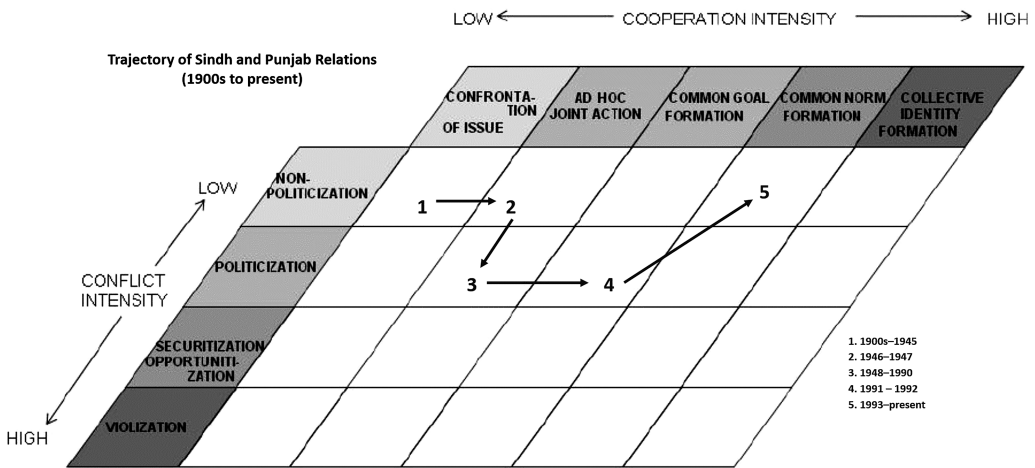


Figure 4. Trajectory of Sindh-Punjab Relations (early 1990s to present)

1900s to 1945 The inter-state distribution of waters of Indus and the ensuing differences of opinions pre-date the modern history of the division of Indian subcontinent into India and Pakistan in 1947. In the early 1900s, the ruling British government devised a detailed plan to develop infrastructure for irrigation by diverting and controlling the Indus flow. The infrastructure development created significant impacts for agricultural economy of the region and gave rise to perceptions of disproportionate allocation favouring the upper riparian – the province of Punjab – over the lower riparian – the Sindh province (Mustafa, 2010). The seed for distrust was thus planted between the two riparians and the distribution of Indus waters became an area of active dispute. Since the mid-20th century, as the infrastructure developed, more complex relationships emerged, and the opposition by the lower riparian (Sindh) also grew in voice and frequency against Punjab's plan to construct additional storage and regulatory infrastructure (Mustafa, 2010). The early attempts to address the disputes resulted in the 1945 Sindh-Punjab Agreement, formulated by the British, as a solution to introduce equity in water distribution amongst the two provinces (IUCN, 2010). The 1945 Agreement stated that Sindh has the right to receive Indus waters and allocated 75% of main-stem Indus River to Sindh and 25% to Punjab, whereas 94% from the eastern tributaries were given to Punjab and 6% to Sindh (Mustafa, 2010). This formula remained in force up until 1947 when the sub-continent divided into two independent nations of India and Pakistan. These events are interpreted on the TWINS matrix with pointer number 1 (in Figure 4) in the upper left quadrant showing both low conflict and cooperation, with conflict over issues becoming more evident.

1946 to 1947 The water sharing formula could not immediately be reviewed, because, when the British Act of Parliament was passed on July 18, 1947, the boundary between the two new nations was not demarcated, and thus, it was impractical to deal with the allocation of water (Salman & Uprety, 2002). As the newly formed federal government in Pakistan began allocating water on an ad hoc basis, the perceptions in Sindh largely viewed this practice as favouring the province of Punjab. While this sentiment continued, the provincial differences were overshadowed by the emerging national interests of the newly formed Pakistan (from 1946 to 1947). These interactions are plotted with pointer number 2 on the TWINS matrix, showing the de-politicization of conflict, and a shift towards cooperation through ad hoc joint action – i.e. maintaining the status quo. These interactions are characterized in the upper left quadrant of TWINS matrix as low conflict, yet showing a slight increase in cooperation even though, the core issues were not resolved.

1948 to 1990 During the years following the 1947 partition, no significant shift occurred in addressing the inter-provincial cooperation. Development of Terbela and Mangla dams in 1960s and 1970s, led to the Green Revolution of enhanced agricultural production, which added strength to the inter-provincial dispute over water sharing. Between 1948 and 1990, several attempts were made to address the dispute through technical committees – namely the Akhtar Hussain Committee (1968), Fazl-e-Akbar Committee (1970), Anwar-ul-Haq

Commission (1981) and Haleem Committee (1983). With these attempts, a gradual politicization of the conflict between Sindh and Punjab emerged that eventually led to an agreed formula for water sharing, based on 10-Day Seasonal System-wise Adjusted Allocations submitted by each province. While the details of the Water Apportionment Accord (WAA) was negotiated – the status quo was maintained which can best be termed as ad hoc joint action – low on cooperation intensity, but raising the politicization of the water dispute with a shift in conflict intensity. These interactions are shown with pointer number 3 in the left quadrants of the TWINS matrix.

