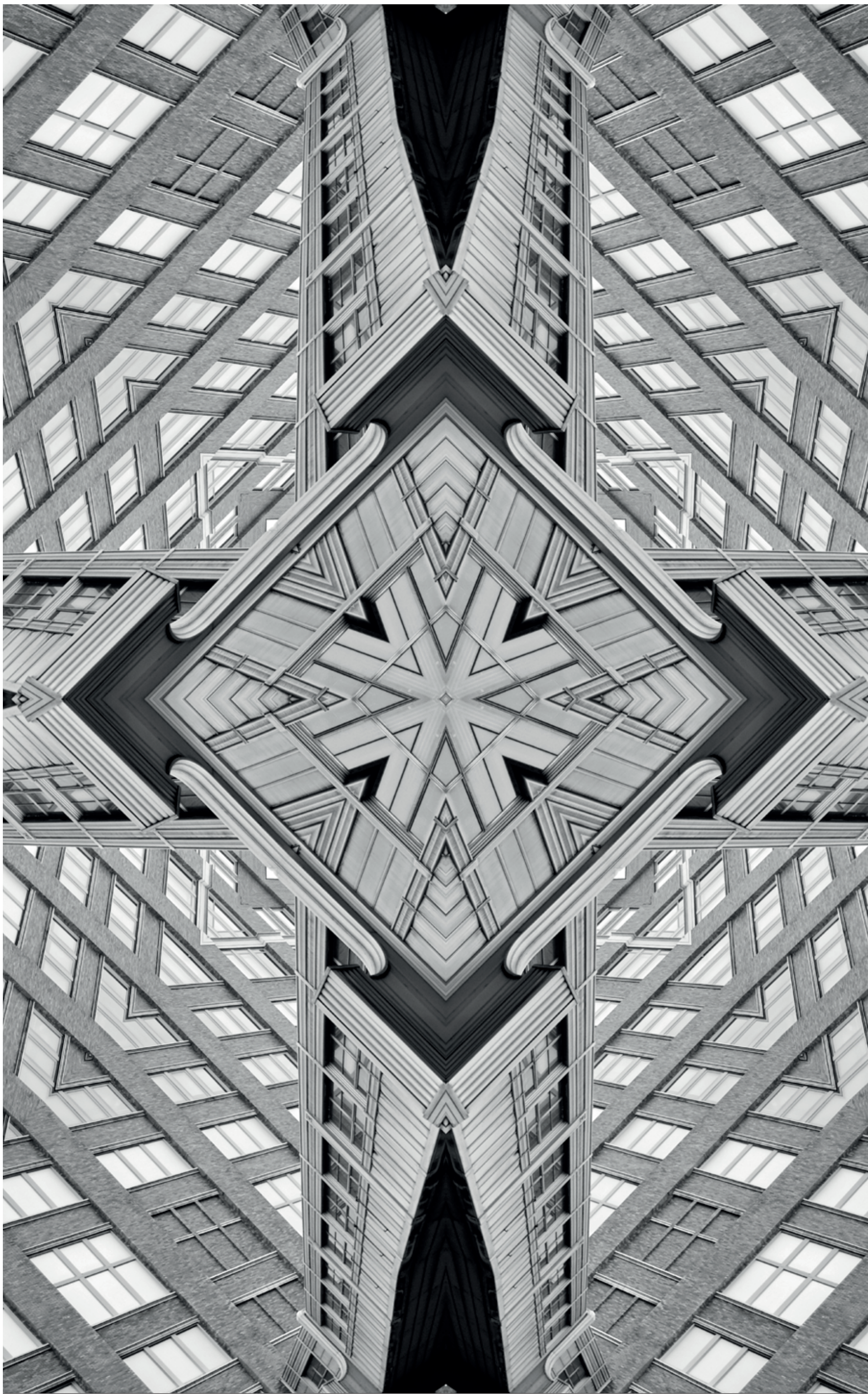
OBSERVER RESEARCH FOUNDATION

Issue Brief

ISSUE NO. 446
FEBRUARY 2021



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India's Enduring War of Water Governance Paradigms

Nilanjan Ghosh

Abstract

This brief examines the silent "water war" being waged in India in the form of conflicts over two opposing paradigms in water governance: the reductionist, colonial engineering paradigm, and the emerging, holistic paradigm of integrated water governance. The brief highlights the paradigm debate at the global scale, and outlines the canons of the integrated approach, contrasting it with the reductionist approach using examples in India. It makes a case for a long-due paradigm shift to the integrated approach.

