Lessons from the Indus Basin

Identification of Best Management Practices for Transboundary Rivers

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Table of Contents

1. INTRODUCTION

Water scarcity is the byproduct of not only regional climate patterns but also a result of demand and use efficiencies. Those regions of the world where conflict is most likely to occur include areas where scarcity, maldistribution and increases in demand overlap (Kliot 2001). Where such areas include international river basins, the potential for and the intensity of conflict is even greater. Yet despite increasing conflict around water use and scarcity, shared waters tend to induce cooperation rather than conflict (even where other issues may invoke political hostilities) (Kliot 2001).

One of the international basins that has been well studied for its purported success in inducing such cooperation is the Indus Basin of Southeast Asia. The following report describes the relevant geographic and political setting of the basin. This discussion leads to an examination of the legal framework of the Indus Waters Treaty and the institutional structure of the Permanent Indus Commission. This is followed by a brief review of the implementation of the treaty and its success in managing the water resource development of the Indus river system. Finally, the preceding discussions are analyzed with respect to the Jordan River Basin and preliminary recommendations for best management practices are suggested.

2. BASIN SETTING

2.1. Geographic Setting

The Indus Basin consists of the Indus River itself and six major tributaries including the Kabul, Jhelm, Chenab, Beas, Ravi, and Sutlej. The main channel of the Indus extends 1800 miles from the Tibetan Plateau to the Arabian Sea. The alluvial basin was formed more than 65 million years ago as the soft soil was moved down mountains and across the Indus Plain (Concannon 1989).

India is the primary upriver stakeholder with all of the Indus Basin rivers either originating or passing through India prior to reaching Pakistan (see Figure 1). The Indus is perennial but highly seasonal with monsoon floods in April-June (with flows 4 times that of winter) (Thatte 2008). Though the river is primarily driven by Himalayan snow melt, the monsoons cause significant flooding which occurs almost exclusively in Pakistan. As such, the concern for flood protection is mostly limited to Pakistan while strategies for successful flood management may extend to the basin as a whole (Rehman 2005). Flooding poses a significant hazard to Pakistan with costs of more than $4 billion and 8000 deaths since 1947 (Rehman 2005).

The annual flow of the Indus is approximately 170 million acre feet (even greater than the Columbia River of northwestern US). The principle sources of precipitation are rain and melting snow from the Himalayas and other basin mountains. The Indus receives the bulk of its flow from the upper mountainous catchments. Surface flow from the downstream plains region is largely insignificant (Thatte 2008). India accounts for the vast majority of source waters (69%). Annual flow is moderately variable though this is considerably less so due to annual snow melt (Concannon 1989). Lowest flow for most tributaries is during December and January. In July and August, monsoons bring most or all of the tributaries and the main channel over their banks with substantial flooding. After

late August, the channels fall in flow until the nadir in December and January (Concannon 1989).

