

Role and relevance of three enabling conditions to resolve inter-provincial water conflicts in the Indus basin within Pakistan

Shahmir Janjua^a, Ishtiaq Hassan^a and Shafiqul Islam^b

^a*Department of Civil Engineering, Capital University of Science and Technology, Islamabad 46000, Pakistan*

^b*Corresponding author. Department of Civil and Environmental Engineering, The Fletcher School of Law and Diplomacy, Tufts University, Medford, MA 02155, USA. E-mail: shafiqul.islam@tufts.edu*

Abstract

Addressing water access, allocation, and use becomes a complex problem when it crosses multiple boundaries: political, jurisdictional, and societal, as well as ecological, biogeochemical, and physical. This paper focuses on transboundary water management (TWM) problems among the riparians with conflicting needs and competing demands. The complexity of TWM problems arises because of interdependencies among variables, processes, actors, and institutions operating at various scales. For such situations, the traditional notion of necessary and sufficient causal conditions is not adequate to resolve TWM problems. In essence, the resolution of many TWM issues becomes contingent upon the changes that occur within the context of the problem. A key for initiating and sustaining the resolution of complex TWM issues appears to be a set of enabling conditions, not any easily identifiable and replicable causal conditions or mechanisms. Thus, before analyzing and addressing contingent and situational factors important for any TWM issues, this paper argues for a reframing of these issues and examining the role and relevance of three enabling conditions. Using the inter-provincial water conflicts for the Indus basin within Pakistan as an illustrative case, it shows why over 30 years of dialog and discourse could not create any formal water allocation agreement. Then, it discusses how the Water Apportionment Accord of 1991 created the enabling conditions to address inter-provincial water conflicts within Pakistan in an adaptive way.

Keywords: Complexity; Contingent; Enabling conditions; Inter-provincial; Transboundary water management (TWM)

Highlights

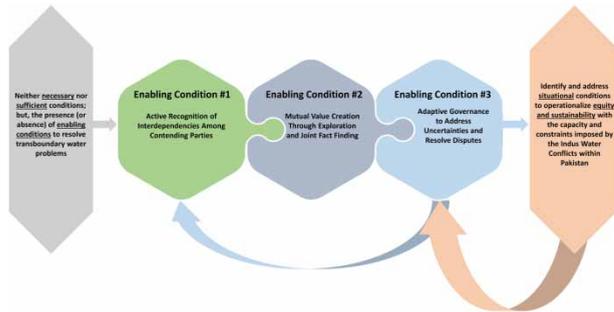
- Issues of water access, allocation, and use become complex because of the coupling of natural, social, and political processes in a transboundary setting.
- The traditional notion of necessary and sufficient causal conditions is not adequate to resolve transboundary water conflicts.
- The presence of three enabling conditions is proposed as an alternative to initiate and sustain the resolution of transboundary water issues.

doi: 10.2166/wp.2020.230

© IWA Publishing 2020

- Inter-provincial water conflicts for the Indus basin within Pakistan were used to show the efficacy of enabling conditions.

Graphical Abstract



Introduction

Despite repeated calls and efforts to develop a comprehensive approach to resolve transboundary water management (TWM) problems, search for causal mechanisms for cooperation has yet to yield any reliable theory (Choudhury & Islam, 2015, 2018). For example, in the 1950s, the United States sent two envoys to address two water conflicts: one to South Asia and the other to the Middle East. In 1960, the Indus Water Treaty (IWT) was signed, and it survived the last 60 years despite several wars between India and Pakistan during this period. Yet, it took several decades to sign the 1994 Israel–Jordan Peace Treaty. Choudhury & Islam (2015, 2018) looked at the similarities and differences for these two as well as several other TWM cases and provided a (re)framing of TWM issues. In particular, they have used the notion of complexity science, contingency, and enabling conditions to understand, explain, and resolve TWM issues.

The IWT resulted in the partitioning of the rivers between India and Pakistan. The 1960 IWT has also created a decision vacuum regarding the allocation of the Indus water among the provinces within Pakistan. Before IWT, the allocation of water within the provinces of Pakistan – primarily Sindh and Punjab – was dictated by the Sindh–Punjab agreement of 1945 (Wescoat *et al.*, 2000; Mustafa, 2010; Ahmad, 2011). Several high-level committees and commissions were appointed by the Federal Government of Pakistan between the enactment of the IWT and Water Apportionment Accord of 1991. Yet, no formal water allocation agreement materialized on how to allocate water among the provinces. This paper examines the evolution of inter-provincial water conflicts in the Indus basin within Pakistan to show why over 30 years of dialog and discourse could not create any formal water allocation agreement. It also shows why the Water Apportionment Accord of 1991 was a game-changer and how the notion of enabling conditions suggested by Choudhury & Islam (2015, 2018) can help explain the evolution and dynamics of inter-provincial water conflicts within Pakistan.

The question of how to govern and manage transboundary water for human consumption, irrigation, hydropower, urban and industrial development, socio-cultural needs, and sustainability of ecosystems continues to be an issue of concern, conflict, and cooperation. Despite its increasing sophistication,

most of this literature and discourse remains wedded to implicit assumptions about values (e.g., that cooperation is desirable and is more cost-effective than conflicts; yet, no formal agreements exist to most shared transboundary basins) and that using various methods, tools, governance structures, and institutions will yield a universal cure.