1991 to 1992 The Water Apportionment Accord (WAA) was signed between the two provinces in March 1991. It was seen as a concrete step towards addressing the inter-provincial distrust through providing overarching guidelines for water allocation and monitoring through the newly established Indus River System Authority (IRSA). The IRSA was formed in 1992, and at that time was seen as the key custodian for implementing the WAA to address the long-standing dispute over equitable distribution of Indus flows. The WAA has been regarded as a key achievement, since it defines unambiguously and in perpetuity, the shares of available water which can be used by each of the provinces (Briscoe & Qamar, 2006). The WAA was based on the following parameters:

- Water entitlements were based on existing use of water based on the average water withdrawal for the period 1977 to 1982, where the ten daily uses would be adjusted pro-rata to correspond to the seasonal allocations of the different canal systems.
- An automatic process for adjusting entitlements depending on availability was specified where the ten daily uses would be adjusted pro-rata to correspond to the indicated seasonal allocations of the different canal systems and would form the basis for sharing shortages and surpluses.
- Provinces were allowed to use their allocation in any way that they want, where no restrictions would be placed on the provinces to undertake new projects within their agreed shares, and the provinces will have the freedom within their allocations to modify system-wide and period-wise uses.
- The Accord implied that in major parts of the Indus Basin irrigation system, there are well-defined entitlements at all levels, from the international, through the interprovincial, and down to canal commands, distributaries, outlets, and ultimately to each farmer on a water course.

The WAA parameters aspire to good-governance in sharing water resources and were agreed through an extended political negotiation process. The negotiation covered provincial population and the area of irrigated lands as the primary criteria in apportioning the available water. For instance, the adjustment of entitlements depending on annual availability is an important parameter that is adhered by IRSA through adjusting up-or-down based on a formula included in the WAA. In 2007, the Punjab province made provisions to publicly declare its canal-head entitlements and deliveries online through the website of Punjab Irrigation &

Power Department (Condon et al., 2014). Similarly, the flexibility for riparians (Sindh and Punjab namely, but also the other two provinces) to decide and modify their allocations between system-wide and period-wise uses. This provided the quintessential expression of provincial empowerment to make decisions – an empowerment often exercised by Punjab (and to certain extent by Sindh) in planning the conjunctive use of surface and groundwater.

While the 1991 WAA provided a solid foundation for framing the disputes over Indus flows and equitable distribution of its waters, in practice, the existing uses of water supply to the provinces remained largely unchanged. Not surprisingly, the distrust amongst Sindh and Punjab continued, partly, due to the difference in interpretation of the WAA. Similarly, the adjustment of entitlements also prescribed that if a province is unable to make full use of its allocation, the surplus may be used by another province without acquiring a right to it. Additionally, the fact that the entitlements were explained as aggregates of specified historical uses in different canal commands, it meant that the Accord was implicitly specifying the distribution of the provincial shares to each of the existing canal commands allocation, which in Punjab are followed to this day. The role of IRSA was also contested due to the perceived influence of Punjab province given its larger population, economy and representation in governing and policy making institutions (Briscoe & Qamar, 2006). Therefore, the interactions that led to the WAA formulation and enforcement is best described with pointer number 4 in the middle quadrant, as an increase in politicization along the conflict intensity, with common goal formation along the cooperation intensity.

1993 to present The WAA and IRSA are seen as key steps towards reaching consensus between the provinces of Sindh and Punjab on water distribution and planning, additional storage, and water management infrastructures. However, to this day distrust continues as the two provinces blame each other, claiming water theft and usage in excess to their allocations. As a result, no additional storage capacity has been added to the system since 1970s, and the potential of hydropower generation as well as optimal flood management remain underachieved (Briscoe & Qamar, 2006). Another complexity that allows the continuation of provincial distrust is embedded in the nature of WAA, which by design, retains ambiguities that cannot anticipate future scenarios, like climate change induced water variability and other externalities. Studies on historical patterns and projected trends have established an increase in overall temperature and precipitation in the Basin (e.g. Rajbhandari, Shrestha, Kulkarni, Patwardhan, & Bajracharya, 2015; Yu et al., 2013). Nevertheless, there is a clear shift towards non-politicization of the political stances held by both Sindh and Punjab. This shift towards non-politicization is evident due to the efforts put in by both provinces to implement the WAA and adhere to its provisions for water allocation despite having clear differences. The WAA enforcement is the most significant effort towards common norm formation between disputing parties – hence it shows an increase in cooperation intensity on the TWINS matrix. On the other hand, despite continuing posturing by Sindh and Punjab, the dispute has gradually become depoliticized with the passage of time – showing a decrease in conflict intensity along TWINS matrix as plotted with pointer number 5.

