Supply-Side Hydrology in India

The Last Gasp

The plan for inter-linking rivers is based on the simple and deeply flawed belief that rivers have surplus waters and that floods and droughts can be banished by technical solutions alone. This belief is grounded in the troubled legacy of hydraulic management in the sub-continent dictated by a supply-side approach, which ignores the complexities inherent in river ecosystems.

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Those who are good at controlling water give it the best opportunity to flow away, those who are good at controlling people give them plenty of chance to talk.

– Chia Jang, a great Han Engineer
(Quoted in Joseph Needham, *Science and Civilisation in China*, Vol 4, Part III, Cambridge, 1971)

Fame had already preceded Colonel Arthur Cotton in May 1858, when he submitted his *Report on the Mahanuddy River* to the colonial government of Orissa. As a hydraulic engineer, Cotton had previously experienced immense successes in the Kaveri, Godaveri and Krishna deltas. Though the report on the Mahanadi river was required to principally suggest a solution to the problem of flooding in the Orissa delta, it dramatically went beyond its modest brief. But 1858 was no ordinary year. The East India Company administration in India had just given way to Crown government and the British empire was busy setting itself up for glory and permanence. The era of high finance moreover had begun, with financiers, bankers and sundry speculators desperately steering money markets in London towards investing in the colonies.[1] It was a time for big-thinking about schemes and ventures. Driven in equal measure by unrestrained speculation about super profits and quick returns.

Colonel Cotton, with a formidable reputation to nurse, was out to seize the moment. His *Report on the Mahanuddy* authoritatively proclaimed that the Orissa delta like "all deltas require[d] essentially the same treatment".[2] The Mahanadi river, he suggested, needed to be 'regulated' by a plexus of irrigation and navigation canals and lined by a system of embankments. The entire project, he estimated, could be completed at the cost of a mere Rs 13 million and would be made to irrigate 2.25 million acres, while generating a 30 per cent return on the investment. The Orissa scheme, as it came to be known, however, was not intended to stand alone. Colonel Cotton in his inestimable confidence had earlier also drawn up a plan to connect the Indian subcontinent through a grid of navigation and irrigation canals. A peninsula system, in other words, which would link Karachi in the northwest to Madras in the south via Kanpur, Calcutta and Cuttack, with additional lines to Poona and the west coast.[3] The Orissa scheme was merely one segment in the larger and of opportunity was, however, also a period of intense competition. Cotton's river inter-linking scheme was double edged; it had to draw capital investments for navigation and irrigation schemes while simultaneously starving the same for the railways, which was then being touted as the most viable mode for mass transport in India. Cotton, in effect, wanted river navigation to trump railway lines. This explains why his *Report on the Mahanuddy* contained several diatribes against the railways, which he unhesitatingly declaimed was an "inferior mode of conveyance".[4] In the subsequent years, Cotton's reputation was all but eclipsed. Not only did the proponents for the railways triumph, but the Orissa scheme and several others, whose construction Cotton had pushed for, had turned into sordid financial disasters.[5] In fact, by the time Arthur Cotton left India, he was a much defeated and broken man.

The idea for inter-linking rivers in India, however, seems to have been firmly planted. In the 1960s K L Rao, the then union minister of state for power and irrigation, spoke of linking the Ganga with the Cauvery through a 2,640 km long canal. By the 1970s, the plan was reworked as a 'national river grid' by which the surplus waters of the Ganga and Brahmaputra were to be diverted to the central and southern states. Earlier, one Captain Dastur, an air pilot, proposed that a 4,200 km long Himalayan canal and 9,300 km long southern canal be linked up at Delhi and Patna. Captain Dastur's proposal was popularly referred to as the Garland Canal.[6] The government of India subsequently set up the National Commission for Integrated Water Resources Development Plan (NCIWRDP) to assess these grand schemes. In their report, submitted in 1999, the NCIWRDP concluded that K L Rao's proposal was "very costly and lower cost alternatives were available". The commission was even more curt about Captain Dastur's proposal, which was dismissed as being "prima facie impractical".[7]