The TWM literature shows a wide range of complexity in terms of competition and cooperation that arise from the interactions and feedbacks among variables, processes, actors, and institutions. These interactions and feedback are attributed to allocation, access, and use of water related to a variety of natural, societal, and political elements. Given the complexity of TWM and its contingent manifestations, the discussion goes on to specify the conditions under which conflict arises or cooperation is attempted (Falkenmark & Suprpto, 1992; Frey, 1993; Lowi, 1995; Wolf & Hamner, 2000; Wolf et al., 2000; Zeitoun & Mirumachi, 2008; Priscoli & Wolf, 2009; De Stefano et al., 2010; Schmeier, 2013; Zawahri et al., 2016; Dinar & Dinar, 2017).

Despite repeated efforts to develop a comprehensive approach to resolving transboundary water conflicts (Swain, 1999; Uitto & Duda, 2002; Dinar, 2004; De Stefano et al., 2012; Dinar & Dinar, 2017), using the conventional notion of causality is yet to yield any reliable framework of theory, as many studies have pointed out (Yoffe et al., 2003; Dinar, 2004; Pahl-Wostl, 2007; Zawahri et al., 2016).

Yet, why have some negotiated mechanisms been successful and resilient despite the shortcomings in the agreements reached? Choudhury & Islam (2015, 2018) suggest that a key reason for such a shortcoming is that while the necessary conditions of certain aspects of causality can be agreed to (e.g., issues of scarcity and need for cooperation), the sufficient conditions cannot be easily identified and agreed upon by all involved parties. Among different modes of cooperation, direct and mediated negotiations have shown resilience in initiating, affecting, and sustaining institutional interactions among riparians, even when they remain hostile to each other on other issues (Elhance, 2000; Biswas, 2008). Choudhury & Islam (2015, 2018) suggest that reasons for such successful outcomes are contingent. More importantly, they argue that reasons for success are not easily identifiable through the conventional notion of causal conditions but to the presence of enabling conditions.

Choudhury & Islam (2015, 2018) introduced three enabling conditions that constitute a pattern of interactions in the negotiated resolution of conflicts in the Indus river between India and Pakistan and the Jordan river between Israel and Jordan. In advancing the notion of enabling conditions, they make the point that the effectiveness of these three enabling conditions rests on operationalizing the values of equity and sustainability in context-specific ways. Here, we examine the role and relevance of these three enabling conditions to resolve inter-provincial water conflicts in the Indus basin within Pakistan. Following Choudhury & Islam (2015, 2018), we highlight the key attributes of these three enabling conditions as follows:

Enabling Condition #1: Active Recognition of Interdependence

Active recognition of interdependence is a critical enabling condition because ‘active’ form of recognition is what transforms a mere desire or policy intent to a declared commitment to make it happen.

Enabling Condition #2: Mutual Value Creation

This enabling condition expands the scope and meaning of interdependence (enabling condition #1) by encouraging involved parties to explore options that create mutual value. Value creation rests on what each party can add to different options to satisfy their respective needs.

Enabling Condition #3: Adaptive Regime of Governance

This enabling condition deals with developing a governance structure and institutional capacity to act on operationalizing the mutual values created in Enabling Condition #2. It requires the governance regime to be adaptive to uncertain and changing scenarios including a dispute resolution clause to address emergent uncertainties.

One may argue that these enabling conditions are already known in terms of cooperation, negotiation, and institution building. Thus, conceptualizing them as enabling is nothing more than another jargon that creates mere semantic variation. Against such argument, Choudhury & Islam (2015) suggest that the notion of ‘active recognition’, ‘mutual value’, and ‘adaptive governance’ introduces a different framing to the conventional meaning of cooperation as conflict prevention, negotiation as mutual gain strategy, and institution building as flexible design. What follows is a brief description of the Indus basin, the history of water inter-provincial water conflicts, and an examination of the relevance of three enabling conditions in resolving inter-provincial water conflicts in the Indus basin.

The Indus basin within Pakistan

The Indus Basin Irrigation System (IBIS) is the largest contiguous irrigation system in the world. Constitutionally, water is a federal subject in Pakistan, and provinces are responsible for domestic water supply, sanitation as well as irrigation and drainage. The constitutional provisions ensure that the important decisions are administered jointly through the Council of Common Interests (CCI) (Mustafa, 2010).

IBIS comprises networks of canals, headworks, and hydropower dams (Figure 1). Pakistan is an arid country with a mean annual rainfall of less than 100 mm in parts of Baluchistan and Sindh to more than 1,500 mm in the mountains. Physical and hydrological variability makes the management of IBIS very difficult. It contributes over 20% of Pakistan’s gross domestic product (GDP) and plays an important role in the livelihood of millions of people (Ahmad *et al.*, 2014).

History of inter-provincial water conflicts in the Indus basin within Pakistan

There are four administrative units in Pakistan called provinces: Punjab, Sindh, Baluchistan, and Khyber Pakhtunkhwa (KPK). It also consists of small areas of Gilgit-Baltistan and Federally Administered Tribal Areas. The principal natural resources of Pakistan are water and arable land, and agriculture contributes significantly toward the country’s economy accounting for almost 19.8% of the GDP (Anwar & Bhatti, 2017). Out of the 27% of the cultivated land in Pakistan, Punjab has the highest proportion (63%), followed by Sindh (18%), and the remainder is equally divided between the provinces of Baluchistan and KPK (Janjua & Hassan, 2020).

