Indus Consortium
for Humanitarian, Environmental & Development Initiatives

OXFAM

Provincial Water Briefing

Upper Indus Basin Irrigation System: A Critical Analysis of Punjab's Water Challenges 2014-15

Organization of Provincial Water Brief

This briefing paper is organized into five sections. The firstsection describes the water challenges of the upper Indus basin of Punjab. The second section traces the shifting waterscapes of Punjab. It shows how the present waterscape of Punjab is a result of a series of hydraulic interventions, social engineering and new administrative disciplines. The third section identifies the key water challenges of irrigation sector, especially the problems faced by the farmers. The last two sections – fourth and fifth –describe the concepts of framing water policy and suggest the next steps.

Water Challenges of Upper Indus Basin of Punjab

Of all Pakistan's provinces, Punjab has many advantages in terms of irrigation water and agriculture. Its status as the upper riparian gives it a critical leverage and claims over the distribution of Indus waters. It has groundwater reserves which are being used as supplementary supply to canal irrigation system[1]. Without groundwater abstractions the irrigated agriculture in Punjab will be questionable, as water allowance per acre of command area is almost one-half to one-fourth in Punjab from that of Sindh and Balochistan. It owns large stocks of water infrastructure and irrigation network.A natural southwardly topographicslope makes the task of drainage and flood management easier.

Notwithstanding these advantages, the province is facing an emergent hydraulic crisis which poses serious threats to ecology, livelihoods and life of large segments of its rural population. Take some examples. Over half of Punjab's share of water in agriculture is lost in canals and

[1] *The potential of groundwater resources is generally estimated on the basis of rainfall recharge, groundwater recharge and recharge from irrigation system. According to some careful estimates, total available groundwater resources of the Punjab Province are close to 42.75 MAF.*

watercourses[2]. Now it is an irrefutable fact that many of irrigation uses are wasteful and water productivity in Punjab is inefficient and inequitable[3]. Most of its large water infrastructure has become old and needs the allocation of substantial financial resources for its sound maintenance and operations. Still the efficiency in Punjab is relatively higher than Sindh.

Majority of canals and distribution network are running below their design capacity. Without regular canal de-silting and controlling system water losses, it would not be possible to meet growing water demands for intensive commercial agriculture.

The case of barrages-the most primary basis of canal irrigation-illuminates the complex nature and scale ofthe problem of hydraulic system. The provincial government is although spending large sums of foreign loans for the rehabilitation of eight barrages but the author is of the opinion that the adopted engineering options are of little significance in terms of correcting adverse hydro-morphological changes evolved over the last many decades[4].

The diminished capacity of barrages coupled with adverse hydro-morphological changes has escalated the risk of devastating floods. Now the only possible way to manage medium and large floods seems to be planned embankment breaches which inflict large losses to public infrastructure, standing crops, livestock, etc. (More details of the crisis and problems of irrigation sector are discussed in the section four).

Political economy of water management is also confronted with the problem of provincial bureaucratic centralism. Owing

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[2] While some portion of the lost water is retrievable through aquifer recharge in sweet groundwater zones but much of it has little value in vast saline areas.

[3] For comparative details on the issues of low water productivity, see John Briscoe Usman Qamar. 2005. Pakistan's Water Economy Running Dry, World Bank and Oxford University Press, Karachi. Pp. 35-40.

[4] Mushtaq Gaadi. Barrages under threat. Daily DAWN, February 13, 2014

to the lack of devolution and decentralization, there are emergent voices for regional deprivation from southwest Punjab or Siraiki speaking belt which needs to be addressed for equitable and just irrigation water management.

The above mentioned crisis cannot be dealt with just routine measures and ordinary problem fixing. What is needed is the paradigm shift in both approach and practices which, in turn, can be only accomplished through triggering the process of policy formulation.

Shifting Waterscapes of Punjab

Waterscape is a holistic notion highlighting the fact of an inescapable integration of water to ecology, society and politics of certain geographical region(s). Its main contention is that natural or ecological conditions and processes do not operate separately from social processes, and that the actually existing socio-natural conditions are always the result of intricate transformations of pre-existing configurations that are themselves inherently natural and social[5]. In other words, both nature and society are co-constituted, thereby shaping each other in mutual ways.