Attribution: Nilanjan Ghosh, "India's Enduring War of Water Governance Paradigms," *ORF Issue Brief No. 446*, February 2021, Observer Research Foundation.

Introduction

A silent "water war" is ongoing in India—the conflict over paradigms of water governance: structural interventions that were the hallmark of colonial-era engineering, or a more holistic system.[a] To be sure, this conflict in paradigms of water management is not unique to India; it is a global phenomenon that has persisted over the last four decades ever since Western countries realised that large-scale dam building and structural interventions had been fragmenting river systems and leading to irreversible ecosystem destruction at the basin scale. In 2000, the European Union (EU) adopted the Water Framework Directive, following which a series of dam decommissioning happened across Europe. Since then, some 5,000 such structural interventions have been decommissioned in France, Sweden, Finland, Spain and the United Kingdom.[1] The same directive mandates EU member states to improve the ecological conditions of the water bodies—this has led to a trend of reviving natural hydrological flow regimes by keeping water instream. In another part of the world, the United States (US)—which witnessed large-scale dam building from the 1920s to the 1960s—also dismantled more than 1,000 such structures in the recent decades[2] in attempts to revive the basin ecosystem.

In India, however, this worldwide call for a shift to Integrated Water Resource Management[b] has so far eluded the water technocracy. Indian hydro-technocracy has remained adherent to archaic notions of water resource development that considers short-term economic benefits while ignoring long-term sustainability concerns. It has also opposed any change from the status quo.[3]

> "The conflict in paradigms of water management is not unique to India; it is a global phenomenon."

a The term "paradigm" here is used in the manner referred to by Kuhn (1969) while explaining changes in the structure of scientific knowledge in general. See T. Kuhn, *The Structure of Scientific Revolutions*. (Chicago: University of Chicago Press, 1969).

b IWRM focuses on demand management, keeping water instream, and ecosystem restoration.

Introduction

In the past few years, the administration of Prime Minister Narendra Modi has made certain efforts to steer the country towards integrated water governance. In 2016 two bills were drafted: the *Draft National Water Framework Bill 2016* (NWFB), and the *Model Bill for the Conservation, Protection, Regulation and Management of Groundwater 2016*. In the same year, the report, *A 21st Century Institutional Architecture for India's Water Reforms*, was released.[c] The Report recommended that both the Central Water Commission (CWC) and Central Ground Water Board (CGWB) be dissolved, and in their stead be created a multi-disciplinary National Water Commission (NWC). This is indeed a rational recommendation, given that groundwater and surface water are not separate entities but integral components of the same hydrological system, and therefore need to be governed using a holistic basin ecosystem governance approach. The Report called for a multidisciplinary approach to governing waters through the involvement of social scientists, natural scientists, professionals from management, and other specialised disciplines.

Such an approach is in clear contrast to the existing paradigm that was imposed on India by its British colonial rulers. The CWC disagreed strongly with the Report and sent a note to the then Minister of Water Resources, Uma Bharti, warning that the Report's "anti-dam" and "anti-development" approach would affect India's food security.[4] This brief will disprove the CWC's position.

> "Since 2016, the government has made efforts to steer the country towards integrated water governance."

c All three were drafted by committees chaired by Dr. Mihir Shah, former member of the erstwhile Planning Commission.

The Global Paradigm Debate

Strands of literature provide enough evidence that the 'business as usual' way of managing water has become unsustainable, and would lead to severe stress, and even possibly conflicts between stakeholders.[5,6,7,8,9,10] The last few years therefore witnessed the increasingly ubiquitous call for change in the existing visions of managing water. The new thinking entails replacing the reductionist engineering-centred paradigm by a new holistic and interdisciplinary notion.[11]

There is no doubt that the progress of the present civilisation is marked by human ability to build bigger engineering structures that modify the flow regimes through storage and diversion. In conjunction with gaining control over the aquifers through stronger pumping technologies, surface water controls were achieved through large dams effectively used for controlling floods and generating hydro-electricity at a massive scale. This offered reasonable protection against seasonal water shortages and even spatial inequities in water availability. The irrigation canals made it possible for humans to grow food in newer as much as it enhanced the growing seasons for crops.

