State and the Community in Water Management

Case of the Damodar Valley Corporation, India

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The Damodar and the DVC

The British administrator, W.W. Hunter, in his Statistical Account of Bengal (1876) described Damodar floods; rainwater rushing off the hills through innumerable channels into the river bed with such great force and suddenness that the water rose to form a gigantic head wave of great breadth and sometimes rising up to 1.5 metres in height. These waves and accompanying flash floods were locally known as *harka ban*[1]. These floods washed away weeds and water hyacinths, cleaned up the drainage congestion in the lower channels and helped maintain the Calcutta port. The very fact that this deltaic stretch had an unusual concentration of agrarian population and settlements, land and water being the two primary resources for farmers, give evidence to the rural prosperity these floods led to (Mukherjee 1938). Yet, over the years, floods in the Damodar have been represented as an aberrant and uncivil behaviour of the river, making 'river training' 'river control', 'taming' and 'harnessing' of it (Lahiri-Dutt, 2000), making its civilising mission by the state a legitimate project. Nandy (2001 p. 711) critiques such use of terminology in describing rivers:

> Note the use of the term "wayward". It is perfectly compatible with the image of some of the larger, more turbulent rivers in folk tales and memories in eastern India, where rovers are revered as powerful demonic mothers carrying a touch of wayward, insane violence. They protect and nurture when in good mood but can turn malevolent and homicidal when not propitiated properly or out of sheer whimsy. That image has not only persisted but powered many of the contemporary efforts to contain or tame rivers in that part of the world[2].

Bhattacharyya (1998) gives a detailed account of the recorded floods beginning 1730 since when floods of different magnitude took place every 8 or 10 years. It appears that over 8,000 m^3/s of peak flow could give rise to 'abnormal' level floods, whereas a 'normal' flood resulted with about 5,500 to 8,000 m^3/s peak flow. 'Extremely abnormal' floods were the ones with over 12,000 m^3/s peak flow, and happened at least four times during the twentieth century (in 1913, 1935, 1941 and 1978). One must, however, remember that besides these categories, there were frequent 'inundations' and subnormal floods occurring with a certain

[1] Meghnad Saha, the famous Bengali scientist and one of the key architects of the river control plans noted this 'maldistribution' as the 'source of trouble': 'the rainfall coming in abrupt surges and lasting only for a short period in the year during the monsoon months' (Saha and Ray, 1942).

[2] Geographers have intensely studied knowledge production about nature; Baker (2000) gives an excellent overview of their contribution in this field of socially constructed knowledge, ideology and institutions other than the market as mediators between humans and nature that filled up a gap in the resource management literature, and how discourses are embedded within institutional configurations of power, knowledge and accepted authority, producing the effects of power within the self, as a form of discipline.

amount of regularity[3]. These floods were accompanied by dramatic shifts in the river's course which, from 1550 to 1800, have been recorded from old maps, and since 1880 have been mapped from other source material such as written historical records (Sen 1973, p. 45).

The village communities had developed, over years of coping with floods, various means of adjustment to the excesses of water. William Willcocks (1930) in his seminal lectures on the Ancient Systems of Irrigation in Bengal described this flood dependence as the 'overflow irrigation' in which broad and shallow canals carried the fine clay and humus rich crest waters of the floods in to the fields, and frequent cuts on the banks of the canals – called *kanwa*s in Bhagalpur - or spill channels called *hana*s (in lower Damodar valley) inundated the fields to fertilise the soil, check the spread of malaria, and helped turn rural Bengal the productive land that it was. The indigenous crop varieties grew rapidly ahead of the floodwaters, and the cropping calendar too was often suited to phases of inundation (Brammer 1990; Hofer and Messerli 1997). Even standing water had its use: jute crops were retted in the stagnating water of the swamplands (Chapman 1995). An intricate network of ponds, aqueducts and water tanks provided seasonal storage of water as well as drainage. Houses in flood prone area were built on raised plinths that withstood the onslaught of the worst flooding[4].