The present waterscape of Punjab Province is the outcome of a series of past hydraulic interventions, social engineering endeavors and restructuring of political relations between state and society. Historically speaking, since the medieval period, there are three major phases of far-reaching and crucial re-ordering of waterscape of Punjab. The first phase started in the thirteenth century when the technology of Persian wheel provided with the opportunity to use hitherto un-exploited groundwater reserves especially of high rainfall areas and riverine belts[6].

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[5] For more details on the concept and its application in Spanish context, see Erik Swyngedouw. 1999. Modernity and Hybridity: Nature, Regeneracionismo, and the Production of the Spanish Waterscape, 1890-1930, Annals of the Association of American Geographers, Vol. 89, No. 3 (Sep., 1999), pp.443-465

[6] The use of wooden Persian wheel comprising chain of buckets (or, rather rope carrying pots) and gearing mechanism was started in the thirteenth century and then fully diffused to different regions at the beginning of the sixteenth century. For the detailed debate on the consequences of the use of Persian wheel and expansion of

Both the northern foothills and the upper portions of Punjab's *doabs* were most favorably placed in terms of the criteria of high rainfall and rich aquifer. Therefore, they transformed and benefited in a great deal from the use of Persian wheel for well-irrigation. Irfan Habib, the renowned scholar of medieval history, partially attributes the migration of the majority of present *Jatt* tribes from Sindh and their subsequent settlement in these areas to the expansion of well-irrigation with the help of Persian wheel technology[7]. Meanwhile, the lower southwestern arid regions mainly comprised of the then Multan Suba and tracts of Bahawalpur and trans-Indus belt experienced the expansion of the system of inundation canals. The Persian wheel was also used to lift irrigation water from flood channels and streams in order to its conveyance to adjoining fields. The rapid and vast increase in irrigated agriculture along with enhanced regional trade led to the population increase, formation of regional states and process of mobility and resettlement in the late medieval and early modern period[8].

The second crucial transformation of Punjab's waterscape was started in the British colonial period at the end of nineteenth century. Initially, the British colonial administration thought it wise to continue with the technology and system of inundation canals in Punjab. They considered the policy of non-interference in the affairs of inundation canals prudent in terms of financial obligations and political implications. Traditionally, local people and regional elites were responsible for digging canals, raising embankments

well-irrigation in the medieval Punjab, see Irfan Habib. 1979. Technology and Barriers to Social Change in Mughal India, Indian Historical Review, vol, I, II; Chetan Singh. 1985. Well-irrigation methods in medieval Punjab: The Persian wheel reconsidered. Indian Economic Social History Review, vol. 22, no. 73.

[7] *Irfan Habib. 1976. Jatts of Sindh and Punjab, in Harban Singh and N. Gerald Barrier (eds.), Essays in Honor of Ganda Singh, Patiala.*

[8] *For more details on the process of state formation, population increase and mobility allied to the expansion of irrigated agriculture in the late medieval period, see Richard Barnett.2008. Ripping Yarns and Rippling Dunes: State Building in Early Modern Cholistan, in Saeed Shafqat (ed.), New Perspectives on Pakistan: Visions for the Future, Oxford University Press, Karachi; David Gilmartin. 2004. Irrigation and Baloch Frontier, in Mansura Haider (ed.), Sufis, Sultans and Feudal Orders, Manohar, New Delhi. Pp. 331-391*

and undertaking annual de-silting works[9]. 'In such cases, when the community displays so much aptitude for self-government,' write Richard Temple, 'the Board consider non-interference the best policy, while they would always be ready to afford any aid which might be solicited'. However, practically, the policy of non-interference was confined to the decision not to invest into inundation canals. Otherwise, they were administratively put under the charge of Deputy Commissioner Office and local government[10].

