Water and Social Structure

I
THE BASIS OF COMMUNITY

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The partition of land is common everywhere but in some areas we find that water rather than land is the subject of careful partition and of a regular tenure on well understood conditions. This is the characteristic feature of the tenures in the North-West Frontier Province and in the districts in the south-west of the Punjab. In early tenures it is not so much the soil that is regarded as the subject of ownership as the produce. This may be the case, especially, where land is abundant and of little value until laboriously cleared of tall grass and jungle. A similar feeling regarding water arises in cases where the land, without means of irrigating it, would be absolutely useless. The principle of distribution depends on the amount of water available. When there is more than enough, every one extends his cultivation according to his means, and then gets water for the whole. But where the water is not superabundant, it is divided according to the inheritance-fraction which each holder represents in virtue of his place in the genealogical tree. Water-shares are in some cases (where the supply is very limited) sold quite independently of land. Thus, a man may have a piece of land dependent on rain only for its cultivation, and he may then buy a water-share, or perform labour and service to acquire it. Naturally such customs arise where cultivation is possible only by the aid of rainfall, but is so inferior, as well as uncertain, that an irrigation share is really the right which possesses the greater value. . . .

Water-Sharing and Human Solidarity.—In many parts of the world

Excerpted from Radhakamal Mukerjee, *Regional Sociology*, Century Co., New York, 1926, ch. VII.

we find men living in arid territories exploiting the water by means of an effective collective organization. Brunches observes:

> 'When men living in arid territories once wish to devote themselves to cultivation and seek to exploit the water they cannot but submit to that effective solidarity which water often imposes upon them. In several cases where the exploited water is furnished to them by a single source (spring, stream, canal or reservoir) and where this exploitation of the water has led them to ease and prosperity, they have clearly understood, or at least definitely accepted, this necessity of the collective union of individual interests.' . . .

In different regions the recognition of this common interest leads to those admirable 'hydraulic communities' of Valencia or of Msila; sometimes, as in Egypt or the Panjab to-day, the State is led to co-ordinate the interests of individuals . . .

In tropical Asia, too, the necessity for collective regulation of water-supply in the case of rice cultivation is an important factor which has contributed to the development and perpetuation of the economic and administrative organization of the village community. In Japan and Java, as in India, rice cultivation has encouraged a good deal of fluid communalism and association of labour and maintained the compact village communities for the common interests of agriculture. Everywhere rice cultivation demands a system of irrigation which can make good the loss of water by evaporation, by leakage and by the continual passing on of some of the water to other plots belonging to other farmers, which encourages co-operative habits of work. Thus there are in Japan, as in Java and parts of India, hydraulic engineering works, as remarkable in their way as those of the Netherlands, which have been the work of unlettered peasants working in co-operation. Tunnels for conducting rice-field water through considerable hills, aqueducts, reservoirs, etc., which are met with in Japan and, indeed, throughout the Far East, represent a vast amount of communal labour hardly to be met with anywhere else. There are also numerous irrigation societies (*suiri-kumiai*) and associations for the readjustment of fields (*kochi-seiri-kumiai*), etc., which had their origin in very remote times. Floods were of frequent occurrence. Hence the construction of dams and dykes was undertaken co-operatively. . . .

The above brief survey of the forms of property and their evolution in connection with natural conditions once again proves the need of introducing into economics the examination of the geographical

environment, which will be found to be a corrective of abstract sociological theory. 'Human Geography', writes Georges Gariel, 'is destined to review all the sociological theories that speculate about some sort of abstract man'. For example, the study of the different forms of ownership of water here examined does away with all *a priori* and absolute theories, both those that lay down as a dogma that individual property is the only form of property acceptable to human reason, and those that tend to a conception of state ownership as applicable to all the countries of the earth.