Over time, it became a predominant view that water scarcity is *spatial*, and that water can be diverted to the water-scarce zones from the water-rich ones, through appropriate supply augmentation plans. In order for water to be distributed equitably—so the thought process explained—supply should be expanded through interventions in the natural hydrological flows.[12]

Such strategies indeed resulted in impressive successes in providing larger supplies to water-scarce regions. The successes were short-term, though, and over time it became clear that the new and emerging challenges of the future are much more complex than scarcity. Concerns heightened that following a strategy that single-mindedly sought to increase intervention into the hydrological cycle were becoming counter-productive as they led to adverse impacts on basin ecosystems. This brought about the call for a holistic knowledge base, identified as IWRM.[13,14]

> "There is no dearth in scientific evidence that the 'business as usual' way of managing water has become unsustainable."

Integrated Water Governance at the basin scale

The recognition that there is an imperative for a holistic approach in managing water and governing river basins is reflected in policymaking in different countries.[15] Apart from dam decommissioning, other means to conserve water instream are being undertaken in various countries across the world. In Australia, for example, the Murray-Darling Basin Commission is contemplating on extending financial assistance to farmers who save on their allocation of irrigation water and allow these savings to remain instream.[16] Meanwhile, in Chile, the National Water Code of 1981 established a system of water rights that are transferable and independent of land use and ownership. The most frequent transaction in Chile's water markets is the 'renting' of water between neighbouring farmers with different water requirements.[17,18] More recently, in December 2019 in Chicago, water derivatives trading began at the Mercantile Exchange in order to combat water availability risk in the US west.[19] This is a significant development towards demand management after years of structural interventions that affected river courses in western US.[20]

The most critical issue here is to acknowledge the need for a systems approach[21] to water governance, in general, and of river basins in particular. River basins are integrated and all parts are linked to changes in others, over space and time. Such changes may be part of either natural processes or else are human-induced.[22] Flows in rivers are not only of water with dissolved chemicals, especially in the conditions prevailing in India—[23] they also carry sediments, energy and biodiversity, and tinkering with any of them will impact all the others. Activity taking place in one part of the basin (e.g. disposal of waste water, deforestation of watersheds) will have impacts in all downstream parts. For example, the construction of the Farakka barrage on the lower Ganges in India commissioned in 1975 is blamed for inhibiting sediment flow further downstream into the delta, thereby restricting soil formation. Successive flood damages in Bihar in 2016 have also been attributed to the sediment accumulation behind the barrage.

"Apart from dam decommissioning, other means to conserve water instream are being undertaken in various countries across the globe."

While the canons of an integrated approach at a basin scale are still evolving, the following points offer a summary based on existing literature.[24]

a) Water needs to be viewed as a flow and an integral component of the ecohydrological cycle, rather than as a stock of material resource to be used according to human requirement and convenience.

b) From an economic perspective, water has value in all its competing uses including for those of the ecosystems (to be recognised through valuation of ecosystem services associated with water and flow regimes). Therefore, water should be recognised as an economic good in its broader ecological economic interactivity. From a social perspective, this cannot preclude the affordability and equity criteria.

c) The river basin should be the unit of governance.

d) Supply of ever increasing volumes of water is not a prerequisite for continued economic growth or even for food security. Rather, options need to be sought in water-saving technologies.

e) There is a need for comprehensive assessment of water development projects within the framework of the full hydrological cycle.

f) A transparent and interdisciplinary knowledge base for understanding thesocial, ecological and economic roles played by water resources is required.

g) Droughts and floods are to be visualised in the wider context of the ecological processes associated with them.

h) It is important to devise an integrated approach towards policymaking, decision-making, and cost-sharing across various sectors in the basin including industry, agriculture, urban development, navigation, ecosystems, taking into consideration the poverty reduction strategies.

i) It is important to create a solid foundation and repository of multidisciplinary knowledge of the river basin and the natural and socio-economic forces that influence it.

j) Gender considerations are important, and as recognised in the Dublin Statement:[25]"women play a central part in the provision, management and safeguarding of water."

These elements are indicative and inexhaustive, and are subject to further refinement with disciplinary progression. What they offer are the pillars for drawing the contours of an emerging paradigm.

Water conflicts in India often need to be attributed to the reliance on a reductionist vision that drives the supply augmentation plans geared by traditional engineering and neoclassical economic thinking. This reductionism in thinking is best described as "arithmetic hydrology" with all challenges of governance and their resolution being reduced to a few numbers, in the process losing out on critical variables and resulting in subsequent water management problems.[26] Indeed, India's environmental security concerns over the transboundary Himalayan waters have arisen more due to the reliance on such reductionism brought about by the structural engineering paradigm of the British colonial engineers, who hardly had much idea about waters flowing down the Himalayan terrain.[27] The application of "one for all" technology in water resource planning and management bereft of the broader sustainability science embedded in it has been the primary cause of concern.[28] This has been the hallmark of the existing water technocracy in India, as this brief will describe in the succeeding paragraphs.

