Abstract

Two competing water demands, irrigation and urban water supply augmented with flood management are the key issues addressed in Indus River Basin (IRB). IRB spans between India and Pakistan, two nations formed in 1947 after British rule for about 100 years. The conflict in the basin started in 1947 when India stopped water flowing through its canals to Pakistan, forcing the later to approach international agencies for help. Agriculture drives the economy (C) in IRB basin. Absence of adequate water for irrigation (Q) stresses regional economy (C) which leads to failing of legal and local governance institutions (G). Apart from that, floods (Q) and urban water supply (Q) was an issue of contention within governance systems in two stakeholders, Indian and Pakistan. The two neighbours have since had four military conflicts till date. Despite this, nuclear armed India and Pakistan have been able to push themselves for a peaceful water treaty in 1960 and have never allowed it to escalate into an open military conflict. Here we find water dispute in IRB arose due to poor governance and lack of proper institutions to manage water between two stakeholders, which stressed the amount of water available in the basin, affecting economy(C) of the downstream water user (Pakistan). To arrive at mutually workable agreement, World Bank provided incentives, in terms of monetary aid, to both the stakeholders. Three eastern rivers (Sutlej, Beas, Ravi) were allocated to India while three western rivers (India, Chenab, Jhelum) were solely allocated to Pakistan. Incentives pushed for a successful and well negotiated water treaty, known as Indus Water Treaty (IWT), in IRB. IRB is a non-traditional water conflict where quantity was never addressed between stakeholders; rather the physical geography in the basin was considered for division of water. Based on our analysis of the conflict over time, the dominant variables are Quantity (Q) from natural domain coupled with Governance and Institutions (G) and Economic considerations (C) from societal domain. We have described how the coupling of these three variables can be used to create a systematic mental model which can explain the success for IWT as well as to create futuristic scenarios.

Questions Addressed and Wisdom Gained

The key questions addressed in this case study are: 1) how interaction between quantity (Q), economy (C) and governance (G) can lead a resolution of water conflict? And 2) Why IRB water treaty is successful? Here we have identified that the presence of external mediator coupled with incentives helps to form a workable and negotiated water treaty. Also, we learn that despite military strength with upstream stakeholder, India; incentives increased the stakes at negotiation table and pushed for a water treaty. The IRB water allocation treaty illustrates that effective dispute resolution mechanisms and stakeholder participation process are essential for water governance to have the flexibility in responding to social and environmental changes.

Issue(s), stakeholders and relevant NSS variables for this case study

<table>
<thead>
<tr>
<th>Issues</th>
<th>Stakeholders</th>
<th>Variables Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Water Supply</td>
<td>India, Pakistan</td>
<td>Quantity (Q), Governance and Institutions (G), Economy (C)</td>
</tr>
<tr>
<td>Irrigation</td>
<td>India, Pakistan</td>
<td>Quantity (Q), Governance and Institutions (G), Economy (C)</td>
</tr>
<tr>
<td>Flood Management</td>
<td>India, Pakistan</td>
<td>Quantity (Q), Governance and Institutions (G), Economy (C)</td>
</tr>
</tbody>
</table>

Indus River Basin spans between India and Pakistan (Figure 1), two nations formed in 1947 after British rule for about 100 years. The two neighbours have since had four military conflicts till date. Despite this, nuclear armed India and Pakistan have been able to push themselves for a peaceful water treaty and have never allowed it to escalate into an open military conflict. Why India, being militarily strong, has never caused any problem in Indus River Basin during four military conflicts? It is therefore necessary to explore the dynamics of the Indus Water Treaty (IWT) and to understand the dominant variables (conditions) which can explain the success of IWT. We have identified two stakeholders in IWT namely, India and Pakistan. Based on our analysis of the conflict over time, the dominant variables are Quantity (Q) from natural domain coupled with Governance and Institutions (G) and Economic considerations (C) from societal domain. We have described how the coupling of these three variables can be used to create a systematic mental model which can explain the success for IWT as well as to create futuristic scenarios.