II
TECHNOLOGY, MANAGEMENT AND CONTROL

NIRMAL SENGUPTA

The Indigenous System of Irrigation in South Bihar

Climatic and Topographical Condition

Average annual rainfall in Bihar varies from about 1,000 millimetres in Patna to 1600 millimetres or higher in the eastern extremes of the state. The variability of rainfall is also higher in the western districts. Within this drier zone, the areas lying north of the Ganges—the districts of Saran and southern parts of Muzaffarpur—are protected to some extent by the water-retaining capacity of the new alluvial type of soil. The southern part of this dry zone—the districts of Patna, Gaya, Shahabad, south of Monghyr and south of Bhagalpur, commonly known as south Bihar—is composed mostly of old alluvial type of soil with very little water-retaining property, which dries

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up very soon after the rains. The ground-water table is very low in south Bihar, excepting in those parts adjacent to the Ganges; and wells can be dug out only with much difficulty. Lastly, the area has a marked slope from south to north which causes quick flow of water. In fact, the natural conditions are so adverse that regular cultivation in most parts of south Bihar is not possible if left to the mercy of nature. Yet south Bihar has been the cradle of a very ancient civilization, and has continued to remain one of the most populous tracts in the world for a period stretching over two millennium.

As will be evident from Table 1, only in south Bihar was the major part of the gross cropped area irrigated in both the years shown. The data for Monghyr and Bhagalpur must be understood in the light of the fact that the irrigation facilities in these two districts are

Table 1

Districtwise Irrigation by All Sources

District	Percentage of gross irrigated area to gross cropped area 1931	Percentage of irrigated area to net sown area 1971
Patna	55.25	58.59
Gaya	48.87	59.37
Shahabad	40.25	64.41
Saran	15.62	25.42
Champaran	7.35	18.11
Muzaffarpur	8.59	5.65
Darbhanga	5.81	8.65
Monghyr	18.77	16.11
Bhagalpur	17.31	34.39
Saharsa		12.25
Purnea	1.53	8.61
Santhal Parganas	17.33	3.64
Palamau	11.59	16.02
Hazaribagh	1.43	2.09
Ranchi	0.19	2.15
Dhanbad	N.A.	2.06
Singhbhum	14.75	3.87
Total Bihar	17.92	19.55

22.84

Source: 1961 Census (*a*) District Census Handbooks, Tables AS—IV, All districts (*b*) Agriculture Census, Bihar, 1971.

concentrated mostly in the southern parts. Table 2 shows the relative importance of the different sources of irrigation in the dry zone area during the first quarter of this century. Under the soil and ground-water conditions in Saran district, well-irrigation, involving little difficulties, was practised extensively. The Sone canal was constructed in the last quarter of the nineteenth century; and canal irrigation has replaced the old modes of irrigation in large parts of Shahabad district as well as in the eastern parts of Patna and Gaya districts. In the rest of south Bihar—in Patna, Gaya, south Monghyr and south Bhagalpur—the major modes of irrigation were from regular tanks and two

Table 2

Area Irrigated by Various Sources of Irrigation

(in early twentieth century)

Sl. No.	District/region	Percentage of net cropped area irrigated by					
		Govt. canal	Pvt. canal (pynes)	Tanks & ahars	Wells	Other sources	Total
1.	Shahabad	22.28	3.83	10.26	4.85	0.70	41.92
2.	Patna	2.23	21.62	24.35	6.80	4.93	59.94
3.	Gaya	4.29	15.96	26.83	5.98	1.77	54.83
4.	South Monghyr	. .	6.94	19.64	3.63	12.38	42.59
5.	South Bhagalpur	. .	16.51	5.54	1.21	12.77	36.03
6.	Saran	. .	0.38	2.80	10.86	1.10	15.14

N. B.: 'It is difficult to say how far the relative figures for private canals (i.e. *pynes*) and *ahars* are correct since in many cases the two are interdependent. . . . In comparing the percentage of irrigation from different sources certain allowances must be made. In South Monghyr (Final Report, paragraph 137) and South Bhagalpur (Final Report, paragraph 207) a certain proportion of area irrigated from other sources should have been included in the area irrigated from private canals and *ahars*. In Shahabad (Final Report, paragraph 314) a certain proportion of area shown as irrigated from private canals is really irrigated from Government canals. It is probably judging from the figures given by the Canal Department reproduced in paragraph 41 of the Patna Final Report, that a similar mistake occurred to some extent in Patna also.