Overall, the TWINS plot for the interactions between national and sub-national scale and the inter-provincial disputes between Sindh and Punjab show an evolution of the TWG structure over time. The trajectory of interactions, however, does not cover the interventions addressing water management issues initiated by each province. For instance, the irrigation and drainage reforms in Sindh through the Sindh Water Management Ordinance (SWMO) of 2002 is an important step for improving irrigation water management through farmers’ involvement. Since the early 2000s, Sindh is implementing the management transfer of minor infrastructure through Area Water Boards (AWBs). Similarly, Punjab is implementing an agricultural water management program through improved water use efficiency through the introduction of programs on micro-irrigation systems (World Bank, 2012).

4. Mapping cross-scale interactions between TWG structures

The specific linkages between TWG structures across governance scales are mapped to track cooperative and conflictive relations through the framework of cross-scale interactions (Figure 5). The map shows a clear absence of TWG structures at global and regional scales that can interact with structures operating at local and civic authority levels. There is no set means for the Permanent Indus Commission as the TWG structure at the regional scale to interact with the provincial authorities (local scale) or farmers organizations (civic scale). However, it can be argued that having provincial representation in IRSA and Area Water Boards might provide an indirect means for some communication, albeit indirect, from the Commission to

		Scale			
		Global	Regional	National	Local
Governance Structures	International Authority (Epistemic and Resource based)	International water law and conventions	Permanent Indus Commission	No set structure	No set structure
	National Authority	Country reporting on conventions	Country reporting of Indus Commission	Indus River System Authority	Water allocation by IRSA
	Local Authority	No set structure	No set structure	Provincial membership in IRSA	Area Water Boards
	Civic Authority	No set structure	No set structure	Data provision by WAPDA and Met Department	Farmer organizations

Figure 5. Map of Cross-scale Linkages between TWG Structures of Indus Basin

the provincial authority via the IRSA and to farmers' organizations via provincial authority. Even if such a sequence of communication is to take place, there is no likelihood that this communication will form a closed information loop that can be qualified as interaction. We argue that this limitation of interactions between TWG structures at regional scale with local scale is at best the manifestation of mandates accorded to TWG structures at the scales where these are allowed to operate. Similarly, since there is no international TWG structure that effects the national and local scale interactions of riparians, cross-scale interactions are limited between these scales. The interactions at the global and regional scales through the TWG structures at international and national levels are evident in the present structures in the Indus Basin – the Permanent Indus Commission and its regular reporting (at regional scale) and the international water law governing interactions at global scale (through conventions and countries reporting their compliance). On the other hand, interactions between national and local scales can be identified through the structures that exist at national level and its influence on national, local (provincial) and civic levels e.g. IRSA in the case of Indus Basin.

The overall findings of the scale-driven TWINS matrices (Figures 3 and 4) are summed up in the following observations:

- The starting points in both matrices (the upper left quadrants) show low cooperation, and low but gradually intensifying conflict. While the initial characterization of inter-country (India and Pakistan) and inter-provincial (Sindh and Punjab) interactions start with low cooperation and with the genesis of conflict intensities, a gradual shift is seen towards relatively high cooperation over time. This shift is characteristic of the TWG structures operating at a given scale, for instance, the shift of inter-provincial interactions towards higher cooperation intensity is more drastic in post-WAA formulation (1990 onwards), whereas, the shift of inter-country interactions towards cooperation is subjected to continued securitization of the water issue between India and Pakistan.
- The interactions at the international scale between the time-periods of 1948 to 1960 show the degree of cooperation and conflict in rapid transition from politicization to common norm formation. This is represented by the fact that a lengthy process of delicate diplomacy between the two competing countries was mediated by a third party (the World Bank). The political importance of this development almost entirely overtook the issue of intra-state dispute. This is evident by the lack of any real movement along cooperation and conflict intensities at national/sub-national scale in the post partition time-period (1947) up until some thirty years later (1990s). It was almost like the intra-state dispute between Sindh and Punjab lost its centre stage status and was overtaken by a higher level – national security interest. This did not mean that the national interest prevailed to a degree where intra-state actors resolved their differences. Rather, it only meant that the dispute between Sindh and Punjab was ignored and the issue was left to be taken on another day. Thus, we find that cooperation at the international scale coexisting with conflicts at the subnational or provincial scale.
- During the post TWG agreement periods, i.e. post IWT in 1960 at the international scale, and post WAA in 1991, at the national/sub-national scale, the riparian interactions

changed. While the time-period difference is significant – almost thirty years – the movement of riparian interactions along cooperation and conflict intensities seem very different. It was almost as if the intra-state dispute between Sindh and Punjab came back to life during the post IWT period (1960 to 1990s). One explanation for this is related to the fact that, at the international scale – not only between India and Pakistan, but also at a more global level, the signing of IWT was celebrated as a significant achievement (which it indeed have been). In contrast, at the national/sub-national scale, the differences remained unresolved and deeply politicised. With the signing of WAA in 1991, a major step towards forming a common norm was achieved. However, to date, neither Sindh nor Punjab has changed their initial stance.