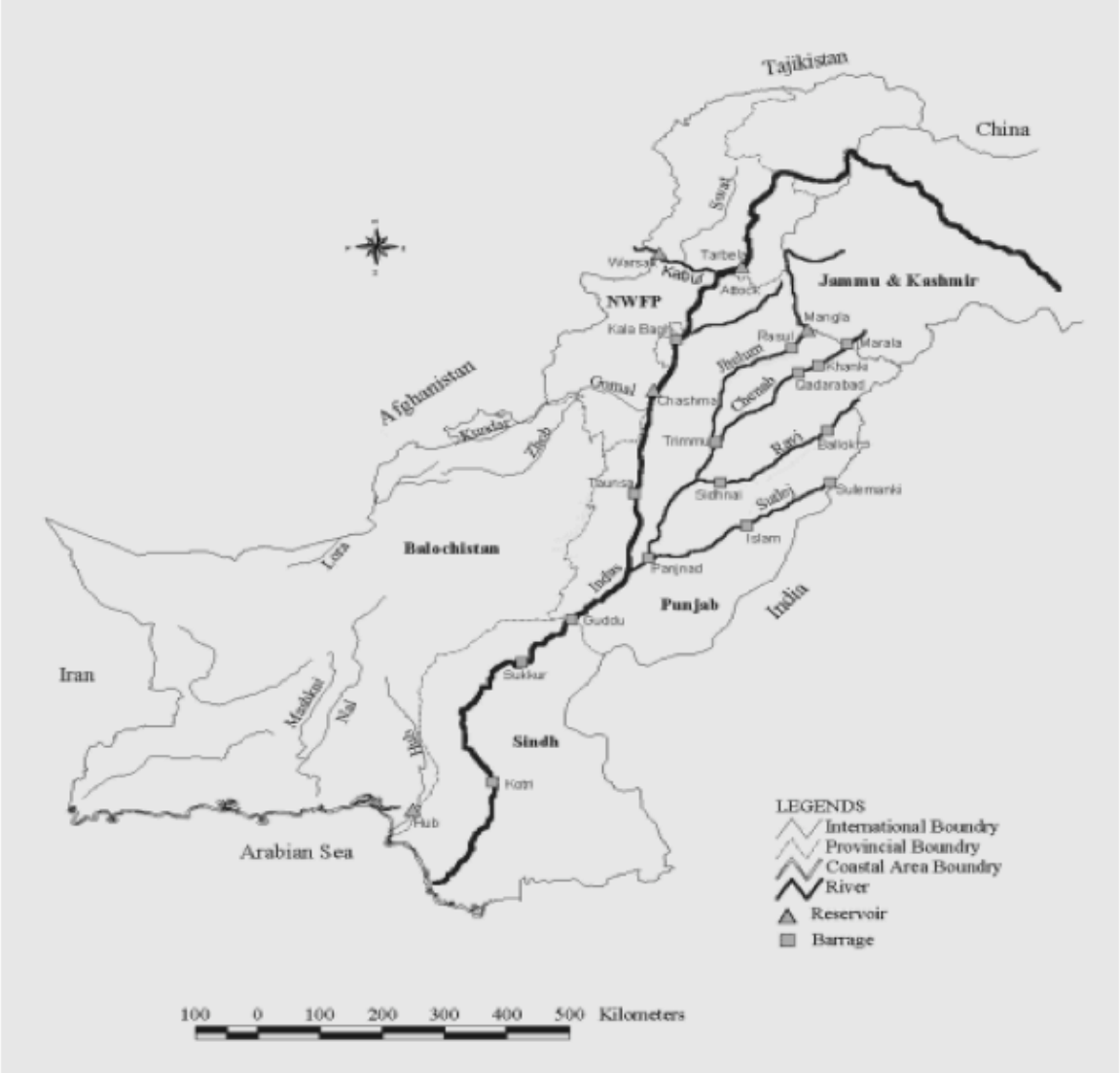

Figure 1. Map of the Indus basin showing the major tributaries and territorial borders (Rehman 2005).

The primary use of Indus waters is for agricultural production. Annualized availability is adequate for most types of irrigated agriculture. However, because of the highly seasonal flow, excess water is available in summer months while insufficient quantities are available during winter. Thus, water shortage in the basin can be considered a technological problem, with insufficiency either due to inadequate storage or poor water use efficiencies (Concannon 1989). The alluvial soils of the Indus basin are highly fertile and conducive to the production of sizable agricultural yields. However, this fertile silt poses challenges through the siltation of canals and irrigation channels (Concannon 1989).

Considerable groundwater flow exists and the region, and while beneficial for supplementing irrigation needs, it also poses a significant challenge through the advent of waterlogging. Additionally, like all irrigated agriculture, salinization poses a considerable problem which is compounded by the waterlogging (Concannon 1989).

2.2. Political Setting

Ever since partitioning under British rule, India and Pakistan have been rivals in regional politics. Three major wars have been fought with ongoing conflicts in Kashmir. Additionally, the development of nuclear weapons has further heightened political tensions in the region. Yet despite all the conflict, the Indus Waters Treaty remains one of the only successful agreements between the countries (Sahni 2006).