2. Description of the Setting
Indus River system is one of the oldest in the history of mankind and it forms lifeline for agriculture in North India. Figure 1 shows the location of Indus river system. The River originate at 17,000 feet above sea level in Tibetan Plateau, travels around 1800 miles before draining into Arabian Sea (Salman and Upreti, 2002). Indus drainage basin is about 450,000 square miles with an average annual inflow of 175 million acre feet (MAF). The flow in the river is heavily dependent on Himalayan snow cover and seasonal rainfall. About 80% of water for Upper Indus Rivers comes from Himalayan glaciers (Salman and Upreti, 2002). Monsoon rainfall plays an important component in discharge in lower Indus Rivers and its tributaries from July to September. Annual rainfall varies from 1000-1400mm in the entire region. About 10% of the rainfall is lost by evaporation and nearly a 41 million acre foot is lost by seepage from unlined canals.

During British Rule in Indian subcontinent, a vast canal irrigation system was built within the Indus Basin in the mid 1800’s to strengthen agricultural activities in the region. India and Pakistan gained independence in 1947. Creation of two independent countries resulted in division of the canal system as well; which now crossed two political boundaries. India being upstream user of the rivers, claimed sovereign riparian rights to water. This lead to a widespread uproar in newly formed Pakistan, when India stopped water giving water to Pakistan in 1948 (Salman and Upreti, 2002).

### Table 1: Water allocations from IWT in MAF/year

<table>
<thead>
<tr>
<th>Plan</th>
<th>India</th>
<th>Pakistan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Indian</td>
<td>29.0</td>
<td>90.0</td>
</tr>
<tr>
<td>Indian Pakistan</td>
<td>15.5</td>
<td>102.5</td>
</tr>
</tbody>
</table>

3. Problem Definition

Before partition of India and Pakistan, the Indus River system has started to become a problem between the two states (Punjab and Sindh) in British India. In 1947, the problem was aggravated when two countries were formed out of a huge landmass thereby creating artificial political boundaries for water sharing. Partition between Pakistan and India resulted in two divisions of Punjab. It resulted in increased hostility and lack of legal authority over water sharing. Looking at Figure 1, it appears, based on the geopolitical boundaries, to be a case of up- and down-stream riparian water allocation issue. While Indus was primarily in Pakistani territory yet the potential of waters from the Indus River were not fully harnessed at the time of partition. All the canal systems were constructed on the eastern Rivers (Sutlej, Beas, Ravi) while there was minimal construction on the western rivers (Jhelum, Chenab, Indus). All eastern rivers were in India and most of the western rivers also originated from Indian Territory.

As a result, a full blown water conflict was reported in 1947 when India stopped water flowing into Pakistan at all the headworks within its territory and there was a hue and cry in Pakistan. Pakistan, a newly formed state, was supposedly avoiding military conflict since such exercise would be detrimental for its existence. Inter-Dominion Accord of 1948 was signed between two countries which provided a temporary agreement requiring India to release sufficient waters to Pakistani regions and Pakistan, in return, will make annual payments to India and will not claim any rights on the river waters. (http://www.transboundarywaters.orst.edu/research/case_studies/Indus_New.htm 11/26/2008). Both East and West Punjab agreed that “the position existent at the time of partition will not be disturbed and waters shall be divided equally.” The basic problem was that the canal system was developed in the Eastern Punjab, a region that was an Indian territory now. However, in 1948, East Punjab stopped the flow of water to West Punjab stating absolute sovereignty over water.

The then Prime Minister of India, Mr. J. L. Nehru, invited Tennessee Valley Authority's David Lilienthal for devising a plan for peaceful resolution of water sharing between two countries. It was after Lilienthal's recommendations that World Bank decided to provide its offices and personal for mediating water conflict between two countries. Negotiation process started in 1951 and continued till 1959. Initially, World Bank asked both parties to come up with their own water allocation formula. Table 1 shows the initial and final demands by India and Pakistan. Neither of the stakeholders agreed to others plan. World Bank suggested that India should use water from three eastern tributaries (Ravi, Beas, and Sutlej) upon payment to Pakistan the "cost of replacement works" (62 million pounds) and Pakistan to use water from three western rivers (Indus, Jhelum, and Chenab). The World Bank and other international agencies provided $870 million to Pakistan and $200 million to India for to defray infrastructure costs.
4. Variable Identification

To identify the dominant variables, we have analyzed the interaction of the all six NSS variables over time. This process will help us identify dominant variables within the NSS framework which can capture the dynamics of the water conflict in IRB. We will explain, systematically, how we have eliminated unnecessary variables in NSS in the next section.