The flood-prone character of the lower Damodar Valley has been attributed to several factors: the specific nature of the basin, the hydraulic regime that is sensitive to the rainfall pattern, and the specific nature of the outlet. The geographical uniqueness of the Damodar basin has ensured a large amount of interest in the river's hydro-geomorphological properties. Beginning as Deonad, from the coalesced seasonal streams from the Khamarpat and Bijrangha hills, the Damodar is over 540 kilometres long, its basin covering over 23,000 square kilometres. The river carries a large sediment load of $41x10^5$ cubic metres every year. The upper two-thirds of the basin is in the Chotanagpur plateau of Jharkhand (erstwhile the southern part of the state of Bihar), and the lower one-third is in the *Radh* (western bank of the Hooghly) plains of West Bengal (Bagchi 1944). Bagchi pointed out (1971) that the course of the Damodar is parallel but opposite to the direction of the rainstorms, the average track of which is towards north and northwest. The monsoon rains in the hills of upper catchment area occur subsequent to those in the plains, but descend quickly from the uplands carrying huge amounts of silt onto the flat land. The silty waters reach the lowland only to find the lower reaches of the rivers already inflated. Saha (1938 p. 55-56) explained the floods as caused by 'the simultaneous rise of two rivers which flow into each other.' In this part of the basin, the gradient of the river is extremely low, so its waters drain very slowly. Above all, the Hooghly being a tidal river allows only intermittent release of water into the Bay of Bengal each day[5].

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[3] Such categorization may seem strange but in Bangladesh too, farmers have been reported to differentiate between *barsha* and *bonna*, normal inundations of the monsoon season and the harmful floods of unusual depth and timing (Boyce, 1990).

[4] The mainstream wisdom, unfortunately, often failed to recognize the importance of these adjustment measures. For example, Chatterjee (1967, p. 2) wrote: 'the consequences of these shifts (in course) in case of the Damodar has been vital. The shifts were almost always accompanied by catastrophic breaches as a sequel to high spates. The people of the region had to adapt themselves to the changes and began cultivating the kanas or dead channels when fields were devoured by newly formed spill channels. The people often agitated for embankments along the main stream and those connected with it. Zemindars were ultimately prevailed upon and the Damodar was embanked.' Yet another view was offered by Bhattacharjee (1986) who believed that Wilcocks, famous for building the dam over Nile has reduced Egypt into a backward under-industrialised country, and 'Likewise in 1928-1930, the goal of Sir W. Wilcocks was to increase the volume of India's agricultural products and the size of her peasant population to serve the military and imperial purposes of the British' (quoted in Nandy 2001, p. 720).

[5] The tidal fluctuation at the mouth is as much as 4 metres.

Intervention for water control

The first intervention to control the river and manage its waters started with building of embankments (the *bandh*s, also known as dikes or levees), weirs and sluices at small scales aimed at 'containing' the river's water within its banks when it is in spate. The process began during the rule of the Burdwan maharajas in nineteenth century, Gastrell (1863) was of the opinion that the embankments were built by local *zamindar*s to protect their land and property, but according to Sengupta (1959) the embankments were meant to protect the main crop of paddy. Locally known as *pulbandi*, these embankments were, however, usually low-lying, not extensive and poorly maintained, allowing spill overs, breaching and outlet of waters into the fields. The left bank embankment of the Damodar seems to have always been stronger and better maintained; the right-hand or the trans-Damodar embankment always breached or had a greater number of *hana*s to let out the waters. On the north bank of the river was the prosperous country town of Burdwan, the headquarters of the district and eventually the seat of the rajas. The trans-Damodar area across the right-bank of the river – the *nikashi* or the drainage outlet area - suffered, in comparison to the north bank, from poor access and was more agricultural in nature.

A system of sluices was built on the left bank to release the top of the flood waters as the bed of the Damodar rose higher (due to siltation) than the water level of the Hooghly. Experts of the Damodar Valley agree that the embankments 'did more harm than good' (Banerji 1972, p. 36). S.C. Bose noted (1948 p. 49-50) that 'A large part of the district being very little above mean sea-level is liable to be flooded every year by the principal rivers and their branches'. The embankments also gradually closed off the headwaters of some of the distributaries, turning them literally into *kana nadi* (or blind river), enhancing the southward shift of the river course mentioned before. They also turned the trans-Damodar area into a rural hinterland - an unhealthy swampland ravaged by complicated problems, one of them being the notorious Burdwan fever (O'Malley and Chakravarti 1909). Rampant malaria, caused by congested drainage in the lower part of the Damodar Valley, was a spin off of the embankment construction[6]. The justification behind embankment construction lay in the efforts to protect the fields from erosion and floods. This ensured a regular revenue collection, and was based on the notion that the dikes would help to increase the river's velocity and help wash off the sediment load, preventing it from spilling over onto the surrounding fields (Inglis 1909).