Much of the current use of the Indus for irrigation began with the rapid development of the basin following British colonization. The Indus waters were rapidly appropriated for storage, canal irrigation, and even the beginnings of cross-basin transfers. The British-led development doubled the area of irrigated land from 20 million hectares in 1890 to 56 million hectares prior to partitioning in 1947 (Thatte 2008).

Much of the political tension in the region arises from the British partitioning scheme of India and Pakistan. The land was divided along religious lines but this geographically arbitrary separation manifested itself in awkward and cumbersome divisions of irrigation districts. The population of the region was split nearly in half but water and arable lands were divided with significant inequity. Pakistan received more than 75% of the irrigated land while India was left with the remainder. Additionally, the basin was divided in manner that did not simply create two equal water-sharing powers. Pakistan was effectively reduced to a downstream riparian despite the fact that a large proportion of Indus waters and its productivity were utilized within Pakistan. The large population (46 million people) spread over a highly arid region, created the preconditions for significant water resource disputes between the two countries (Thatte 2008).

Concannon succinctly describes the political conflict between India and Pakistan: "Since independence in 1947, the two countries have engaged in open warfare, clandestine subversion, and mudslinging in international forums" (1989). The antipathy between India and Pakistan is deep and includes significant religious divisions (Hindu vs. Muslim). Violence has been bloody and included tens of thousands of civilian deaths (Concannon 1989). The manifestations of political conflict include subterfuge and covert manipulation of neighboring political system. Disagreement and opposition occurs at nearly all levels of governance. Political divisiveness extends beyond the borders of the two nations, with international actors also playing a role in political hostilities. Russia, UK, and the United States have all extended political conflict to the realm of the "super-powers" (Concannon 1989).

India's role in transboundary river management has been criticized as regionally hegemonic. Due to the sheer size and dominance of India in South Asia, it is capable of exerting undue influence with an apparent tendency towards absolute sovereignty (Noshab 2001). Compared to Pakistan, India is superior both economically and militarily. This power asymmetry further amplifies discordant relations.

In terms of water usage, Pakistan is more dependent on the Indus since it is the primary source of all surface waters for Pakistan. India, by contrast, is economically dependent (with Indus waters irrigating the nation's agricultural "breadbasket") but has other significant sources of water available (Zawahri 2009). India also controls the headwaters for Pakistan's most important sources of water and thus Pakistan can be viewed as the more reliant party. However, India too requires the cooperation of Pakistan especially in terms of ensuring the mitigation of downstream flooding. The irrigated lands of the Punjab region have experienced significant water logging with up to 25% of the land area already waterlogged. Pakistan must maintain its drainage system in order to ensure that further water logging and salination does not impact the "otherwise fertile soil within Punjab" (Zawahri 2009).

3. BASIN MANAGEMENT COMPONENTS

3.1. Legal Framework

International law arises from two primary mechanisms: formalized treaties and international agreements, or informal agreements known collectively as customary law. The latter can be categorized according to five types of international doctrines including absolute sovereignty, absolute riparian integrity, limited territorial sovereignty, communality, and correlative rights. These different doctrinal policies differ significantly with respect to cooperation and shared management (Kliot 2001).

More formalized international law (i.e. from international bodies such as the UN and International Court) identifies five key principles for the management of transboundary waters. These include: (1) the aggregate management of surface and groundwater, (2) equitable use which accounts for all riparian countries, (3) obligation not to cause harm such as through flow alteration or water pollution, (4) joint development of international rivers, and (5) relaxing of absolute territorial sovereignty (Kliot 2001). The Indus Water Treaty (IWT) satisfies these different criteria to varying degrees but these ideals identified by Kliot et al. set a good benchmark for analysis (2001).