4.1 All variables included: A general prospective

The history of water administration in Indus River basin dates back to the early 1700s when rapid expansion of agriculture in the region created extensive demand of irrigation which prompted withdrawal of large amount of river waters. This demand for irrigation is created economic costs and benefits (C) in the entire region which eventually created opportunity, two commissioners will work closely resolve the difference. However, if the difference turns out to be a dispute then World Bank is allowed to appoint a "neutral expert". Neutral expert will provide independent opinion, however, if the dispute is still not resolved then, both countries can appoint negotiators. If either side (or the mediator) disagreement, there are provisions which include convening of a Court of Arbitration.

Appointment of two Commissioners, Neutral Expert Difference (appointed by World Bank), Court of Arbitration dispute (seven members)

In case of a difference of opinion, two commissioners will work closely resolve the difference. However, if the difference turns out to be a dispute then World Bank is allowed to appoint a "neutral expert". Neutral expert will provide independent opinion, however, if the dispute is still not resolved then, both countries can appoint negotiators. If either side (or the mediator) disagreement, there are provisions which include convening of a Court of Arbitration.

Development of IBDF (Indus Basin Development Funds)

$ 900 million (71% participating nations, 19% India, 10% World Bank)

Indus Water Treaty (IWT) was signed between India and Pakistan in 1960 and it is perhaps the only conflicting international trans-boundary water treaty which is successful.

Our objective is to study IWT within context of Natural and Societal Systems (NSSs) and explain (1) why Indus Water Treaty was successful and (2) How NSS can explain any possible futuristic scenarios emerging from failure of treaty?

4.2 Under the British Administration and after Partition

In the 1940s, both Pakistan and India were part of the British India and thus there was a singular jurisdiction which essentially dictated water use. It was also during this period that agriculture experienced rapid growth. Water problems emerged when the Government of India Act in 1935 put water under provincial jurisdiction. There were intensive conflicts between the province of Punjab and Sind due to the extensive irrigation development leading to intervention by federal government. The then British India Government attempted to resolve the conflict by calling for an integrated basin management approach in 1942. The breaking up of water jurisdiction into the provinces was seen as the seed of water conflict. Both provinces increase their level of water usage (Q) and create a conflict due to a weak institution and governance structure (G). The new interaction is shown in Figure 4.
Although there were few attempts for negotiations during British rule yet both the provinces could not find common ground solution. The British involvement in World War II has also exhausted the British Empire and weakened its influence on its colonies. They were therefore unable to arbitrate the terms and conditions to make them acceptable to both sides. Water negotiation was extended all the way to 1947 when the Indian Independence Act of 15 August 1947 transformed it to an international conflict between two countries, India and Pakistan. The poorly established boundary of the partition of Pakistan and the newly independent India has placed both parties in direct conflict over the Eastern Rivers of Sutlej, Beas and Ravi where most of the irrigation and water infrastructure was constructed. India being the upper riparian had dammed the tributaries on their side of the border therefore depriving water to Pakistan which is required heavily for its agricultural development. It was also a security concern to Pakistan that sudden release of water from the Indian dams could potentially cause destructive floods.

On the western rivers of Jhelum, Chenab, Indus, which Pakistan could potentially use, there was ample water but insufficient infrastructure to divert for irrigation use. The resultant of the inter-state nature of the conflict further weakens the management of the water basin (G) and the actions of India have created a severe water shortage (Q) for Pakistan. These have very severe impact economic impact (E) to Pakistan. The dynamics of the full blown conflict in 1948 is shown in Figure 5.

### 4.3 Indus Water Treaty

Given the availability of water from western rivers, Pakistan would be able to alleviate its water problem if it builds necessary water infrastructure on the three rivers. However, a major hurdle would be the lack of economic resources (C) that puts constraints from managing such construction work. Introduction of the World Bank has a mediator (G) in the conflict and the economic assistance (C) offered, therefore acted as a catalyst to solve the conflict. Previous contention over specific water quantity entitlement was also ameliorated by application of Harmon Doctrine. The river tributaries were divided between two countries, where each would have an absolute jurisdiction over river waters. The World Bank, through a consortium of countries, provided loan provided for the construction of water infrastructure on the Western rivers. India was to going to pay a small portion of its costs. This alleviated the contest on the eastern rivers and thus breaking the deadlock on the issue. The dynamics of the water treaty is illustrated in Figure 6.