Based on plotting of the key events in terms of cross-scale linkages between TWG structures, we can observe the following trends: First, the cross-scale interactions between TWG structures at the international scale and local scale and between local scale and global and regional scales have no set structures through which governance interactions take place. What this shows is a breakdown in cross-scale communication where the objectives set at a higher scale (regional and international) failed to inform decisions at local scale (sub-national and local). This however may not mean an absence of knowledge at local scale about objectives of regional and global agreements and institutions. Rather, it shows the lack of formal mechanisms to link the impact of global and national scale objectives to the operations of the local scale institutions.

Second, in the absence of any mechanism – agreement or institution – that structures interactions across local and regional and to global scales, it is impossible to track the contribution that local scale structures make in the cooperative and conflictive interactions between riparians operating at the national and regional scales.

Third, the linkages between global and regional scales may not have an influence on decision making and interactions at national and local level. This may be due to the riparians acting on their immediate scale-specific interests without having a clear link with the higher-level objectives operating at global and regional scales, even though their long-term effects are acknowledged.

Conclusion

A positive effect of TWG governance is to increase cooperation and manage the conflict among riparians. However, this approach, as we have depicted in the case of Indus needs to be multi-scaled. This is because, the TWG structure operating adequately at one scale may not address complex inter-riparian issues operating at another scale. Thus, to ascertain whether or not TWG structures are effective requires scale specific consideration of how governance structures have operated and evolved over time. Mapping and tracking the evolution of interactions reveals that while at one scale, only cooperation or conflict characterizes the governance process, at another scale, both cooperation and conflict emerged. Improved cooperation while a desirable outcome of a TWG arrangement may also become

an obstacle if the embedded decision support systems are unable to respond to the uncertainties of flow and changing stakeholders' interests, which often remains unaccounted for due to the uni-scalar focus of analysis.

The Indus River was used to point to the scale sensitive nature of transboundary water governance structures that operate both at the basin-level (international scale) and the riparian-level (including the national and sub-national scales). We chose to use TWINS framework for describing the nature of riparian interactions on the Indus River because TWINS provide a more robust analytical frame to capture the shifting degrees of cooperation and conflict. Analysis of the TWINS trajectories of Indus riparians at basin-level and riparian-level suggest that there has been an evolution of riparian interactions at both scales. While the institutions formed under IWT and WAA (sub-national/provincial bodies) have largely remained the same, they have emerged also as a result of a 'social contract' forged among affected stakeholders, to use the term coined by Ostrom (1992). For example, institutions, like the Permanent Commission and IRSA were established to allocate responsibilities among riparians. In the backdrop of the history of cooperation and conflict on the Indus River at the international, national and provincial scales, it can be argued that the principal instrument of TWG – agreements/treaties and national governance institutions – need to incorporate the developments at the subnational levels, in order to account for as well as address the uncertainties that each riparian faces in relation to the changing climate, political process, international system, and public needs.

We summarize our key observations in the following points in order to draw the implications of the research.

1. TWG cooperation as a goal in itself is insufficient without giving due consideration to the mechanisms and structures that are designed with the intention to achieve this goal.
2. TWG cooperation and conflict seen through scalar lens provides an improved understanding of the effectiveness of governance structures in relation to the needs of the affected stakeholders.
3. Even when institutional design seems appropriate, the lack of scale consideration may lead to only superficial understanding of cooperation. For instance, a seemingly cooperative state without much actual cooperation among sub-national actors renders a false sense of effective governance, and weakens the legitimacy of the current arrangement. The ability to recognize changing conditions and/or emergence of uncertainties that a scaled approach accounts for leads to a discourse of the adaptable nature of governance structures that contributes to their effectiveness.
4. Upward and downward assessment of basin-level impacts of policy decisions, institutions and how these structures operate remain essentially a scale-sensitive exercise of effective governance.

These key points of the evolution of the TWG of Indus provide important insights into the discourse of scale-sensitive TWG. While this paper presented interaction of national/sub-national scale in the Indus River within one country – Pakistan, we intend to extend the scope of mapping the process by including the intra-state disputes and national/sub-national

TWG structures for the flow of Indus in India in our next phase of research. We also invite other researchers to engage in similar analysis for the flow of Indus in India as well as on other transboundary rivers.

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