Proposal for Interlinking of Rivers

The proposed River Link Project (RLP) in India is a classic example of the reductionist "arithmetic hydrological" paradigm upholding the supply augmentation mechanisms for combating water scarcity. The project entails creation of large project for storage and long-distance water transfer mainly from what is perceived as "water-surplus" Ganges-Brahmaputra-Meghna (GBM) basin, to "water-deficit" peninsular river basins (See Figure 1), through the construction of nine large and 24 small dams, and digging of some 12,500 km. of canals. The definition of "surplus"and "deficit" river basins were taken by NCIWRDP[29] from an unpublished document by AD Mohile.[30,d]

The project hardly fulfils the canons of scientific validity from the perspective of sustainability and equity,[31] or even ecological economic viability.[32] Apart from the ecological and cost perspective apprehensions that the project may further aggravate interstate water disputes, there are also concerns that it will aggravate the international hydro-political situation in South Asia.[33]

d The methodology simply concerns itself with a few numbers of supply side depending on 50-75% dependability, and maps the same with economic demand without any concern of the broader ecosystem needs or flows needs.

Hydropower in the Himalayas

The successive disasters in the Indian state of Uttarakhand in the Himalayas in 2013, and then again recently in 2021, raise questions about the wisdom in constructing hydropower projects in the seismic-prone zone that has also been severely affected by global warming. The sole objective of exploiting hydropower keeping in mind the myopic economic benefits, often results in complete neglect of the probable threats that emerge as *social costs* by aggravating the impacts of disasters through losses in lives and properties. Indeed, scientists have long cautioned about glacial melt and the dangers of development projects in those regions.[34]

This is true for many such hydropower projects on the Himalayas. While often, multi-purpose projects are conceived for flood control, storage facilities in the hydropower reservoirs upstream, potential for employment generation as well as providing boost for services and tourism, there is no escape from the broader ecological costs that these projects impose.[35] Such structural interventions alter the flow regimes, trap the sediments, affect the ecosystem structures and functions, and eventually the ecosystem services.[e] These services have a significant bearing on the downstream livelihoods as large populations of the poor are reliant on them.[36] Unfortunately, these costs are not considered in the *ex ante* cost-benefit matrix of the projects; had they been, the projects would have been deemed not feasible.

There are accounts[37] to suggest how unabated construction of successive hydropower projects over the Teesta River (a tributary of the Brahmaputra river) has practically "killed" the river.[38] The massive decline in dry season flows and the consequent water conflict between Bangladesh and India can be attributed to the existence of as many as more than 25 hydropower projects in Sikkim and West Bengal. Despite the fact that these projects claim to be "run-of-river", the decline in water flow during lean seaons force storage of water for a large number of hours for turbines to run and generate hydropower. On the one hand, this makes the investment in hydropower unviable, resulting in many private players exiting the market;[39] on the other, it impedes the integrity of the flow regime in its various components and degrades the basin ecosystem structure, processes, and functions.

The Cauvery Water Conflict

The conflict over the Cauvery basin in India between the states of Karnataka and Tamil Nadu is also a reflection of the fragmented piecemeal approach of the water governance architecture in India.[40] While water being a State subject in

e These are services provided by the ecosystem free of cost to the human community, including water provision, fisheries, and climate regulation.

the Indian Constitution already leads to a fragmented nature of basin utilisation accentuating the conflict (a phenomenon described as "conflictual federalism"[41]), deeper economic analysis also reveals that the galloping minimum support prices favouring the production of water-consuming irrigated paddy has also led to increased competing demand for water between the two states.

The *2007 Award of the Cauvery Water Tribunal* is another example of "arithmetic hydrology" (See Table 1). The Supreme Court judgment of February 2018 brought about some changes in this allocation between the states by acknowledging urban water use through reduction of allocation of the Cauvery Waters for Tamil Nadu from 192 TMC to 177.25 TMC annually. The remainder 14.75 TMC was allocated to Karnataka for the growing city of Bangalore. Though in one sense, this judgment calls for better agricultural water management on the part of Tamil Nadu, the fundamental structure of the CWT Award hardly changes as the cause of the ecosystem remains unaddressed.