At the end of nineteenth century, the colonial reluctance to stay away from large irrigation projects vanished. Both the new science of irrigation engineering and certainties of assured economic returns prompted the British Punjab administration to plan and execute the construction of a series of perennial canals. The ever-growing investment can be gauged by the fact that at the start of 1900 a total of Rs. 92,000,000 had been invested on theperennial canals in Punjab, and by 1926 over Rs. 158,600,000were spent in just five ofthe major canal projects. The total outlay on all the irrigation canals in 1926 amountedto about Rs. 295,400,000[11].

This huge financial investment in the construction of a series of barrages and weirs, canals and associated distribution network led to the rapid expansion of irrigation to higher grounds of western *doabs* in Punjab[12]. As a result, between

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[9] The early colonial official accounts are full of praise of the great canals of Multan constructed under the former Pathan rulers and Sawan Mal and the value of the Derjaat canals.

[10] The decision to extend state control over community operated inundation canals especially without state investment was questionable in many ways. One of its consequences was however the reduction of private investment and progressive alienation of local communities in operations and maintenance of these canals.

[11] Irrigation Department Report. 1926. Part II, p. 8.

[12] The sequence of major irrigation schemes executed and completed during the British colonial period in Punjab include Sidhnai (1886-88) in Multan,; Lower Sohag Para (1986-88) in Montgomery (present Sahiwal); Upper Bari Doab (1896-98) in Lahore; Lower Chenab Canal (1902-1905 and 1926-1930) in Lyallpur, Lahore, Jhang, Gujranwala and adjoining districts; Lower Jhelum Canal(1902-1906) in

1885 and the end of British rule in 1947, the canal-irrigated area in the Punjab, excluding the princely states, increased from under 3,000,000 to around 14,000,000 acres[13].

These massive hydraulic interventions accompanied far-reaching social engineering especially the development of canal colonies, military allotments and population transfer from the eastern Punjab. Overall, nine colonies were settled around these canals and together they carved up over 4 million acres of pastoral land for agrarian settlement.

Once irrigation became available, Punjab colonial officials were of the view that these pastoral lands could be ordered and a new society could be founded with the immigrants from the eastern and central Punjab. Moreover, for the accomplishment of colonial dream, a new regime of customs introduced, villages and markets planned, valuable commercial crops produced. A large grazing lands and pastoral landscape could thus be covered with cultivating fields, made commercially productive.

The third phase of the re-ordering of waterscape in Punjab started after the partition, particularly the Indus Waters Treaty in 1960s. In the aftermath of the Treaty, Pakistan had to construct two large storage reservoirs (Mangla and Tarbela Dam), six barrages and *400 miles of new link canals with a total discharge of 150,000 cusecs, or about two-third of the entire pre-exiting system in the Indus River Basin[14].*

The large scale river engineering and development have although fulfilled the eternal dream of greening deserts but not without price and adverse consequences. The construction of complex artificial hydraulic environment led to

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Shahpur and Jhang; Lower Bari Doab (1914-1924) in Multan and Montgomery; Upper Chenab (1915-1919) in Gujranwala, Sialkot and Sheikhupura; Upper Jhelum (1916-1921) in Gujrat; and Sutlej Valley Project (1926-1945) in Montgomery, Multan and parts of former Bahawalpur state.

[13] Imran Ali. 1988. Punjab under Imperialism, 1885-1947, Princeton University Press, Surrey.

[14] For more details on the partition of rivers and process of negotiations on the Indus Waters Treaty, see Aloys Aruther Michel. 1967. The Indus Rivers: A Study of the Effects of Partition, Yale University Press, London.

unique kinds of challenges and problems.

Key Water Challenges

There are four policy areas which need immediate attention. They included (i) maintenance and operations of water infrastructure; (ii) low water productivity and irrigation inequities; (iii) institutional appropriateness and reforms; (iv) climatic change and flood management. Some main details of these challenges and problems are in the following.