Beginning with the construction of extensive canal irrigation projects by the British, the issues of water use, access, and allocation continue to be contentious. The first significant treaty between the downstream Sindh and upper riparian Punjab regarding the inter-provincial water allocation dates back to 1945. According to this treaty, 25% of the water of the main part of the Indus River was allocated to Punjab, and the remaining 75% was allocated to Sindh. Punjab was given 94% of the water

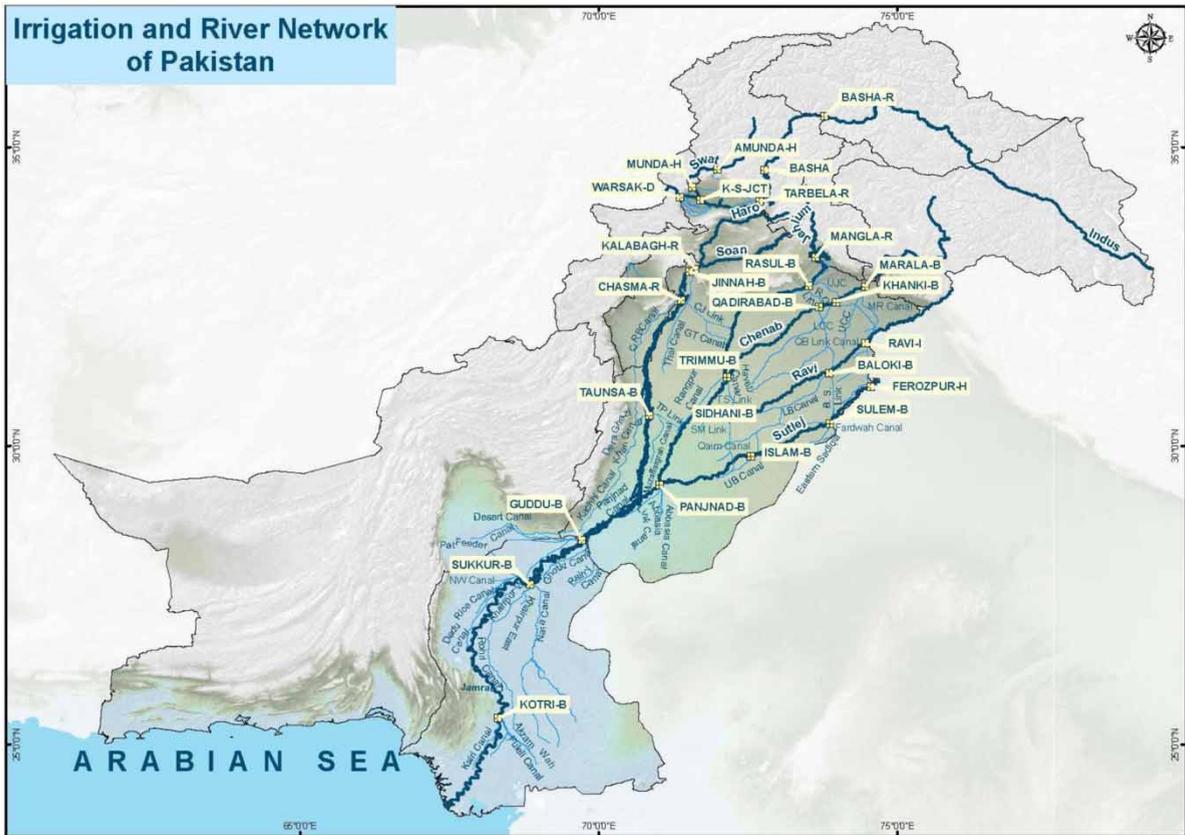


Fig. 1. Irrigation and river network of Pakistan's Indus basin. Available online: http://pakirsa.gov.pk/images/IrrigationNetwork_Pakistan.jpg.

from the five eastern tributaries of the Indus, and the remaining 6% was allocated to Sindh (Atiq *et al.*, 2020).

After the emergence of India and Pakistan as an independent nation, the IWT between India and Pakistan was signed in 1960. The IWT allocated most of Punjab's share of the Indus River (according to the 1945 agreement between Punjab and Sindh) to India. It also provided for the construction of the link canals and storages from the western half of the Indus Basin to the eastern half which was done to compensate for the water loss to India. The allocation of water and storage provisions created with the IWT was widely perceived by the Sindh to be favorable to Punjab (Mir & Muhammad, 2001).

The boundary of Punjab under the IWT treaty included the Punjab of what is now in India. Therefore, this treaty cannot be used as a guide to understand the evolution of inter-provincial TWM issues. That is, the context of the enabling conditions will be very different to discuss TWM issues within Pakistan. In other words, the context of the 1945 treaty and that of post-partition provincial interactions, and the interaction with the national government is a problem of federalism. Therefore, the context is federalist. Briscoe (2014) provided a more detailed discussion about process, substance, and implications of federalism. Thus, to understand the evolution and dynamics of inter-provincial water conflicts, we need to identify the nature of interdependencies that are relevant among the provinces within Pakistan (not

between India and Pakistan as was done with IWT). To address these inter-provincial water conflicts among the provinces, several commissions and committees were formed.

History of committees and commissions to address inter-provincial water conflicts

The IWT brought drastic changes to water allocation among provinces within Pakistan. The IWT made the 1945 agreement between Punjab and Sindh irrelevant. In the absence of any formal agreement among the provinces, water allocation was done by the Water and Power Development Authority (WAPDA) on an *ad hoc* basis. To address these contentious inter-provincial water issues, the Government of Pakistan appointed several committees and commissions as briefly discussed below. More details about these committees and commissions are available in [Mustafa \(2010\)](#) and [Khalid & Begum \(2013\)](#).

Akhtar Hussain Committee (1968)

The Government of Pakistan formed the Water Allocation and Rates Committee in 1968 under the chairmanship of Mr Akhtar Hussain. The Committee was tasked to recommend reservoir release patterns, barrage allocations, and drawdown levels. It was also asked to examine the use of groundwater with surface water. The major disputed parties were Punjab and Sindh ([Khalid & Begum, 2013](#)). The water demands of KPK and Baluchistan were small. On 30 June 1970, the committee submitted its report to the governor of West Pakistan. Unfortunately, the next day (1 July 1970) constitutionality of four provinces was dissolved, and entire West Pakistan was made into one unit to be administratively consistent with East Pakistan (now Bangladesh). Consequently, this report did not get any attention ([Khalid & Begum, 2013](#)).