Originally, India sought to maintain its hegemonic control of the Indus Basin by claiming absolute sovereignty based on the Harmon doctrine (Concannon 1989). This staunch political position set the stage for the initial tension between the parties. In 1950, the problem of allocating the Indus was viewed primarily as one of political challenge. In that respect, a solution was not easily envisioned given the apparent stalemate between the countries. Neither side seemed willing to compromise on its position of absolute necessity of all available water.

Riding high on his apparent successes in the United States, David Lillienthal proposed a more technical solution based on the model of the Tennessee Valley Authority (TVA) (Concannon 1989). The World Bank played a key role in the negotiation of the IWT. Sustained involvement occurred at the highest levels of the Bank (including President Eugene Black). Additionally, the Bank adopted a flexible approach that enabled negotiations to continue beyond the initially conceived agreement. The Bank was also key in raising adequate funding for the projects required for the equitable distribution of the Indus basin rivers. Without this financing the treaty would have been moot (Salman 2008).

The World Bank initially proposed the fully joint management of the Indus with irrigation being directed by a single multi-party unit. This proposition was consensually rebuked by both Pakistan and India (Salman 2008). The final ascribed to treaty included three main provisions: (1) the complete utilization of Indus waters, (2) expressed delimitation of respective rights, and (3) a system for the resolution of disputes (Concannon 1989). One of the most notable features of the treaty is the lack of expressed cooperation between parties. In fact, rather than devise a system for the equitable distribution of tributary waters, the agreement simply divided up the six main tributaries of the basin in order to avoid the "internationalization" of rivers and thus mitigate the chances for dispute. What the treaty does instead is to divide the basin into Eastern and Western tributaries, with India receiving the former (Sutlej, Beas, and Ravi) and Pakistan receiving the latter (Indus, Jhelum, and Chenab). Non-consumptive uses of India's tributaries are afforded to Pakistan, but otherwise the treaty essentially avoids any need for more detailed negotiation of allocation schemes and use limitations. In essence, this divisional agreement enables the employment of unilateral management of the separate treaty basin halves. Active management for drought and user efficiencies occurs within and not between countries (Concannon 1989, Iyer 1999). Ultimately, the treaty allowed an equitable starting plane from which each party could separately determine their own development trajectory (Concannon 1989).

The legal solution for the Indus "problem" seemed to also rest on the adequate financing of storage and diversion projects. Here the World Bank entered as a major party in the negotiations and worked to foster discussions of how to fund development of the Indus (Concannon 1989). Financing was a key component of the agreement, whereby India contributed significantly to the development of Pakistani projects. Outside parties to the agreement (Australia, Canada, Germany, New Zealand, and the United States) also helped finance projects through the World Bank. The Bank itself contributed a sizable $90 million dollar loan (Concannon 1989, Salman 2008).

The annexures of the IWT also laid out strategies for transitioning towards full treaty compliance. Importantly, Pakistan was reliant upon Eastern river water for irrigation. The Western/Eastern allocation scheme required that Pakistan develop the Western rivers in order to supplement the loss of this irrigation source water. The annexure includes another provision that provides emergency funding in case Pakistan was unable to complete these important supply projects (Salman 2008).

Some of the express exemptions of the treaty do threaten to undermine its stability. Namely, exceptions for domestic and industrial uses of all tributaries by both parties, as well as uses for mining, could prove critically important in the future. In 1960, industrial water use in the region was primarily non-consumptive, with most of the water being returned to the stream. However, modern industry could potentially be a large consumptive user and imperil the delicate balance of equitable water distribution. Similarly, mining can be a highly significant use of water and any single major prospect development could lead to unmitigated dispute. In this respect, the treaty supports self-interested behavior and it benefits each party to consume water under the exemption. (Concannon 1989). Resolving this potential conflict post-hoc requires considerable effort. In order to modify these exemptions, the treaty would require renegotiation, a prospect that is not easily envisioned.

An additional major shortfall of the treaty is its failure to address issues of water quality. While pollution is addressed within the treaty, the definitions and prescriptions are so limited or vague as to be almost inconsequential. The standards for water quality are highly inflexible and based almost entirely on 1960 standards of use and considerable exemptive language compounds the problem (Concannon 1989).