Risks and maintenance issues of water infrastructure:Punjab owns the largest stock of water infrastructure. However, much of this water infrastructure has become old and thus poses significant risks as well as being operated below its design capacity. In this regardthe case of barrages is the most significant and needs urgent attention. Take the example of Taunsa Barrage that appears to be even tragic and alarming. About four years ago, the barrage underwent emergency rehabilitation thanks to a World Bank loan totaling $134m. The intervention was meant to mitigate the risk of structural demise and to modernize the barrage's operating system.

However, a few months after the remedial works, the left marginal bund was breached and unprecedented devastation was seen during the floods of 2010. The estimated financial cost of the barrage dysfunction and subsequent flood disaster in Muzaffargarh district was to the tune of $6 billion.

Notwithstanding the expensive rehabilitation, the barrage is still considered to be a highly vulnerable hydraulic structure over the Indus River. The rehabilitation works failed to control perfuse subsurface seepage and the resultant forces of uplift pressure. The recent barrage sounding and probing reports that assess the stability of the structure confirm the sinking of loose stone and creation of wide pits on the downstream floor

of the barrage.

The Taunsa Barrage is a classic case wherein an ill-conceived engineering remedy turned out to be the cause of colossal human tragedy. The construction of a secondary weir, i.e. an un-gated obstruction wall downstream, has triggered several adverse changes. It has worsened the problem of backwater flow, and helped to make way for a delta-like formation in the upper reaches, complicated barrage operations and increased the risk of structural failure and flood disaster.

Ironically, similar kinds of risks and challenges are also involved with respect to other barrages which are being rehabilitated with large sums of foreign loans.

Another important implication of having large waterinfrastructure is ever-growing operation and maintenance (O&M) costs. According to the World Bank estimates, Punjab has US$20 billion of water infrastructure managed by the Irrigation Department. Based on the typical 3 percent of the value of the capital stock of water infrastructure, the cost of replacement and maintenance of Punjab's stock of water resource and irrigation infrastructure would be about US$ 600 million a year.Given the dwindling fiscal space, the task of allocating such large amount for the operations, maintenance and replacement of critical water infrastructure seems almost an impossible task.

Institutional Reforms and Management Transfers: The importance of dynamic social institutions for better water resource management is a well acknowledged fact. Before the advent of perennial irrigation during the British colonial period, regional elites and local communities were more responsible for the excavation and maintenance (especially de-silting) of inundation canals and construction of *sailaba bunds* (irrigation embankments) in the riverine and deltaic region. These institutions became irrelevant and dysfunctional after the introduction of centralization and

bureaucratization of irrigation management practices. For the long run period, this overwhelmingly techno-bureaucratic approach enmeshed with a kind of fossilized body of rules and laws resulted into the alienation of farmers and local communities in everyday management and operations of irrigation canals and associated distribution network.

In the mid-1990s, a sort of jumbled and half-hearted effort to institute irrigation management reforms was initiated under the thrust of the World Bank and allied international donors. The original World Bank's proposal was the privatization of canal waters and introduction of irrigation water markets. The plea argument for irrigation water market was summarized in the World Banks report entitled Pakistan Irrigation and Drainage: Issues and Options. The report emphasized that the government should not treat irrigation water as public good and private markets must be allowed to trade water. However, after stiff resistance from provincial irrigation bureaucracy, farmers' groups and political elites, the compromise was somehow made on the initiation of institutional reforms component under the World Bank's financed National Drainage Program (NDP) that aimed at handing over management responsibilities as well as shifting O&M costs to irrigation users at canal level[15].

The results of now almost a decade long experience of irrigation management transfer to farmers in selected canals have not been so far very successful. The main irrigation reform objectives of improved collection of irrigation tax and enhanced water supplies especially at the tail end areas through Farmers' Organizations (FOs) have not been satisfactorily accomplished.

Rather, the evidence suggests that the management system tends to work in duality without any vision and plan for change and way forward.

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[15] For more details on the origin and development of irrigation reforms under the World Bank financed National Drainage Program (NDP), see Mushtaq Gaadi. 2003. Re-colonizing the Indus Basin Irrigation System, in Kaisar Bengali (ed.) "The Politics of Managing Water", SDPI, Islamabad. Karachi: Oxford University Press, pp. 97-105.