The resultant water treaty therefore provides the legal framework (G) for the use of the water basin. Although it is not an integrative basin management yet it created a means for information sharing, a joint commission with equal representation, a conflict resolution mechanism and basin management fund to manage the transition work for Pakistan. The relationship of three factors of Quantity (Q), Economic Considerations (C) and Governance, Institution and Legal Framework (G) can be constructed in the model as shown in Figure 7.

The governance, institutions and legal framework (G) affect the quantity available to the riparian states (Q) and in a water conflict, this relationship is stressed. Quantity factors would in turn create an impact on the economic condition (C) on the states that use it for agriculture. Economic considerations in turn are would set boundaries to the water negotiations whereby funds are needed for new water infrastructure. The introduction of the World Bank was able to reverse the relationship through two critical pathways of directly mitigating the negotiation process to manage the water as well as to provide economic incentives to resolve the quantity dilemma. In summary, we acknowledged that there exist sub-variables which control the IWT. At present, the primary variables and the sub-variables are shown in Table 2.

### Table 2: Identification of major variables and the sub-variables for IWT.

<table>
<thead>
<tr>
<th></th>
<th>Quantity (Q)</th>
<th>Economic Considerations (C)</th>
<th>Governance, Institution and Legal Framework (G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation</td>
<td></td>
<td>Infrastructure</td>
<td>Territorial Division</td>
</tr>
<tr>
<td>Flood Control</td>
<td></td>
<td>Agriculture</td>
<td>Inter-country</td>
</tr>
<tr>
<td>Non-consumptive use</td>
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### 4.4 Application of NSS to Baglihar Dam

If the variables that we have identified are correct then we should be able to explain any futuristic scenarios in the IRB. We will demonstrate how interaction of three variables can explain any conflict in IRB. India, in 1993, proposed to build a hydroelectric project, known as Baglihar Dam, on eastern river, Chenab, which is initially allocated to Pakistan. Pakistan complained to World Bank about the same but India reiterated that the project is a hydroelectric project and it has no storage potential. Figure 8 shows the interactions between variables that can explain various stresses which may create future conflicts. The solid black lines are the natural interactions explained above. With construction of Baglihar Dam, Governance and Institutions (G) will create stress on quantity (Q) which will lead to stressed economic conditions (C). The provisions in IWT are loosely written and give right to India to construct any non-damming hydroelectric power plants in its territorial waters of Eastern Rivers. Therefore, Indian Government decided to build a dam on strategic location on Chenab. In future, such dam will restrict natural flow or India may release only historical/mean flow to Pakistan thereby affecting the quantity of water meant for Pakistan. Since the economy of the region is heavily dependent on water driven agriculture, it will reduce the income/revenue from agriculture in Pakistan. Loss of revenue in Pakistan will affect local governance within Pakistan. In this case there would be stress from G to Q and it will result in a conflict.
5. Summary and Key Questions Addressed

Our objective in this study was to examine (1) why Indus Water Treaty was successful and (2) How NSS can explain any possible futuristic scenarios emerging from failure of treaty? The dynamics of this conflict revolves around the tripartite relationship between quantity (Q), economy (C) and governance and institution (G). A small perturbation in any of the dominant variables may lead to a wide water conflict in the region. We have identified that inclusion of third party providing financial incentives eventually raises stakes for a peaceful resolution of the water conflict. NSS theory is capable in explaining a water conflict in making (Baglihar Dam), thereby proving that the identified variables play major role in the success of IWT. Additionally, how important are the geographical boundaries over political boundaries? IWT was formulated based on the geographical boundaries of rivers and not on the political boundaries, which further implies that quantity of river water being divided was never an issue on the negotiation table. Had there been political boundaries, India would have demanded more water since it is upper riparian state and all rivers originate from India.

References

http://www.transboundarywaters.orst.edu/research/case_studies/Indus_New.htm