Another limitation of the treaty, though understandable at the time of agreement, is the failure to account for climatic changes (e.g. human induced climate warming). Given the global awareness of climate related changes in water supply, modern water treaties are likely to and should include measures which allow for the adaptation to climate induced changes in water availability. In the case of the Indus Basin and treaty, it is unclear how climate related changes will be addressed. Given the dependence of the basin on snowmelt-derived water, climate will likely play a significant role in basin changes. With the basin's current management strategy (i.e. separate and independent management of tributaries), efforts to mitigate climate changes will not be adequately addressed on the basin-wide scale (Concannon 1989).

An obvious but no less important note about the treaty is that it is strictly bilateral. Though at the time of treaty China and Afghanistan were only minor users of the Indus, both countries (especially Afghanistan) are increasingly asserting their rights to Indus waters. The IWT was formulated with no input from either riparian and the treaty does not include provisions for extending the agreement to include other parties (Salman 2008).

3.2. Institutional Framework

Despite the initial Eastern/Western allocation scheme that seemed to minimize any active cooperation between parties, the IWT contains administrative or and institutional provisions which expressly permit and necessitate some joint cooperation (Zawarhi 2009). Identified within the annexures of the document, provisions for permissible uses of unallocated rivers (e.g. India's hydropower use of the Western rivers) means that joint management does still play a role in the implementation of the treaty (Sahni 2006, Salman 2008, Thatte 2008).

Article VIII of the treaty stipulated the conditions for the establishment and operation of the Permanent Indus Commission (PIC). The commission is comprised of one individual from each country who serves as the representative for the respective country for all matters relating to treaty. Thus, the commissioners exercise considerable authority in the administration of the treaty. The treaty stipulates that commissioners are required to meet at least once yearly and may meet more frequently at the request of either commissioner. Since 2008, the commission has met regularly for the preceeding 45 years for a total of 93 times. Another important duty of the commissioners is to inspect the entirety of the basin once every five years. Although the treaty includes disclosure requirements for most river projects, this extra layer of oversight serves a very important role in ensuring transparency for both parties (Thatte 2008).

While the literature sometimes identifies the IWT as a treaty which lacks active cooperation, provisions exist which run counter to this broad assertion. The permitted uses of opposing party's river allocation provide testament to this fact. Further evidence

for required cooperation exists within the provisions for notification. For any project that may potentially impact any other river, notification of the other party is required along with adequate description of the project specifications and the predicted scale of impact. Even if an impact is not projected, information must be provided upon solicitation of the other party. This provision mandates considerable transparency especially between two nations with a history of conflict and mistrust. This mandated transparency can be viewed as a dispute prevention measure itself since unilateralism and disagreement are less likely when information parity exists (Salman 2008).

The final important detail of the annexures is the prescription of a "neutral expert" and "court of arbitration" in case of unresolved disputes amongst the commission (Salman 2008). A notable section of the Treaty specifically addresses the need for dispute resolution (Article IX). According to the article, if a dispute arises between commissioners which cannot be resolved adequately at the commission level, the dispute will dealt with by a "neutral expert". This expert is jointly appointed by both parties, or, barring agreement, is appointed by the World Bank. The treaty outlines which specific areas of disagreement warrant the use of the neutral expert. If the dispute concerns one of those not covered under the treaty, then the matter is to go before a "court of arbitration". The court itself is selected through somewhat convoluted means (the committee for court appointments is to include such disparate actors as the UN, the president of MIT university, and the Lord Chief Justice of England) (Salman 2008). The chain of dispute arbitration is not hierarchical but linear in organization. Utilization of the neutral expert or the court of arbitration only occurs when the commissioners are unsuccessful at resolving a dispute. A decision agreed to by the commission cannot be overturned by the expert or court (Salman 2008).