Fazl-e-Akbar Committee (1970)

Another committee was set up on 15 October 1970 – chaired by the former judge of Supreme Court of Pakistan Mr Justice Fazl-e-Akbar – for the water apportionment of the Indus River System within West Pakistan. In addition to surface water allocation and storage provision considerations, the Committee was asked to examine the role of groundwater as well. The Committee could not come to a consensus and the Justice Fazl-e-Akbar formulated his recommendations and submitted his report. Recommendations of this report were discussed in October 1972 at the Governor's Conference, but no decision was finalized and the *ad hoc* allocation of water by the WAPDA continued ([Syed & Choudhury, 2018](#)).

Indus Water Commission (Anwar-ul-Haq Commission of 1981)

On the recommendation of the CCI, the President of Pakistan constituted the Indus Water Commission in 1981. The chairman of this committee was the Chief Justice of Pakistan and chief justices from four High Courts as its members. The commission was asked to prepare a report within 9 months, but it could not finalize its recommendations. In June 1982, the commission suggested to the President that the distribution of waters from the Indus and its tributaries could be based on the report of the Fazl-e-Akbar

Committee with provisions for modifications and adjustments as needed (Khalid & Begum, 2013; Bhatti & Farooq, 2014).

Haleem Committee (1983)

In March 1983, the President of Pakistan directed Chief Justice Haleem to reexamine the issue of apportionment of waters on an equitable and fair basis with the assistance of Chief Justices of High Courts of the four provinces. The Committee submitted its report to the President on 15 April 1983 with a dissent note of the Chief Justice of Peshawar High Court. Recommendations from the committee remain pending and the *ad hoc* allocation of water by the WAPDA continued until 1991 (PILDAT, 2011).

Despite the formation of several committees and commissions from the initiation of the 1960 IWT to the establishment of the 1991 Water Apportionment Act, it appears that no tangible outcome emerged to resolve inter-provincial water issues. One may speculate about several causal reasons for this outcome. For example, the supply-demand gap from the Indus was not considered to be a serious issue because provinces were addressing water shortage through overexploitation of groundwater. The Federal Government – with the military rule was preoccupied with external conflicts and threats – did not pay much attention to water issues (Anwar et al., 2018).

We make a distinction between causes and conditions to address TWM issues. In such situations, conventional causal reasoning based on specifying the effects of exogenous or antecedent factors that cause cooperation – reasoning commonly used in TWM literature; for example, in Song & Whittington (2004), Tir & Ackerman (2009), Zawahri & Mitchell (2011), and Zawahri et al. (2016) – loses its primacy. In contrast to searching for causal conditions, following Choudhury & Islam (2015), we examine the efficacy of three enabling conditions that constitute a pattern of interactions to address inter-provincial water conflicts in the Indus river within Pakistan.

Role and relevance of three enabling conditions for conflict resolution

Enabling condition #1: active recognition of interdependence among the provinces

Active recognition of interdependence means that the parties (four provinces) in the governance process agree to resolve a focal conflict and cooperate on a set of agreed upon operating rules. This can happen when parties in a conflict recognize their mutual water needs, constraints, and capacity. Although several committees and commissions were formed as discussed above, none of them played an active role in resolving the inter-provincial water conflict. In 1990, when the Federal Government took the initiative to address inter-provincial water issues, a sense of urgency was created which encouraged four provinces to engage in a dialog making the role of active recognition of interdependence relevant (Khan & Awan, 2020).

The four provinces were recognized in the 1973 constitution, and a new system of federal administration was created. Water management was considered a provincial matter, and the constitution did neither establish nor define the provincial water allocation rules. However, the doors for active participation for the provinces in the decision-making process were kept open in the constitution. A new institution called the Council of Common Interests was formed, which enabled active participation

from the provinces related to water management issues. The CCI was the first to initiate discussion around water disputes among the four provinces. The CCI would hold meetings upon the request of one or more stakeholders (provinces of Pakistan). Its functioning was similar to that of the 'Indus Water Commission' which was established as a part of the IWT. However, the CCI did not have a legal basis or a water treaty to refer to, unlike the IWT. Thus, any water-related issues were addressed by the CCI primarily through negotiation (Paukert, 2016).

After assuming the office in November 1990, the new government of Pakistan took the initiative to address provincial water disputes. A subcommittee was appointed under the supervision of the cabinet. The main purpose of this committee was to explore different options to address water disputes among the provinces (Indus River System Authority (IRSA), 1991). The CCI acted upon the recommendations from the cabinet and the 'Inter-Provincial Committee on the Apportionment of Indus Rivers' was set up in 1991. This committee first met on 30 January 1991. It held several other meetings throughout February in which the stakeholders of the provinces discussed technical and legal aspects. The committee presented its recommendations to the provincial governments. On 3 March 1991, the Chief Ministers of all the provinces met again (Yang et al., 2014).

Finally, the four Chief Ministers – with the support of CCI and the Federal Government – agreed on the water apportionment on 16 March 1991. The Water Apportionment Accord protected existing uses of canal water in each province, with recognition of the need for escape below Kotri for environmental purposes, and apportioned the 'balance of river supplies', including 'flood surpluses' and 'additional supplies' from future storages. It defined provincial water entitlements based on water availability of 141 km³, assuming that new water storages will provide additional water of around 12.33 km³ for the environmental flows (Garrick et al., 2014).