Table 1:
Water Allocation from the Final Award of the CWT (figures in TMC)

	States				Total
	Kerala	Karnataka	Tamil Nadu	UT of Pondicherry	
Irrigation Requirement	27.90	250.62	390.85	6.35	675.72
Domestic and Industrial Water Requirement in 2011	0.35	1.85	2.73	0.27	5.20
Water Requirement for Environmental Protection	-	-	-	-	10.00
Inevitable escapages to the sea	-	-	-	-	4.00
Share in balance water	1.51	17.64	25.71	0.22	740

Source: CWT (2007b)[42]

As such, the CWT Award failed to consider the changing precipitation in South Asia that affects the seasonality and quantity of the Cauvery basin flows.[43] The sustainability of the proposed schedule recommending for greater releases during the period of July-September remains questionable, given the possibility of greater variability in the precipitation pattern. From the perspective of an integrated basin governance approach, what is more disturbing in the allocations are "quantity reserved for environmental protection" (10 TMC) and "quantity determined for inevitable escapages to the sea" (4TMC). Both these statements do not seem to adhere to any scientific assessment of the ecosystem-based water uses in the basin, but are sheer ad-hoc allocations. Evidently, the Award has turned a blind eye to the globally emerging literature on "environmental flows" and benefits of "free flowing rivers" that are becoming important pillars of integrated basin governance.[44]

The Supreme Court verdict also directed the GoI to set up the Cauvery Water Management Authority/ Board (CWMA) in line with the Final Order of the Cauvery Water Tribunal. However, the design of the CWMA, as stated in the CWDT Award of 2007, misses out on both the elements of acknowledgement of multidimensionality of the basin system, and consitution of a multidisciplinary team with both disciplinary expertise and interdisciplinary understanding of river basin.

According to the Award, the constitution of the CWMA is heavily loaded towards engineering professionals—from the fulltime Chair being an Irrigation Engineer of the rank of Chief Engineer, to the members and the Secretary of the Board. Such mono-track and mono-disciplinary board composition is in contravention with global best practices that highlight the imperative of having a multi-disciplinary approach to water governance.[45] Scientific research has made it clear that a complex imbroglio like the Cauvery dispute cannot be resolved only by traditional engineering and agricultural solutions and the top-down water technocracy-driven approach proposed by the CWDT. Instead, it must include many other stakeholders at various levels including those for the ecosystems so as to follow a bottom-up approach, as in the case of the Mekong River Commission.[46]

Food security definition and irrigation networks

The Indian delineation and action towards food security have been resource-intensive, and was largely based on the reductionist engineering-based approaches of supply-augmentation. The Green Revolution in the late 1960s, introduction of minimum support price (MSP) mechanism in the late 1970s, and governmental procurement policies led to food security being viewed through the lens of production and procurement of two major water-consuming foodgrains, i.e., rice and wheat. While the Green revolution led to rise in yield levels, the MSPs of the two staples were increased at a much faster rate than the less water-consuming millets in an attempt to promote their production and easy procurement.

MSP acted as a financial derivative instrument for hedging, "put option": if prices fall below the MSP, there is an option of selling rice/ wheat at the MSP to the state.[47] Over time, MSP became the "floor" price-setter for rice and wheat, as whenever MSPs for rice and wheat were increased by the Commission for Agricultural Costs and Prices (CACP), the traders put across a higher bid, thereby increasing the market prices of the two foodgrains.

This moved the terms-of-trade (defined as ratio of prices of two competing crops, e.g. rice and millets) substantially in favour of rice and wheat with acreages moving in favour of water consuming staples and displacing drier millets that require around 10-20 percent of the water needed by paddy. This phenomenon prevailed in many parts of India, e.g. in the Krishna and Cauvery basins or in the Upper Ganges in Uttarakhand and Uttar Pradesh, where irrigated wheat and/or paddy became the dominant crop during the non-monsoon summer months, and were produced as the third crop of the cropping year. This led to substantial increase in groundwater extraction and surface water diversions.

Though agricultural economists argue that this irrigation in India is largely groundwater-dependent, it needs to be kept in mind that groundwater depletion due to overuse is creating pressure on surface flows. At the same time, it is often forgotten that groundwater feeds and sustains the surface flows. Over time, in large parts of southern India, canal irrigation became prevalent, taking a heavy toll on surface flows. The Cauvery basin has witnessed a massive increase in agricultural area for summer paddy (which is fully irrigated) in the 1990s. This is also true for the cases of Haryana-Punjab water conflicts where HYV water-intensive crops increased water demand; the Bangladesh-India conflicts over the waters of the transboundary Teesta river, where acreage of summer paddy has increased extensively; and many other cases of transboundary water conflicts.