The important point concerning the measures towards limited joint management and dispute resolution are the large efforts within the IWT and PIC towards maintaining transparency and fairness. At all stages of the PIC operations, transparency and equity are maintained at the expense of considerable effort. The important implied prerequisite necessary for such measures is the ability of both parties to compromise sovereignty. Without diverging from a Harman doctrine stance, the PIC would not be able to maintain the cohesion and trust required for good administration.

3.3. Implementation

Despite the general success of the PIC and the Treaty, not all development efforts have been executed without conflict. One example is the Tulbul Navigational Project proposed by India. Contrary to the proper notification channels stipulated the IWT, Pakistan learned of the project through the general press in India. The proposed dam site significantly threatened Pakistan in that water critically important for irrigation could easily be controlled or diverted. When the dam project was referred to the commission, it failed to negotiate a settlement. Direct bilateral negotiations spanning more than a decade were necessary for reaching an amicable agreement (Noshab 2001).

The case of the Baglihar dam well illustrates the function and limitations of the IWT with respect to joint management and dispute resolution. As identified, the IWT includes annexures which expressly permit certain uses of the Indus for rivers allocated to the other party. In the case of the Baglihar dam, India intended to construct a run-of-river

dam on the Western Indus Chanab River in accordance with the provisions. Pakistan, concerned that the dam could serve a tactical role in potentially cutting off irrigation supply, claimed that the dam was in violation of the annexure provisions.

Before being sent to the neutral expert, a more basic dispute existed over whether the disagreement was even ripe for review. India asserted that the issue was still under discussion while Pakistan asserted that a disagreement existed. Through iterations of dispute documentation by both parties, after more than 3 months the World Bank finally determined that a dispute did in fact exist. An additional 3 months were necessary for the even more complex procedure of appointing the expert with mutual "consultation". This process was not explicitly outlined under the treaty such that the Bank served an importantly critical role as a neutral arbitrator. In this way, the Bank, with transparent communication to all parties, was able to navigate the unforeseen complexities of administration while maintaining treaty support from both India and Pakistan. After extensive consultation by the neutral expert with both parties, an amicable resolution was eventually reached which permitted the construction of the dam. Both parties claimed to have benefited from the process and this resolution has only served to increase credibility of the IWT and its dispute resolution processes (Sahni 2006, Salman 2008).

More detailed discussion of the Baglihar incident is available but the example well illustrates the important role served by the World Bank when the treaty is incapable of fully describing proper administrative procedure (Salman 2008). A process that took more than 20 months from the time of Pakistani request would likely have been only more difficult and hazardous without such a third party. Key in the entire process was the paramount importance of transparency and equity. The procedures by the Bank and the expert, though possibly tedious and surely time consuming, ensured a level of stakeholder involvement that was likely instrumental in the continued support for the IWT and the resulting expert decision.

The IWT project reporting requirement has in practice meant that India bears the primary burden of the clause. India is the upstream riparian and its projects most always have the potential to impact Pakistan. In contrast, as the downstream riparian, Pakistan is highly unlikely to impinge upon the treaty rights of India. Thus India faces the most expenses and constraints with respect to the reporting requirement (Thatte 2008). In the case of the highly disputed Kashmir and Jammu regions, Pakistan has reacted to almost any project proposed by the Indian government whether or not it is expected to have an impact on river flows. This confrontational approach has stunted development projects which have the potential to significantly improve the lives of people inhabiting the region. These disagreements surround not issues of basic water distribution and allotments, but technicalities not originally envisioned as problematic in the initial treaty. Due to advances in testing and prediction sciences for river management, the context of terminology such as bed load, live storage, and sluice spillways has evolved beyond their 1960 meanings. The treaty itself does not easily rectify conflicting or differential definitions and thus Pakistan has frequently found cause to question the impacts and motivations for many development projects (Thatte 2008).