Source: Compiled from the different Final Reports of the Survey and Settlement Operations in South Bihar districts (1905–1918) by E. L. Tanner, *Final Report on the Survey and Settlement Operations in the District of Gaya, 1911–18*, pp. 136–7.

other systems peculiar to this area, namely *ahars* and *pynes* (called 'private canals' in the early statistics included in Table 2).

Description of 'Ahars' and 'Pynes'

Being bounded by Chhotanagpur Plateau in the south and the Gangetic valley in the north, south Bihar has a marked slope from south to north roughly at the rate of one metre per kilometre. Using this terrain condition, an *ahar* is made by erecting an embankment of a metre or two in height on the lower ground, generally the north side. From the two extremes of this embankment two other embankments are constructed so as to project towards the higher ground (generally the south), gradually diminishing in height as the ground-level rises, and ultimately ending at the ground-level. Thus constructed, an *ahar* resembles a rectangular catchment basin with embankments only on three sides. The fourth side—the highest ground—is left open for drainage water to enter the catchment basin following the gradient of the country. Unlike tanks, the beds of *ahars* are not dug out. Sometimes these are built at the end of drainage rivulets or artificial works like *pynes* further ensuring the supply of water. *Ahars* with sides more than a kilometre long and irrigating more than a thousand acres of land, are not by any means rare. But smaller ones are more common.

Pynes, on the other hand, are systems devised for utilizing the water which flows through the numerous hilly rivers flowing from south to north intersecting the whole country. For most of the days in the year these rivers remain almost dry, but turn rather suddenly into swollen torrents following heavy rainfall in the Chhotanagpur hills. But the slope of the country is so great, and the beds of most of these rivers are so sandy that the water is rapidly carried through the region or percolates down through the sand, within a few days returning the same old sandy look to those rivers. In order to prevent the waste of water in this manner, numerous artificial channels called *pynes* are led off from points facing the current of these rivers to the agricultural fields. Some of the biggest *pynes* are 20 or 30 kilometres in length, feeding a number of distributaries, and irrigating maybe a hundred villages. Since the beds of the sandy rivers of south Bihar are usually high, there is no need to make the *pyne* beds deep in order

to divert the water into those. Further, because of the gradual slope of the country, within a few kilometres from its beginning, the beds of the *pynes* rise to near the level of the ground to facilitate irrigation of the adjacent areas, while still retaining sufficient fall to ensure the flow of water from the rivers into it. To raise the water level to field level the *pynes* are temporarily blocked at suitable length. In this way some of the small rivers of south Bihar never reach any of the main rivers like the Ganges or the Punpun, and are completely dispersed by several *pynes*. Sometimes *pynes* are impounded into *ahars* at the end, ensuring storage of any superfluous water. Alternatively, small *pynes* are also led from *ahars* for distribution of water. Both *ahars* and *pynes* generally carry water during the rainy season, from July to September, and guarantee against the untimely or scanty rainfall, frequent in south Bihar.

In the course of his Bhagalpur trip, Francis Buchanan was not much impressed by these irrigation works. He had felt that in comparison to similar works (i.e. tanks and *anicuts*) in Mysore, the works in south Bihar were 'vastly more imperfect' which he conceded as happened 'probably because the necessity is not nearly so great' in south Bihar. He had, of course, admired the economy of water use by impounding *pynes* into *ahars* as a 'judicious plan, so much neglected in Mysore.' As he proceeded further from Bhagalpur to reach Gaya, much of his earlier reservations vanished. His earlier characterization was that no attempt had been made to construct perennial works in the south Bihar system, and the intention was limited 'to supply the fields in intervals of fair weather that occasionally happen during the rainy season, and for the first month after these [rains] cease.' While in Gaya, he learnt that 'both canals and reservoirs contain also so considerable a supply, that they enable the farmer not only to bring the crop of rice to maturity, but, by the means of above mentioned (manual water-lifts), enable him to rear a winter crop of wheat, barley, & c.' Thus, although apparently crude, the *ahar-pyne* system is a remarkable indigenous system making possible the best out of a very unfavourable natural condition. Apart from the irrigation facilities there is still another utility of the system which has rarely been investigated. Being a region in between Chhotanagpur Plateau and the Gangetic valley, south Bihar is very prone to floods. But the abundance of storage works as *ahars* and the large-scale dispersion of torrential flood water into the

pynes has minimized the rush and speed of the flood water passing through south Bihar.