It took 30 years for this pivotal breakthrough – the Water Apportionment Accord of 1991 – to happen. The mediating role of the Prime Minister was important for this enabling condition to become a reality (Indus River System Authority (IRSA), 1991). One may argue that without the power and authority of the Prime Minister, this breakthrough would not have happened. In our assessment, mediation as the means of dispute resolution functioned here as enabling because the advisement and facilitation process of mediation allows both parties to remain engaged and negotiate their respective needs and concerns. Active involvement of a powerful mediator increased familiarity, reduced mutual vulnerability, and hence, buffered the perceived risks of cooperation among all four provinces of Pakistan. The above set of actions emerged from recognizing that if provinces recognize their interdependence, combine their efforts, and recognize each other's needs, only then, they can achieve the sustainable development of the Indus waters for the benefit of all stakeholders.

Enabling condition #2: mutual value creation through cooperation

Mutual value creation builds on the notion of exploration of options without commitment. This enabling condition allows parties to be creative in exploring options that are mutually beneficial to parties involved. This is an exploratory phase of cooperation and does not require anyone to commit to any particular option. It demystifies the notion of the zero-sum situation by allowing parties to explore what each side can gain from cooperation by connecting issues and resources from multiple sectors and by going beyond the traditional notion of allocating existing water as the only resource. We emphasize interest-based negotiation as opposed to position-based negotiation. Understanding the difference between interests and positions is a cornerstone of collaborative negotiation success and mutual

value creation through cooperation. Exploring and integrating scientific input into political decisions through joint fact finding is an important step in developing options to enhance mutual value creation (Islam & Suskind, 2015). For example, estimating the costs and benefits of a proposed irrigation project can be explored among the provinces using the notion of joint fact finding. Parties can discuss and agree on the underlying science of how to quantify the uncertainties of water availability and use so that appropriate cost and benefit for different likely scenarios can be estimated.

One way to explore mutual value creation is to have a professionally facilitated discussion among contending parties to identify and agree on mutual benefits and costs of cooperation as well as to devise instruments to secure them (Chazournes et al., 2013). An important aspect of guiding negotiations of water treaties is to ensure that the parties have an opportunity for open and candid conversation to better understand each other's position and interests. For the inter-provincial water sharing in Pakistan, this involved exploring the benefits of allocating and sharing water for agriculture and environmental needs. Through the Water Apportionment Accord, each of the four provinces achieved more benefits than they originally expected. For example, Punjab received 69 km^3 of water per annum, Sindh $60.14 \text{ km}^3/\text{year}$, KPK 7.12 km^3 , and Baluchistan received 4.77 km^3 of water per year. Another $3.7 \text{ km}^3/\text{year}$ of water from the civil canals above the rim stations was further allocated to the province of KPK. The 'balance river supplies' which included future storages and flood flows were apportioned to Punjab and Sindh at 37% each, Baluchistan at 12%, and KPK at 14% (Bhatti & Farooq, 2014).

Several other mutual gains options were discussed and included in operationalizing the accord. It was decided to set aside $12.33 \text{ km}^3/\text{year}$ for environmental flows downstream of Kotri to combat seawater intrusions and protect mangrove forests. The provinces were also allowed to plan new projects. No restrictions were placed on small schemes not exceeding 20 km^2 above the elevation of 366 m. It was agreed that concerted efforts be made by the provinces to minimize wastage of water (Ranjan, 2012). If a province cannot make full use of its allocated water, the other province may be allowed to use it without acquiring a right on it. It was decided that allocation will be done based on ten daily usages. The operation of the existing reservoirs will give priority to provincial irrigation uses, and provisions are included to address future scenarios like the construction of new dams and storage reservoirs (Indus River System Authority (IRSA), 1991).

The Water Apportionment Accord provided flexibility to each province to use their allocated water most effectively by recognizing their context, capacity, and constraints. For example, over 5 million acres of additional land was expected to be brought under cultivation. The production of wheat was expected to increase by 2 million tons per year. The province of Sindh received an additional $5.55 \text{ km}^3/\text{year}$ from this accord which was 13% more than its existing share. The province of KPK received 50% more water than it demanded in 1983. This increased allocation increased the sugarcane production in KPK. The province of Baluchistan also came out to be a major beneficiary from the accord, and it was hoped that 0.6–1.6 million acre additional land would be brought under cultivation under the new allocation. Punjab also benefitted significantly by increasing its irrigated area by 3 million acres (Rajput, 2011; Paukert, 2016).

Enabling condition #3: adaptive regime of governance through creating the Indus River System Authority (IRSA)

This enabling condition deals with developing institutional capacity to act on the negotiated agreement in adaptive ways. As a result of the Water Accord signing between the provinces, an independent entity known as the Indus River System Authority (IRSA) was created. Within 20

months after the signing of the Water Apportionment Accord, the IRSA came into being with the IRSA Act as a federal law (XXII, 6 December 1992) passed by the parliament. According to this law, the IRSA would implement and oversee the implementation of the agreement between the provinces. It would also work toward just and equitable allocation of water (Ranjan, 2012). A detailed discussion about tasks assigned to IRSA along with implementation, and monitoring plans are available in Paukert (2016). Few relevant IRSA tasks are provided below:

- provide the basis for the distribution and regulation of surface waters amongst the provinces according to the policies and allocations discussed in the Water Accord;
- review and specify reservoir and river operation patterns on a regular basis;
- coordinate and regulate the activities of the WAPDA in exchange of data sharing between the Provinces;
- address any dispute that may arise between the provinces related to the distribution of river flows and reservoir levels;
- evaluate water availability against the provinces allocated shares and make appropriate recommendations;
- resolve questions related to the implementation of Water Accord by the majority vote of members.