Yet another genre of interventions comprises transverse structures of various widths and heights across the river bed for flood control and irrigation. The Anderson weir and the Eden Canal are notable among them.

Envisioning total control

The nationalist ideology in India expressed itself in water management; the 1947 report of the Sub-committee on River Training and Irrigation of the National Planning Committee reveals the philosophical standpoint of the nationalists of emerging India, that the flowing waters in rivers are at once hold the potential of bringing great economic wealth but at the same time pose grave dangers through floods. It thus became a matter of concern that only a small proportion of the available water wealth in the rivers had been utilised and the 'balance runs to waste' (Shah 1947, p. 21), or that floods are a 'problem' (p. 61). River regulation was seen

[6] As early as in 1925, Dr C.A Bentley advocated the reintroduction of flood waters into the Bhagirathi-Damodar doab as well as in the trans-Damodar tract in his book 'Malaria and Agriculture in Bengal'. In 1931, Mr C Adams Williams stated that the silt-laden waters be used to increase the fertility of the soil and decreasing the ravages of malaria.

as the pre-requisite for maintaining rivers in 'efficient working condition' so that they can be put to the greatest use in the shortest practicable time. This 'efficiency' required that 'Rivers have to be tamed first, in order that the attempts to train them may be successful' (p. 64).

For the communities living along the Damodar river banks, the rise of ambitious modernist plans for the total control of the water flow in the river, especially after the flood of 1943, meant disaster. When at the peak of the World War II, with the Indian National Army of Subhash Chandra Bose advancing towards India across the Burmese border, in mid-July, the Damodar breached its left bank levee a few kilometres downstream of Burdwan and disconnected Calcutta from the rest of the world for weeks. This prompted the colonial government to set up the Damodar Flood Enquiry Committee to advise on the permanent measures to control the floods in the river[7]. Under the leadership of the Maharaja of Burdwan, this Committee suggested in 1944 the adoption of the Tennessee river control measures as a model for the Damodar[8]. The envisioning of the Damodar Valley Project in detail was left to W. L. Voorduin, a senior engineer of Tennessee Valley Authority. Mishra (1998 p. 23) reminds us that flood control by means of dams in the upper catchment had been considered since 1860 by various British engineers, but was always shelved as an uneconomic proposition. Voorduin submitted his *Preliminary Memorandum* on the Unified Development of the Damodar River System. The primary objective of the project was flood control, although irrigation and power generation were also envisaged as ancillary benefits arising out of the control turning it truly into a 'multipurpose' project. Voorduin's scheme of flood control involved construction of a system of dams in the upper valley with a weir across the lower valley for diverting water into a network of canals and a combined system of hydro and thermal power stations with transmission and distribution facilities. The Damodar Valley Corporation was brought into existence on the 7th July, 1948, by a special Act, just after Independence. Voorduin's original recommendation suggested the construction of eight storage reservoirs – but the DVC decided to implement the work in two phases. In the first phase, the construction of four dams at Tilaiya, Maithon, Panchet and Konar with hydroelectric stations connected to each dam, the Bokaro thermal power station and the Durgapur Barrage[9] and canals leading off from it were to be built. It was envisaged that the second phase would cover the construction of the remaining four dams and hydroelectric stations at Balpahari, Aiyar, Bokaro and Bermo[10]. Although hailed widely as 'an amazing project', a mighty experiment and a great adventure' (according to Gen. Wheeler, Engineering Adviser to the World Bank, see Luthar 1981) this dream-child of Nehru eventually was able to complete only the first phase of building four dams[11].

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[7] Mookerjea (1992) describes the DVC as 'the response to the challenge' and gives a detailed account of how crucial the timing of this 1943 flood was triggering off the Damodar's subsequent control measure.

[8] One of the critiques of the DVC plan was put forth by Kapil Bhattacharyya as early as in late 1950s (detailed in his book 1986) who wrote in detail about how the alignment of roads and railways have already created drainage congestion in lower Bengal and how the DVC dams have hastened the decay of the Calcutta port by blocking off the water inflow into the Hooghly to flush off the silt.

[9] As the number of dams was reduced, to have better control over the runoff, the Durgapur barrage was constructed in place of the weir suggested by Voorduin.