The case of Derajat Canal Zone in D.G. Khan provides us a microscopic view of the situation on the ground. The formation of users associations (WUAs and FOs) and transfer of irrigation management to them was experimentally started in Chashma Right Bank Irrigation Canal (CRBC) in 2007. Later on, the process was also expanded to the entire of Derajat circle, Dera Ghazi Khan, in 2011.

According to the updated figures of PIDA, total water charges recovery in Derajat Circle amounts to sixteen (16) percent. The case of CRBC represents the worst example. After the start of FOs' tenure, the recovery of water charges plunged to four (4) percent. Later on, it improved merely up to fourteen (14) percent[16]. Overall, total water charges recovery in Derajat Circle amounts to sixteen (16) percent up to 30th August 2014[17].Whatever are the reasons of the failure in the collection of water charges but its cost is very high in terms of the financial and institutional sustainability of FOs as well as the operational sustainability of irrigation services and system.

A number of personal interviews with irrigation officers and farmers indicate how much pervasive is the culture of mutual denial, blame-game and confrontation between them. The irrigation officers working under Punjab Irrigation and Drainage Authority (PIDA) tend to consider themselves kind of abandoned children of their department. Many of them think that they have been posted to PIDA regulated canal areas as a punishment. While, on the other hand, majority of the representatives of FOs felt themselves helpless due to the lack of capacity, limited authority and absence of enforcement powers.

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[16] *Ibid*

[17] *For detailed information on the status of Abiana collection of FOs and PIDA share in Punjab Province, http://www.pida.punjab.gov.pk/?q=system/files/Abiana_310814.pdf*

As a result of the lack of future vision and sustained confrontation between irrigation bureaucracy and farmers, irrigation management reforms have become static and part of the status quo. Without instilling energy and changes, they seem to fail and thus further compound the prevalent institutional crisis in irrigation management.

Water productivity and inequalities: It is now beyond doubt that the availability of irrigation water would continue to reduce owing to the multiple water demands from different sectors of economy. The only option now left is to shift the focus from productivity per unit of land to productivity per unit of water.

The empirical evidence suggests that water productivity of Punjab in comparison to other similar cases is very much low. A comparison of wheat yields in California (USA), the Indian Punjab, and the Pakistani Punjab shows that productivity in Pakistan relative to India and California is about 3:6:10 per unit of land, and about 5:8:10 per unit of water[18].

Much of the low water productivity is related to supply uncertainties and widely prevalent irrigation inequalities. Numerous studies show that within watercourses, tail-enders typically get about 20 percent less water than those in the middle, who in turn get about 20 percent less than head-enders[19].

Climatic Change Risks and Flood Management: A significant percentage of the Indus River flows (about 60-80 percent) originate from the snow and glacier melting in Karakoram, Himalaya and Hindu Kush mountain ranges. The trend of glacial retreat and melting would cause both large destructive floods in the short term period and dwindling river inflows in longer period. Without getting prepared to adjust with this situation would result into new kinds of environmental, economic and social risks.

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[18] For more details on the comparison and related issues of water productivity, see John Briscoe Usman Qamar. 2005. Pakistan's Water Economy Running Dry, pp. 35-40

[19] Ibid, p. 31

Review of Concepts of Framing Water Policy

A cursory comparative analysis of irrigation water policies across diverse countries and regions confirm that "they embody, tentatively or permanently, formally or informally, several traits that are part of the global "toolbox" of what is being promoted as "best practices," "internationally recognized principles," or "modern management"[20]. In this regard, A. K. Biswas notes that the hegemony and popularity of such principles have something to do with their vagueness. "Integrated," "participatory," "decentralized," "pro-poor," "transparent" or "accountable" practices signal a "brave new world[21]."

This striking similarity of irrigation water policies applied in diverse ecological, social and political environments actually indicates how a standard global policy toolbox is being promoted by a set of actors including multilateral and bilateral institutions, academia, world conferences and influential international NGOs.