IRSA's main task is the distribution of water among the provinces based on the 1991 Accord. Regular monthly meetings are held by IRSA with all relevant stakeholders. About planning and allocation of water supplies for the provinces, especially during the crop seasons, two committees support the decision-making process of IRSA (Wescoat et al., 2000). The Technical Committee provides the data and support on the operation of reservoirs and the irrigation system while the Advisory Committee represents the institutional link between the affiliated bodies and IRSA and is composed of the representatives of provinces, Federal Government, WAPDA, and representatives of IRSA (Ahmad, 2009).

How adaptive governance helped IRSA to be effective?

The IRSA did not have the data or access to the monitoring stations. The WAPDA was responsible for the operation of barrages and the collection of data. To make allocation decisions, IRSA was dependent on WAPDA to provide the necessary data. This impeded IRSA's decision-making on a real-time and transparent basis (Anwar et al., 2018). It prompted IRSA to work with the Federal Government in modernizing the data collection by installing telemetry systems. This move proved very beneficial, as it provided IRSA an opportunity to independently determine the exact flows rather than relying on data provided by the WAPDA and provincial irrigation departments. This also provided IRSA a state-of-the-art facility for assessing the water availability and evaluating allocation patterns on a real-time basis (Paukert, 2016).

Some concerns were raised by the downstream provinces of Baluchistan and Sindh regarding the reliability and accuracy of the telemetry system. To resolve this issue, a neutral consultant was appointed to assess the accuracy and reliability of the telemetry system. In 2008, the consultant reported that only minor adjustments are required in the telemetry system and the system is working as intended (Garrick et al., 2014). In summary, the implementation of the Water Apportionment Accord through the IRSA shows how an adaptive governance regime can act as an enabling condition to resolve contentious transboundary water issues.

Discussion and concluding remarks

Choudhury & Islam (2015, 2018) introduced three enabling conditions and examined seven cases – Indus, Jordan, Nile, Danube, Colorado, Brahmaputra, and Ganges – to illustrate the utility of three

enabling conditions for effective resolution of complex TWM issues. These three enabling conditions are (a) active recognition of interdependence, (b) mutual value creation, and (c) adaptive regime and rules of governance. Together they provide a focal set of conditions to initiate, design, and implement a resilient negotiated process to resolve TWM water issues.

There is a growing consensus that the complexity of issues as well as the competing and often conflicting values and priorities call for a reframing of the TWM problems. The politics of water demand answers: Who decides? Who benefits? Who bears the burden? At what scale? At what price? These difficulties are amplified by practical questions like, in the Nile, how can we reconcile the building of the dam to support Ethiopia's economic development with the need for adequate water for a growing population in Egypt? Questions for the Ganges may include: How can future management meet the previous agreements on the Ganges that allocate water between India and Bangladesh? How does any water agreement among the Himalayan basin countries relate to larger regional concerns beyond water?

Over the last several decades, integrated water resources management (IWRM) has been strongly endorsed as a guiding principle to coordinate and manage water, land, and related resources to maximize economic and social benefits. In a critical assessment of IWRM, Biswas (2004) argued for a focus on operational (what will be) concerns and suggested deemphasizing normative (what ought to be) dimensions. The WDF does not endorse either normative or operational perspective; rather, it emphasizes both normative and operational aspects through an explicit conversation about facts and values that need to be integral to any sustainable and resilient water treaty framing, formulation, and implementation.

The WDF recognizes that solution space for many of these complex TWM problems are intertwined with facts and values that cannot be pre-stated without understanding contextual nuances. Consequently, the goal is not to search and satisfy the necessary and jointly sufficient conditions for securing predictable outcomes (Islam & Susskind, 2015). We need to look for and identify situational conditions for effective intervention and desirable outcomes. Identifying and implementing these successfully is a craft, and this craft is dependent on engaging in continual adaptive learning. In March 2016, for example, after decades of hostility and stalemate, Egypt, Ethiopia, and Sudan signed a Declaration of Principles on the Grand Ethiopian Renaissance Dam, signaling a concrete expression of the three parties' desire to move beyond political posturing and rhetoric. Now, moving forward from satisfying this first enabling condition, there are opportunities to seek lasting water security for the Nile. Similarly, as the time for the 1996 Ganges Treaty renewal nears, this is an opportune time to think about enabling and situational conditions for effective TWM of the Himalayan rivers (Choudhury & Islam, 2018; Islam, 2019).

Using the negotiated agreements of the 1991 Water Apportionment Act to resolve inter-provincial water conflicts in the Indus basin within Pakistan as an example, we have illustrated the presence and applicability of three enabling conditions that led to negotiated cooperation among four provinces. The resolution of conflicts happened due to the willingness of the affected parties to recognize their interdependencies and to settle their differences through the mediating role played by the Federal Government. The enabling conditions emerged not only for pragmatic reason (i.e., the emergence of political opportunity and active involvement of the Federal Government) but also from the operationalizing the contingent meaning of equity and sustainability by creating flexible and adaptive processes to address uncertainties in physical (e.g., inter-annual variability) and institutional (e.g., changing roles of WAPDA and IRSA) settings.

The effectiveness of the interaction among provinces is also reflected in the options explored and adopted to realize the mutual gains. These gains formed the foundation for creating mutual values

that were absent before the negotiation. The 1991 Accord allowed each of the four provinces to achieve more benefits than they originally expected. Also, the Accord provided flexibility to each province to use their allocated water most effectively by recognizing their context, capacity, and constraints. In other words, exploration related to finding mutual gains led to the emergence of interactions on creating mutual values. We suggest that sustained interaction among provinces will make this Accord more resilient by being adaptive to changing circumstances.