[10] The government of Bihar later constructed the fifth dam at Tenughat in place of the Aiyar, funding for which was given as a loan to the state, and which is not integrated to the DVC system. It supplies water mainly to the Bokaro Steel Plant and the thermal power station.

[11] About 93,000 people were displaced from 27,500 ha of land and 45,000 houses. The policy was to give land for land, only if the displaced persons indicated their choices by a certain date.

Impacts of the DVC dams on floods and economy

Has the DVC been able to keep the promises it made to the residents of the lower reaches? This question is connected to the question of evaluating the impacts of the DVC on the regional economy, both of which have been intensely debated. The DVC has remained not only incomplete but as noted by Aich (1998 p. 79), has deviated significantly from its aims of flood control: 'the DVC project moved far away from the original concept of Mr. Voorduin, to meet the national priorities and regional needs laying special emphasis on generation and distribution of electricity…'. This claim is supported by Biswas' (1998 p. 5): 'the DVC … has now mostly become a power generating and transmission authority in the interests of industrial development in the valley, though hydel power could not be installed more than 144 MW for non-construction of 2nd Phase reservoirs.' One reason of such a deviation is that the barrage and canal networks are not integrated with dam operations. The Durgapur barrage with its 137 km long Left Bank Main Canal and 89 km long Right Bank Main Canal with a 2270 km long network of branch or minor canals now operate under the Government of West Bengal whereas the Central Water Commission overlooks the management and operation of the reservoirs (Biswas 1998).

For the residents of the lower Damodar valley, indeed, the floods have not been fully controlled, the nature of floods have changed, whilst building up a false sense of security amongst the residents of the lower valley (Lahiri-Dutt 2003). There were three major floods, post-DVC, - in 1958, 1978 and 1998 – raising concerns whether the DVC was indeed a boon or a calamity (Basu 1982) and a range of economic appraisals of the project (Ganguly 1982)[12]. The scrutiny was intense especially after the devastating 1978 flood – 'the biggest ever handled by the DVC' according to one of its reports (DVC 1980). This flooding is understood to have happened because of a combination of excessive rains from cyclonic cloud-burst of the retreating monsoons in late September and the release of large amounts of water from the reservoirs when they were full to the brim[13]. Similarly, in 1998, yet another major flood kept the lower valley under water for nearly a week.

The blame has been laid on 'uncontrolled' parts of the catchment below the dams that bring in additional runoff into the lower system of the river. This area comprising about 3,200 km^2 extends from below Maithon and Panchet dams to Durgapur Barrage for about 60 kilometres. It has been pointed that even with the construction of additional dams in the upper reaches this area contributes significantly to the runoff. Aich (1998 p. 81) also held responsible 'administrative bottlenecks' for leading to the failure in the provision of full flood control by the Maithon and Panchet dams (as their capacity was reduced to 780,000 acre-feet (0.96 km^3) half that originally envisaged). Many of these bottlenecks were to do with the inability of the DVC to acquire land. Disputes between Bihar and West Bengal on irrigation water allocation from the reservoirs have also caused these bottlenecks, and the regulation manual prepared by the Central Water and Power Commission (GOI, 1969) has been inadequate in dealing with occasional years of excessively heavy rains in late monsoons[14]. Pathak noted by (1981 p. 634)

[12] The priorities of the DVC has changed significantly; for example, the capital expenditure in 1977-'78 showed that it spent over 82% on power generation whereas flood control, irrigation and subsidiary activities (such as soil management in the upper catchments) received around 11%, 4% and less than 3% respectively.

[13] It remains a fact that the quantity of sand being deposited in the DVC reservoirs has been far greater than the originally envisaged, reducing the lifespan of the dams. This was believed due to the accelerated pace of mining-based industrialization and urbanization of the upper valley.

[14] On the effectiveness of this manual in coping with the 1978 floods, Pathak noted (1981 p. 629): 'The vagaries of monsoonal rainfall … belied the DVC water release manual because of heavy downpour of 72cm. during September 26-28 in 1978. The DVC reservoirs received an all time record inflow of 851,000 cu.ft. According to the manual, the DVC was to release 200,000 cu.ft/sec. whereas it released only 160,000 considering the heavy rainfall; but at Durgapur barrage point it

the poor governance, leadership and corruption in running the internal matters of the DVC as being responsible for its lacklustre performance.