Oddly enough, the idea for inter-linking India's rivers, despite its repeated dismissal by expert opinion, seems to be merely shelved rather than killed. On October 31, 2002, the Supreme Court bench headed by Justice Kirpal 'suggested' that the government take up the plan for linking rivers. This set off an immediate chain reaction. By November, the central government claimed that feasibility studies for six of the peninsula links were ready and by December 16 of the same year appointed a Task Force under the chairmanship of Suresh Prabhu to prepare and outline an action plan for implementing the project.[8]

As it now stands, the plan, which, from a hydrologist's point of view, reads like a suicide note, advocates for 37 rivers in India to be connected through 30 links and 36 major dams. The claim is that it will generate 30,000 MW of cheap hydropower, supply drinking water to 101 districts and five metros and irrigate 34 million hectares. This idea, as stated, turns on the proposition that one has to "divert waters from surplus areas via storage dams and canals to where it is scarce."[9] This simple and deeply flawed belief that rivers have surplus waters and that floods and droughts can be banished by technical solutions in actual fact draws from a troubled legacy of hydraulic management and control in the subcontinent.

History and Hydraulic Practice

Historically, technologies for hydraulic manipulation in the Indian subcontinent has moved through three distinct, though overlapping, phases. From the earliest times, tanks, inundation canals, temporary bunds to trap drainage, wells and water-wheels made up the ensemble of water harvesting structures. These techniques were essentially directed towards either impounding precipitation, tapping river inundations or retrieving groundwater recharge.[10] At the risk of oversimplification, one could perhaps conclude that the underlying hydraulic principle was to adapt the water harvesting structure and design to micro-climates, topography and fluvial process. In the early 19th century, however, British colonialism initiated a radical break in both technique and hydraulic principle by introducing perennial canal irrigation in several parts of the south Asian subcontinent. For the first time, permanent head-works in the form of barrages and weirs were thrown across river-beds and their waters diverted through intricate and extensive canal systems. These barrages and weirs were equipped with a series of shutters to regulate flows by impounding water during lean seasons and diverting it into canals and on the reverse the former could be flipped open to release waters during periods of the river's peak discharges. In effect, by flattening the river's variable flow regime at certain points along its course, irrigation was transformed from a seasonal to a perennial possibility. This phase, often referred to as the advent of the era of modern irrigation, witnessed the construction of several large canal irrigation schemes with permanent head-works such as the Ganges Canal (1854), the Godavery (1852) and the Krishna (1855).[11] These gargantuan projects made possible a dramatic hike in cropping intensities, fuelled the growth of commercial farming and encouraged the spread of mono-cropping. By the time the great production boom from perennial irrigation began to level-off sometime in the early decades of the 20th century, the attendant problems of salinisation and waterlogging had irreversibly, in many instances, turned a fair amount of formerly fertile and cultivated lands into barren and unproductive deserts.[12] But just about the time that large-scale canal irrigation projects began to falter in their financial returns and productivity gradients, a third wave in hydraulic manipulation emerged in the 1930s, which was chiefly developed and pioneered in the US. Under the rubric of Multi-Purpose River Valley Development (MPRVD), a slew of new technologies were put into operation to effect the virtual industrialisation of river

due to water-logging in large areas of the command.[20] Similar instances, in fact, abound of post-project soil degradation caused by reckless canal irrigation; the Sriram Sagar (Andhra Pradesh) irrigation project has water-logged close to 60,000 hectares of its command and the corresponding figures for Chambal (Madhya Pradesh and Rajasthan) and Gandak (Bihar and Uttar pradesh) are ascertained at 98,700 hectares and 2,11,010 hectares respectively.[21] Salt build up has also been an equally vexing problem in irrigated tracts. By the late 1980s, India's share of salinised

transformed into a "succession of waterlogged morasses" in which "dismal swamps breeding malaria" were debilitating the population and the fertility of the soil.