Given the changing nature of TWM issues, continued interactions among provinces will sustain these enabling conditions and provide stability to institutional processes to address emerging issues on an incremental and case by case basis. The implementation of the Accord needs to remain flexible to address the contingent needs of the IBIS as they arise, for instance, issues like adapting to climate change, relying more on virtual waters, and using conservation technologies more effectively to gain water efficiency and improve water quality.

These three enabling conditions constitute a set of minimum – neither exhaustively sufficient nor a guaranteed prescription for the predictable outcome – conditions to initiate, design, and implement a negotiated process to resolve TWM issues. Recall, solution space for complex TWM problems cannot be pre-stated. Consequently, in resolving TWM conflicts and challenges, the goal is not to seek and satisfy the necessary and jointly sufficient conditions for securing reliable and predictable outcomes. The ingenuity and creativity need to focus on identifying the situational conditions for effective intervention within an emergent pattern of interactions as exemplified by the effectiveness of the 1991 Water Apportionment Act.

Data availability statement

All relevant data are included in the paper or its Supplementary Information.

References

- Ahmad, B. (2011). Water management: a solution to water scarcity in Pakistan. *J. Indep. Stud. Res.* 9, 111–125.
- Ahmad, S. (2009). *Water Insecurity: A Threat for Pakistan and India*. Atlantic Council, Washington.
- Ahmad, S., Aziz, K. & Khan, M. (2014). 15. Inter-jurisdictional water management in Pakistan's Indus basin. In: *Federal Rivers: Managing Water in Multi-Layered Political Systems*. (D. Garrick, ed.). IWA Publishing, London. p. 243.
- Anwar, A. A. & Bhatti, M. T. (2017). Pakistan's water apportionment accord of 1991: 25 years and beyond. *J. Water Resour. Plan. Manag.* 144, 05017015. [https://doi.org/10.1061/\(asce\)wr.1943-5452.0000831](https://doi.org/10.1061/(asce)wr.1943-5452.0000831).
- Anwar, A. A., Asce, M. & Bhatti, M. T. (2018). Pakistan's water apportionment accord of 1991: 25 years and beyond. *J. Water Resour. Plan. Manag.* 144, 1–13. [https://doi.org/10.1061/\(ASCE\)WR.1943-5452.0000831](https://doi.org/10.1061/(ASCE)WR.1943-5452.0000831).
- Atiq, M., Rehman, U., Giesen, N. V. D. & Janjua, S. (2020). An engineering perspective of water sharing issues. *Water* 12, 477.
- Bhatti, M. N. & Farooq, M. (2014). Politics of water in Pakistan. *Pakistan J. Soc. Sci.* 34, 205–216.
- Biswas, A. K. (2004). Integrated water resources management: a reassessment: a water forum contribution. *Water Int.* 29, 248–256. <https://doi.org/10.1080/02508060408691775>.
- Biswas, A. K. (2008). Management of transboundary waters: an overview. *Manag. Transbound. Rivers Lakes*, 1–20. https://doi.org/10.1007/978-3-540-74928-8_1.
- Briscoe, J. (2014). The Harvard Water Federalism Project – process and substance. *Water Policy* 16, 1–10.
- Chazournes, D., Boisson, L. & Leb, C. (2013). *International Law and Freshwater: The Multiple Challenges*. Edward Elgar Publishing, Cheltenham, UK.