Zawarhi tested the resilience of the PIC by looking at the function of the commission during periods of political tension (2009). During the 1965 war, the commission

continued to meet and execute successful management decisions despite the ongoing war. During the 1971 war (which lasted until 1975) political relations between the countries deteriorated significantly with Pakistan severing all relations. Despite the diplomatic breakdown, the PIC continued to meet each year, though with a decreased frequency. Additionally, the PIC continued to work through its agenda including two tours of inspection and the ongoing exchange of monitoring data. During this political stalemate, the PIC was essentially the only aspect of cooperation between the two countries. According to Zawarhi, both these resiliency "tests" well demonstrate the capacity of the IWT to endure political stressors (Zawahri 2009).

While other authors find the IWT to be an example of the lack of active cooperation, Zawarhi provides evidence which supports the idea of active cooperative management. Examples exist in which both parties have had to compromise their positions or initial project intentions. India has modified the construction of several dam and diversion projects to address the concerns of Pakistan. Pakistan has allowed development projects on the Western rivers despite initial concerns and objections. In this way, both parties have been involved in the active management of the basin despite the initial separated allocation scheme (Zawahri 2009).

4. BASIN EVALUATION

4.1. Identified Best Practices

The IWT is a particular and regionalized implementation of a transboundary treaty and not all these treaty features may be appropriate for other political and geographic settings (see Table 1). However, the multiplicity of measures all point toward the overarching importance of transparency between parties. Being able to communicate freely and reliably ensures that trust endures between parties that would otherwise be highly mistrustful of one another. Ultimately, when transparency prevails and the parties can trust the available information, stakeholders will express confidence in the international management scheme and commit to supporting its ongoing success. The significant cost of adequate transparency is the loss of sovereignty to some degree. Both parties must be willing to compromise absolute autonomy for the benefit of basin management.

"Best" Practices	Poor Practices
Transparency	Basin partitioning
Territorial access	Bilateral treaty
Resilient dispute resolution	Lack of comprehensiveness
Dedicated staff	Treaty misuse
Adequate funding	
Context specific framework	
Third-party involvement	

Table 1. Summary of management principles identified in the Indus basin.

Along with transparency, access to entire basin by all treaty parties serves both to reinforce transparency and to provide adequate monitoring data. In the case of India and Pakistan, even during times of violent conflict access was granted to commissioners. The ideal collaborative management scenario would have each party maintain the

monitoring of their own sovereign territories. However, where a history of conflict and mistrust exists, granting full basin access to commissioners bolsters stakeholder buy-in.

Zawarhi and others point to the significant success of the IWT's dispute resolution mechanisms. Importantly, the treaty allows for tiers of dispute resolution operating essentially as a fail-safe mechanism. Where the commission fails, the neutral expert can pick up. If the expert is unable to find an agreeable solution, then the court of arbitration can settle the case. Additionally, each resolution is final (no appeal is possible). It is critical to note that at each stage in the process, every effort is made towards transparency and equity.

Given the complexities of water resource management, the utilization of dedicated staff is highly preferred. The PIC includes commissioners and staff which are able to collect to and analyze basin monitoring data in order to ensure good governance. While most nation states possess some entity or agency which manages intrastate water affairs, it seems prudent to utilize dedicated staff which can focus on the increased challenges of international river basin management.

Adequate funding is a prerequisite for any basin management scheme. Without appropriate financing mechanisms, projects may be implemented in an adhoc manner only as funding becomes available. Especially where financial parity does not exist between countries, this may especially be problematic. The IWT had the major advantage of readily available foreign assistance facilitated by the World Bank. Where internal funding sources are inadequate, large development projects would likely require similar external funding.

The broader role of the World Bank in the formulation of the IWT and the operations of the PIC is readily apparent. Whether a third party is appropriate in all transboundary management scenarios is unclear (Sahni 2006). However, the World Bank has served several important roles in the Indus basin and a mutually trusted party can be especially important for high conflict basins. Especially in the case of dispute resolution, the World Bank has been instrumental in ensuring treaty sustained treaty support.