The post-independence phase has been no better, with successive governments continuing to intensify embankment construction and aggravate drainage congestion. More specifically, through unrestrained and unplanned urban growth. The consequent destruction of wetlands, which are vitally important as flood cushions and breeding grounds for a variety of flora and fauna,

support natural processes.[41] In other words, dammed rivers are dead rivers.

By thus recasting, in fundamental ways, the manner in which fluvial processes are understood, hydrologists, ecologists and popular initiatives the world over are now defining an altogether fresh paradigm for interacting with hydraulic endowments, which I would loosely term as essentially a demand-management approach. This new mood has perhaps, also helped push for the CALFED Bay-Delta Programme, which was initiated in the state of California in 1994, with the task of restoring the "ecological health and improving water management" in the region. The CALFED programme is a unique exercise in attempting to 're-store' the states' immensely stressed and degraded river system as viable natural processes.[42] Something to the tune of between $8-10 billion has been marked to be spent on the task and in turn it is breeding a whole slew of pioneers in the field of river restoration and management, who, unlike civil engineers and dam builders of a previous era, seek hydraulic integrity as their objective rather than short-term river control. River restoration is currently an expanding area of investment by public water management bodies in Australia, the USA and the EC and has been used for the enhancement of instream habitat, for reducing nutrient and sediment loads from intensively farmed agricultural land, for enhancing landscape quality and for the stabilisation of eroding stream systems.[43]

Concluding Remarks

Supply-side hydrology was the product of a certain political era. Its main proponents and benefis

relieve India's water stress. Reviving, restoring and achieving natural drainage, fluvial process and hydraulic integrity will perhaps cost just about that much.

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Notes

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1 On British capital exports to India in this period see Leland H Jenks, *The Migration of British Capital to 1875*, New York, 1927.
2 Colonel Arthur Cotton, *Report on the Mahanuddy River*, Calcutta, May 1858, p 3.
3 Daniel Headrick, *The Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850-1940*, UK, 1988, p 20.
4 Colonel Arthur Cotton, *Report on the Mahanuddy River*, p 22.
5 On the failure of the Orissa scheme see Rohan D'Souza, 'Canal Irrigation and the Conundrum of Flood Protection: The Failure of the Orissa Scheme of 1863 in Eastern India', *Studies in History*, January 19, 2003, pp 41-68.
6 Aniket Alam, 'Linking Rivers: Would It Drought Proof India?' in *The Hindu: Survey of the Environment, 2003*, p 48.
7 *Dams, Rivers and People*, SANDRP, Issue One, February 2003, p 3, Available on www.narmada.org/sandrp.
8 Ibid, p 2.
9 Shankar Aiyar, 'Changing the Course', *India Today*, January 20, 2003, pp 28-32
10 For a comprehensive discussion of the various types of water harvesting structures termed traditional see Anil Agrawal and Sunita Narain (ed), *Dying Wisdom: Rise, Fall and Potential of India's Traditional Water Harvesting Systems*, Centre for Science and Environment, New Delhi, 1997. Also see Nirmal Sen Gupta, *User Friendly Irrigation Designs*, New Delhi, 1993.
11 Following the 'sepoy mutiny' of 1857, the Indus river system was over-run by a series of irrigation schemes. Beginning with the Bari Doab canal (1859) and the Sirhind system (1882), the drive climaxed with the 'most ambitious' irrigation project of the colonial period – the Triple Canal Project (1916). For studies on colonial irrigation history in India see Elizabeth Whitcombe, 'Irrigation' in Dharma Kumar (ed), *The Cambridge Economic History of India, C 1757 – C 1970*, Vol II, New Delhi reprint, 1984.
12 For studies on colonial irrigation history in India see Elizabeth Whitcombe, *Agrarian Conditions in Northern India*, Vol I, Berkley, 1972, Ian Stone, *Canal Irrigation in British India*, New Delhi, 1985 and Imran Ali, *The Punjab under Imperialism (1885-1947)*, New Delhi, 1988