- Choudhury, E. & Islam, S. (2015). Nature of transboundary water conflicts: issues of complexity and the enabling conditions for negotiated cooperation. *J. Contemp. Water Res. Educ.* 155, 43–52. <https://doi.org/10.1111/j.1936-704x.2015.03194.x>.
- Choudhury, E. & Islam, S. (2018). *Complexity of Transboundary Water Conflicts: Enabling Conditions for Negotiating Contingent Resolutions*. Anthem Press, New York.
- De Stefano, L., Edwards, P., De Silva, L. & Wolf, A. T. (2010). Tracking cooperation and conflict in international basins: historic and recent trends. *Water Policy* 12, 871–884. <https://doi.org/10.2166/wp.2010.137>.
- De Stefano, L., Duncan, J., Dinar, S., Stahl, K., Strzepek, K. M. & Wolf, A. T. (2012). Climate change and the institutional resilience of international river basins. *J. Peace Res.* 49, 193–209. <https://doi.org/10.1177/0022343311427416>.
- Dinar, S. (2004). *Water Worries in Jordan and Israel: What May the Future Hold?* Springer, Dordrecht.
- Dinar, S. & Dinar, A. (2017). *International Water Scarcity and Variability: Managing Resource Use Across Political Boundaries*. University of California Press, Oakland, CA.
- Elhance, A. P. (2000). Hydropolitics: grounds for despair, reasons for hope. *Int. Negot.* 5, 201–222.
- Falkenmark, M. & Suprpto, R. A. (1992). Population-landscape interactions in development: a water perspective to environmental sustainability. *AMBIO* 21, 31–36. <https://doi.org/10.2307/4313883>.
- Frey, F. W. (1993). The political context of conflict and cooperation over international river basins. *Water Int.* 18, 54–68. <https://doi.org/10.1080/02508069308686151>.
- Garrick, D., Anderson, G., Connell, D. & Pittock, J. (2014). *Federal Rivers: Managing Water in Multi-Layered Political Systems, Federal Rivers*. Edward Elgar Publishing. <https://doi.org/10.4337/9781781955055>.
- Indus River System Authority (IRSA) (1991) *Apportionment of Waters of the Indus River System Between the Provinces of Pakistan*. Available at: <http://pakirsa.gov.pk/Doc/WaterApportionment Accord.pdf>
- Islam, S. (2019). Neither necessary nor sufficient; Three enabling conditions for effective transboundary water management. *Dly. Star*.
- Islam, S. & Susskind, L. (2015). Understanding the water crisis in Africa and the Middle East: how can science inform policy and practice? *Bull. At. Sci.* 71, 39–49. <https://doi.org/10.1177/0096340215571906>.
- Janjua, S. & Hassan, I. (2020). Use of bankruptcy methods for resolving interprovincial water conflicts over transboundary river: case study of Indus River in Pakistan. *River Res. Appl.* 1–11. <https://doi.org/10.1002/rra.3621>.
- Khalid, I. & Begum, I. (2013). Misperceptions in Pakistan: perceptions. *South Asian Stud.* 28, 7–23.
- Khan, A. & Awan, N. (2020). Inter-provincial water conflicts in Pakistan: a critical analysis. *J. South Asian Middle East. Stud.* 43, 42–53.
- Lowi, M. R. (1995). Rivers of conflict, rivers of peace. *J. Int. Aff.* 49 (1), 123–144.
- Mir, B. & Muhammad, A. (2001). *Water Shortage in Sindh: Causes and Consequences 2001–2004*.
- Mustafa, D. (2010). *Hydropolitics in Pakistan's Indus Basin*. US Institute of Peace, Washington DC.
- Pahl-Wostl, C. (2007). Social learning and water resources management. *Ecol. Soc.* 12, 1–19.
- Paukert, M. (2016). *Bridging Troubled Waters: Water Sharing and the Challenge of Hydro-Solidarity in Pakistan*. Doctoral dissertation.
- PILDAT (2011). *Interprovincial Water Issues Pakistan, Background Paper*.
- Priscoli, J. & Wolf, A. T. (2009). *Managing and Transforming Water Conflicts, Managing and Transforming Water Conflicts*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511551536>.
- Rajput, M. I. (2011). *Inter-Provincial Water Issues in Pakistan*.
- Ranjan, A. (2012). Inter-provincial water sharing conflicts in Pakistan. *Pakistaniaat J. Pakistan Stud.* 4, 102–122.
- Schmeier, S. (2013). *Governing International Watercourses: River Basin Organizations and the Sustainable Governance of Internationally Shared Rivers and Lakes*. Routledge, Abingdon, UK.
- Song, J. & Whittington, D. (2004). Why have some countries on international rivers been successful negotiating treaties? A global perspective. *Water Resour. Res.* 40, 1–18. <https://doi.org/10.1029/2003WR002536>.
- Swain, A. (1999). Constructing water institutions: appropriate management of international river water. *Camb. Rev. Int. Aff.* 12, 37–41. <https://doi.org/10.1080/09557579908400257>.
- Syed, T. & Choudhury, E. (2018). Scale interactions in transboundary water governance of Indus river. *Int. J. Water* 4, 64–84. <https://doi.org/10.7564/18-IJWG135>.
- Tir, J. & Ackerman, J. T. (2009). Politics of formalized river cooperation. *J. Peace Res.* 46, 623–640. <https://doi.org/10.1177/0022343309336800>.

- Uitto, J. I. & Duda, A. M. (2002). Management of transboundary water resources: lessons from international cooperation for conflict prevention. *Geogr. J.* 168, 365–378. <https://doi.org/10.1111/j.0016-7398.2002.00062.x>.
- Wescoat Jr, J. L., Halvorson, S. J. & Mustafa, D. (2000). Water management in the Indus basin of Pakistan: a half-century perspective. *Water Resour. Dev.* 16, 391–406. <https://doi.org/10.1080/713672507>.
- Wolf, A. T. & Hamner, J. H. (2000). Trends in transboundary water disputes and dispute resolution. *Environ. Secur.* 123–148. https://doi.org/10.1057/9780230596634_8.
- Wolf, A. T., Stahl, K. & Macomber, M. F. (2000). Conflict and cooperation within international river basins: the importance of institutional capacity. *Database* 125 (2), 1–10.
- Yang, Y. C. E., Brown, C., Yu, W., Wescoat, J. & Ringler, C. (2014). Water governance and adaptation to climate change in the Indus river basin. *J. Hydrol.* 519, 2527–2537. <https://doi.org/10.1016/j.jhydrol.2014.08.055>.
- Yoffe, S., Wolf, A. T. & Giordano, M. (2003). Conflict and cooperation over international freshwater resources: indicators of basins at risk. *J. Am. Water Resour. Assoc.* 39, 1109–1126. <https://doi.org/10.1111/j.1752-1688.2003.tb03696.x>.
- Zawahri, N. A. & Mitchell, S. M. L. (2011). Fragmented governance of international rivers: negotiating bilateral versus multi-lateral treaties. *Int. Stud. Q.* 55, 835–858. <https://doi.org/10.1111/j.1468-2478.2011.00673.x>.
- Zawahri, N. A., Dinar, A. & Nigatu, G. (2016). Governing international freshwater resources: an analysis of treaty design. *Int. Environ. Agreements Polit. Law Econ.* 16, 307–331. <https://doi.org/10.1007/s10784-014-9259-0>.
- Zeitoun, M. & Mirumachi, N. (2008). Transboundary water interaction I: reconsidering conflict and cooperation. *Int. Environ. Agreements Polit. Law Econ.* 8, 297–316. <https://doi.org/10.1007/s10784-008-9083-5>.

Received 10 December 2019; accepted in revised form 10 July 2020. Available online 11 August 2020