The *ahar* and *pyne* system of irrigation attained its highest development in the district of Gaya. The first Irrigation Commission (1901–3) had noted that in total 1,670,000 acres—more than half of the total area of the district—was said to be watered in this way. As will be evident from Table 2, nearly three-fourths of the total irrigation facilities in south Bihar (excluding Sone canal command area) were from *ahars* and *pynes*. Among the other methods of irrigation, well-irrigation alone was of some importance. But wells were constructed, maintained and operated mostly by individual efforts and raised few social problems. The discussion here will be restricted only to the *ahar* and *pyne* systems.

Method of Cultivation and Irrigation

To a ryot of Eastern Bengal the country would seem utterly unsuitable for rice cultivation, both from the nature of the surface and the comparative throughly the plants begin to deteriorate at a steady rate. Thus, although the cultivators expect late rains during *Hathiya* no one will risk practising *nigar* hoping for a timely rain. The need for irrigation from *ahars* and *pynes* is mostly felt during *Hathiya nakshatra*, and even if there is good rain during this time and little artificial irrigation is actually practised, the irrigation works go far as to increase the yield by encouraging the cultivators to undertake *nigar* operations. The late rains during *Hathiya* is crucial also for the sowing of the *rabi* crops. In case there is a failure in some year the cultivators exert their efforts to use up the last bit of water left in *ahars* and *pynes* for preparation of rabi fields for sowing, after irrigating the rice crop.

What great protection the *ahar-pyne* system of irrigation of south Bihar had lent to the tract can be understood from the fact that Gaya district, where the system reached its highest level of development, remained practically immune to famines while the rest of India suffered from several big famines. In the year 1866, the year of the so-called Orissa Famine, during the Bihar Famine caused by the untimely rain in 1873–4, and during one of the greatest famines in record, the famine of 1896–7, the district of Gaya required practically no relief, although the whole of the eastern region had suffered

very badly. It is however significant that the immunity to famines began to disappear once the irrigation works began deteriorating. There were several years of scarcity in the thirties of this century. Gaya district, in particular Nawadah sub-division, was in the grip of severe droughts and famines in 1950–2 and 1957–9. Lastly the famine of 1966 struck Gaya district with the same severity as it struck other districts of Bihar. Today Gaya is regarded partly as a drought-prone area, no more as an area immune to famines.

Like famines, Gaya district was also immune to floods in the heyday of indigenous irrigation. But in recent years that immunity too has been lost.

A Note on Antiquity of the System

The effective settlement of the middle Ganges Plain does not seem to have begun until the eighth and ninth centuries BC. It is suggested that the dense forest cover had probably delayed settlement of this region. The first evidence of rice being grown on the margins of the Ganges delta dates from 700 BC. The effective occupation was even later. By then the settlers had probably known plough and iron axes without which settlement of this forest region would probably not have been possible. It appears that another invention—the characteristic irrigation system of this region—contributed greatly to, if not the original settlement, at least the extensive and dense settlement in this region. The *ahar-pyne* system of irrigation was already well in use during the time of the *Jatakas*. The *Kunala Jataka*, written in this area, mentions that canals were excavated communally and served sometimes as demarcation lines between two neighbouring properties, that the use of this commonly owned water often gave rise to keen dispute, that it was not uncommon for the course to be diverted in the direction of one village's fields at the expense of another's. In such cases violent quarrels resulted which developed occasionally into pitched battles between rival villages and the disagreement had to be brought before the local council for adjudication. The description sounds as if it is happening in a south Bihar village in modern times.