Essentially, the "agricultural economic" perspective supported by "reductionist engineering" thinking of water management through constructions of large irrigation projects have accentuated water conflicts – all because of a wrong vision of "food security" defined in terms of production and procurement of high-water consuming, and resource-intensive crops. This is in contravention with global scientific literature and best practices that state that water and food security need not have a simple positive-linear relation.[48] Rather, there are several best-practice-mechanisms of water management that delink the two variables.[49] In large parts of south Asia, agricultural expansions have caused widespread changes that degrade the ecosystems and restrict their ability to support critical services including food provisioning.[50] The ecological foundation of the food system has been challenged by extensive use of fertilisers and pesticides that impair the natural soil fertility in large parts of south and northern India. The natural soil formation function of ecosystem through sediments is also impaired by large constructions that impede the sediment carrying capacity of rivers.[51]

Conclusion

Nilanjan Ghosh *is Director of ORF, Kolkata. He is a natural resource economist and econometrician by training*

The current water governance paradigm that is reliant on structural interventions over water flows has become unsustainable. The existing dispensation of water technocracy appears to have no intention of instituting reforms in policy, and calls for change have been subjected to attacks from the lobby that continue to believe in the status quo.[52] This has been the fate of many such recent calls for change, like the one embodied in the 2016 report, *A 21st Century Institutional Architecture for India's Water Reforms*. While the report recommended creation of a multi-disciplinary National Water Commission, and called for greater involvement of social scientists, professionals from management and other specialised disciplines, it received intense critiques from the existing water technocracy.[53]

Such resistance to change needs to be understood from the perspective of deeply entrenched visions of structural interventions to govern rivers that have historical origins in India's colonial era. The establishment of Thompson Engineering College at Roorkee (now IIT Roorkee) during the British era created this vision of "training the river", and the legacy still lives on across civil engineering departments in India. Early British projects had been exemplified by the Sarada Barrage, flood control of the Kosi, and the Upper Ganges Canal to divert water from the Ganges at Hardwar near Roorkee, all of which altered the flow regime of the river system, thereby causing irreversible changes in the basin ecosystem structures.[54]

Concerns were raised about the futility of the Farakka barrage project in West Bengal to meet the avowed objective of flushing out sediments to resuscitate the Kolkata Port along with the associated immense ecosystem problems at the inception stage. Those apprehensions have come true, with the Farakka being a subject of contention between Bangladesh and India, and the structure also being blamed for trapping sediments and impeding the process of soil resuscitation of the Ganges delta.[55] Unfortunately, the voices within Indian technocracy that opposed the construction in the inception phase were marginalised by the previous administration.[56] What we witness today is the continuation of that legacy.

> "British-era water engineering taught India to "train the river", and the legacy lives on. The paradigm now needs to change."

Conclusion

The 'structuralist' interventions in the colonial and post-colonial era hardly incorporated the concerns of —

a. Eco-hydrology, treating floods and droughts as integral components of the eco-hydrological cycle;

b. Hydro-meteorology, understanding the relation between meteorological variables and extreme events;

c. Seismic science, making the structures resistant to earthquakes; and

d. A holistic WEBS perspective of the river systems that acknowledge that a river system is not merely a flow of water (W), but a dynamic equilibrium of flows of sediments (S), and energy (E) along with water to sustain the basin-scale biodiversity (B).[57]

The National Water Mission 2009, one of the eight missions being constituted under the National Action Plan for Climate Change (NAPCC), launched under the aegis of the erstwhile Ministry of Water Resources,[58] talks about action points of which *Promotion of basin level integrated water resources management* is one. However, the idea hardly seems visible in action as far as the water technocracy in India is concerned. At the same time, the idea of the multidisciplinary approach to water governance as suggested in the 2016 Report seems to be resonating well with the Ministry of Jal Shakti. In November 2019 the ministry constituted a committee to draft a new National Water Policy (NWP). Violating past trends, the committee consists of a group of multidisciplinary professionals.[59]

The colonial engineering paradigm that embodied the metabolic rift between human and nature has to be replaced by a more interdisciplinary thinking combining engineering with social and ecological sciences. It remains to be seen whether the new NWP drafting Committee will be the crusader of change in this paradigmatic war. ORF

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20, Rouse Avenue Institutional Area,
New Delhi - 110 002, INDIA
Ph. : +91-11-35332000. **Fax :** +91-11-35332005
E-mail: contactus@orfonline.org
Website: www.orfonline.org