While there is no doubt that the sharing and transposing of "success stories", "best practices", or "appropriate technologies" can be the great source of inspiration and mutual leaning but the adequacy of their application outside of their particular context remains a valid question.

A solution to resolve this conundrum of policy formulation, as suggested by Brian Steensland, offers a reasonable way forward. According to him, the public task of policy framing should be accomplished through the integration of two approaches, namely actors' representation approach and adoption of actual policy frames. The first, an actor representation approach, emphasizes the changing positions and distribution of actors in policy deliberation and

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[20] *Molle, F. 2005. Irrigation and water policies in the Mekong region: Current discourses and practices. Colombo, Sri Lanka: IWMI. 43p. (Research report 95).*

[21] *Biswas, A. K. 2004. Integrated water resources management: A reassessment. Water International 29(2):248-256*

decision-making. The second, a frame adoption approach, aims at the changing distribution of frames that actors attach to a policy/practice/rule. While both approaches are most often separately treated in policy framing but they can work contemporaneously to produce best results[22].

If we simplify the above argument, the success of any policy framing is usually contingent upon two crucial factors. The first is the democratization of decision-making process through the involvement of diverse interest groups and stakeholders. Doubtlessly, it not only enlarges the definition and set of policy actors but also involves both the confrontation of interests and worldviews as well as dialogue, trust building and mutual social learning. Therefore, it must allow for a degree of "messiness and unpredictability" that is usually not recognized in classical approaches to Common Property Resource management[23].

The second factor relates to the identification of core issues and ideas which can become the basis for policy deliberation and dialogue.

Next Steps

Punjab is encountered with complex hydraulic crisis of its history. What is the way forward to cope with this crisis and get prepared for future risks? The typical answer would be formulating a provincial water policy that should set legal and institutional reforms into motion in order to address these problems. However, as experience shows, a policy comprising the standard toolbox with all fancy jargons is bound to fail in addressing the scale of crisis and its diverse manifestations.

For this purpose, it is imperative to adopt dialogic and

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[22] *For more discussion on the dynamic relationship of these two approaches, see Brian Steensland. 2008. Why do Policy Frames Change? Actor-Idea Coevolution in Debates over Welfare Reform, Social Forces, vol. 86, issue 3, p. 1027*

[23] *Cleaver, F. 2000. Moral ecological rationality: Institutions and the management of common property resources. Development and Change, vol. 31, no. 2:361-383*

democratic approach so that the representatives of all old and new actors should be able to participate, confront and forge consensus on the key areas of water challenges. However, it would require the strong ownership of policy deliberations and reform process by the government.

Secondly, the process should start from the identification of key frames of debate which should guide it in realisticdirections. It is recommended to take the following aspects into close consideration:

- What are the most pressing issues regarding water and irrigation practices, laws and institutions and in which locale are these issues more salient?
- What are the realistic practical measures that the provincial government can practically deal with, given its current power and the political-economic environment?
- What can be learnt from the present policies, laws and practices on the ground? What scope is there to enhance social learning, build trust and favor endogenous processes?
- What is the nature, and what are the implications of private-sector involvement? How are community and private conceived in each case as alternatives to state roles?
- What kind of role external aid agencies and groups of civil society can play in the process of deliberation and change?

IMPROVING WATER GOVERNANCE AT LOCAL LEVEL

Project's background: The canal water irrigation system in Sindh and Punjab needs to be improved drastically to benefit small farmers who draw water from the tail-ends of canals and water courses. These small farmers receive little or no water compared to their entitlement. Water theft, water losses due to seepage and leakage, delayed supply, absence of information, large landholders' exploitation, unmaintained water courses and over-installation of tube wells are the main causes of hardship for small farmers at the tail-ends.

Besides that, there is a need to expedite the process of policy formulation at the provincial level ensuring that the policy formulation is informed by the real problem of the tail-end farmers.

Keeping in view all these problems, Indus Consortium has launched a project of Improving Water Governance (IWG) at Local level with the financial assistance of Oxfam Novib. The project covers the area of Rangpur Canal (Muzaffargarh), Daajal Canal (Rajanpur) and Akram Wah (Badin).

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