IWT management strategy was adapted to fit the geographic and political realities of the Indus basin. The World Bank originally developed a management scheme which required significant joint management throughout the basin. This framework was scrapped in favor of the Eastern/Western tributary allocation, possible because of the particular geographic layout of the Indus basin. Concannon assertively advocates that any treaty should be well adapted to the region of application (1989). While certain overarching management practices are important for any basin management plan, the applicability of one basin to another is a case-specific question.

While the IWT and PIC demonstrate many possible "best" management practices, there are notable failures or shortfalls that can be equally informative. These include the lack of truly integrative joint management that precludes holistic planning efforts. The treaty is bilateral and not easily adapted to additional riparians. The inability to adapt to climatic changes is another obvious shortcoming which could threaten the overall success of basin management efforts. Water quality is a glaring omission that is only minimally addressed within the treaty. Also, the reporting scheme may unfairly shift the burden of

reporting to the upstream riparian. The transparency measures have the potential to be leveraged inappropriately to blockade legitimate development projects in the absence of control measures.

Finally, it is important to highlight that the "success" of the IWT is an ongoing question. Several projects are on the horizon that could significantly derail historical cooperation. Despite the many efforts to create geopolitical parity between parties, India is undoubtedly the larger political player in the region and often seeks to leverage this position. Even a cursory review of the IWT implementation indicates that "cooperation" is far from an objective term. While major conflict over water resources has been averted, tendencies toward the Harman doctrine approach still pose ongoing challenges.

4.2. Relevancy to the Jordan River

The Indus basin is most readily applicable to the Jordan basin in terms of political conflict between riparian countries. Similar to the borders of Israel, the international boundaries between India and Pakistan were the product of considerable external influence. The division of India and Pakistan has fueled much of the ongoing conflict and political relations between the countries are continually strained. Many of the IWT components appear to directly address the resulting mistrust from ongoing conflict. Similar measures may be important for the efforts towards joint management in the Jordan basin.

A related issue of relevancy is the existence of significant religious differences between India and Pakistan. One of the primary reasons for the initial partitioning scheme of the British, differences in religious beliefs still serve to cause significant tension between the countries. The IWT has seemingly worked well to overcome these differences.

Climatically, the plains of the Indus basin lie within a very arid region. However, unlike the Jordan basin, the Indus receives overwhelming rainfall in the form of monsoons. The Jordan basin can be considered over-allocated while any water budget shortfall within the Indus is primarily viewed as a technological problem (i.e. the need for more storage capacity). One can imagine that considerably less active management and compromise is necessary where water supply surpluses exist. The Jordan basin presents a very different water allocation problem that cannot be easily mitigated through the use of technology alone.

The Indus basin also differs significantly in terms of geography. While Zawahri advocates for the perspective that the Indus still does require joint management, the Eastern/Western partitioning scheme does go a long way towards circumventing the need for cooperative management (2009). Given the geographic layout of the Jordan basin, it seems unlikely that such a partitioning scheme could be implemented. If not, then the Jordan basin will require a level of joint management that is considerably more difficult to acheive.

The particular water issues of the Indus are also quite different from the Jordan basin. Surface water quantity is the primary issue of the IWT. Water quality, groundwater extraction, and environmental flows are minor components of the treaty whereas in the Jordan basin these are primary issues necessitating cooperative management. Then the

IWT and PIC may suggest general best practice principles but specific details may be less directly relevant for the Jordan basin.

4.3. Conclusion

As one of the few transboundary treaties with a historical legacy of commission operation, the Indus basin is clearly an important example of international river management. The basin is not the ideal of cooperative management, but it does point to the importance of some general principles of basin management such as transparency, equitable dispute resolution, relaxed sovereignty and appropriate financing among others. However, the treaty is neither adequately comprehensive nor sufficiently integrative for direct application to the Jordan River basin. Though joint management does exist, the partitioning scheme minimizes such cooperation and thus the IWT does not truly represent basin-wide management. Other basin commissions must be studied to provide better examples of the more active cooperation that is likely necessary for a smaller basin such as the Jordan. Additionally, management strategies will only be more strained when the basin is over-allocated and highly stressed basins may be more informative for a Jordan River treaty.

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