Conclusion

One would expect that the DVC experience would probably lead the next generation of water management specialists away from gigantic, constructional plans such as the Sardar Sarovar dams. Unfortunately, that lesson has not been well understood in India. Moreover, during the decades of its existence, the DVC has turned into an icon for the modernist and technology-worshipping urban elites almost symbolically representing centralised and systematic water control. Many experts (Banerjee 1991, p. 201) claim that if the DVC was completed as per Voorduin's vision, the problems would not have occurred: 'As the system was not built upto the design capacity, the capability of the system is restricted and supply of the desired output cannot be guaranteed at all times.'

To the villagers living in the lower reaches of the valley, however, the DVC is a grand design that has failed to keep its lofty promises of flood control and irrigation. The river control measures adopted in DVC by the state in India have created a complex web of practical difficulties for the inhabitants, endangering their survival of certain groups of people. Bank erosion has been a result of the river controls put in place by the DVC. With Dakshin Damodar Khara Bonya Pratirodh Committee, we undertook a study of the perceptions of local residents of the floods and river bank erosion, and observed that a large number of respondents noted that, whilst the floods have indeed decreased in frequency, they have become more unpredictable. An unexpected flood can ravage immensely more than one that is regularly expected, especially if the flood is caused by the very institution that was created to protect the people. Often the warning that the DVC Control Room is supposed to provide before releasing the water from the barrage fails to reach people in the lower valley on time. Aich (1998 p. 81) observed that:

> Before the construction of the DVC damns, the flood peaks were high but the duration was small. The construction of dams has moderated the peaks but increased the duration of floods. This increase in duration has enhanced the chances of synchronization of floods from the upper and lower valleys as also from the adjoining river basins.

Consequent to the controlled flow, excessive amounts of sand deposition on the entire channel of the Damodar downstream from the Durgapur barrage has given rise to *char*s or river islands. As the existence of these sandy pieces of land are extremely uncertain, their fragile environments offering risky habitats and their existence legally unrecognised, they tend to be settled by migrant groups from Bihar as well as from across the Bangladesh border (Lahiri-Dutt and Samanta, 2004). The high embankments have, in places, created extremely complex networks: for example that of Dadpur village in Burdwan district where the village is completely surrounded by a series of embankments. this village lies about 20 km east of Burdwan town at the apex of the Damodar delta where the river turns nearly 90^0 to swing to the south-southeast. The villagers suffer from the constant threat of inundation from breaches in the *bandh*s in which case the entire village may be wiped out in a matter of hours.

In 'Why the Damodar scheme deserves top priority among India's development projects', the proponents of DVC (1948) emphasised the wealth creating potential of the scheme which is in

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was 380,000 cu.ft/sec. threatening the barrage itself. Besides, other rivers in the lower Bengal – like Silavati, Darkeswar, Kansavati, Ajoy and Moyurakshi – were swollen and added to the Damodar flood.'

turn equated with nation-building enterprise. It becomes indeed a magnificent design, an exemplary achievement of the civilising effects of technological intervention on a grand scale, and the showcase for undertaking similar experiments elsewhere. The specificity of the river and the understanding of its specific geographical and historical context are lost in the explicit efforts in pushing through this agenda (p. 8):

> The Damodar Scheme represents the first attempt in India to provide a comprehensive valley-wide demonstration of water conservation and use….For this pioneer demonstration work the choice of the river could hardly have been better. The Damodar is a big enough river for the purpose and yet not too big while the economic potentialities of the Valley are not only among the highest in the country, but also immediately realisable because of the ready demand for power and water. Once a successful demonstration of comprehensive river harnessing has been provided in the Damodar Valley with its manifold benefits, it will be easier to undertake similar experiments in other river valleys of the country in the light of the experience gained here.

This statement reveals that no allowance was made for appreciating the different characteristics between European or American rivers and the Damodar, thus a western concept was transplanted lock, stock and barrel into a setting seen as an empty landscape devoid of a history and people. This knowledge puts faith in the universal models and stands outside of the social context as autonomous and objective. This knowledge puts values such as scientific reason and rationality of those with greater powers as necessarily 'good' and co-terminus with 'development'. People in the lower part of the DVC's command area have literally challenged the 'command' and refuse to imbibe the obedience that the DVC expects to flow naturally (unlike its water!) from its distant position of power.

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