In the *Arthashastra* there is reference to *aharyodaka-setu* as a method used for irrigation. The word *para* (see *parabandi* later) is also found in the same book as a regulation for the violation of

which persons shall be fined 6 *panas*. However, *para* and similar words (e.g. *wara* in Punjab) are still in use to describe the rotational arrangements in irrigation not merely in south Bihar but also in many other corners of India. Megasthenes' description too confirms the existence of closed canals in Bihar, from which water was distributed in the conduits for the purpose of irrigation. It must be understood that even if such earthworks had existed quite extensively in ancient times it would be impossible to find any trace of those in archaeological excavations. On the other hand, it may not be very surprising if some of the surviving works happen to be so old.

Social Organization

Such a society, with irrigated agriculture based on large irrigation works, has to accomplish several social tasks peculiar to irrigation. There is a set of technical tasks relating to planning, construction and maintenance of irrigation works. There is a set of relations necessary for the control and allocation of water among the users for meeting the cost and labour required in carrying out the technical works, for resolution of conflicts and even for organization of rituals, if any. Both Julian Steward and Karl Wittfogel had made the drastic generalization that the irrigation works in traditionally irrigated societies were centrally organized, requiring complete control over labour power. This gave rise to bureaucratic management, from which emerged a bureaucratic state power, despotic in its nature. Thereby resulted 'a state stronger than the society', and consequently, social relations were determined according to the needs of the despotic state, and were delegated to social classes by the state power. However various studies indicate that the social organizations in such irrigated societies are not as strongly modelled as suggested by Wittfogel, and that there are various aspects of social relations which deserve special attention. In this paper I will restrict my discussion to the production relations between the cultivators and their overlords, and only to those relations which arise because of the irrigation works. The relations among the individual cultivators, among the artisans, labourers and cultivators in the irrigated villages, among the residents of different villages using the same source of irrigation—all of which form interesting and important aspects of social relations—are not dealt with here. Further

the availability of data imposes restrictions on the period of inquiry in this study. The discussion here will mostly be confined within the period of colonial rule. However, there is an interesting aspect within this period—there occurs a transformation of the social organization of irrigation in south Bihar. In the following section of the article that transition will be the major focus.

Physical Aspects of Organization

Hunt and Hunt inferred, from a review of the various studies on indigenous social organization of irrigation works, that the social organizations at higher levels are involved in matters of infrequent decisions, e.g. construction, repair of major areas of conflict including external conflicts. The areas of interaction between the village communities and the overlords—the *zamindars*, in south Bihar—with respect to irrigation works were more or less the same. During the *zamindari* days, the responsibilities of construction and maintenance of the *ahars* and *pynes* lay mainly with the *zamindars*, although there is no mention that they were responsible for similar works on the smaller distribution channels emanating from *ahars* and *pynes* and for distribution of irrigation water within the villages. Most of the *ahars* and *pynes* were very old and how these were constructed cannot be asserted, although officials have been emphatic that they were constructed by the *zamindars*, presumably inferring this from the records of construction of the few works undertaken in the nineteenth century. Fragmentary references to the modes of operation of the *zamindars* in matters of construction and maintenance are available. 'The expenses both of making and repairing the canals and reservoirs is entirely defrayed by the zamindars' observed Buchanan. Besides, there was a collective system called *goam* in which every cultivator had to supply one man per plough to turn out on certain occasions and carry out the physical works. But the *zamindars* had the responsibility of organizing such collective work by fixing and announcing the date of *goam* and even by forcing the unwilling to participate in such matters. The maintenance works need to be carried out regularly. Being crude earthen high silting of the hilly rivers and the methods of diversion of water by various ways of cutting the embankments. If repaired regularly, these works do not involve very great effort either in manpower or

in finance. But negligence results into quick deterioration of these crude works, so much so that within a few years, even the trace of an old work may be difficult to locate. The smaller parts of these repair works, the negligence of which would affect only a few plots were probably done by the interested cultivators themselves. The responsibility of the *zamindars* lay more in organizing works which involved the interests of several villages.

Allocation of water within the villages was managed mostly by the cultivators themselves. Allocation between villages was a major source of conflict, and was a concern of the *zamindars*. Buchanan wrote that the *zamindars* would 'appoint proper persons to divide the water among the tenantry.' More detailed description is obtained for the later period. There was a system called *parabandi* by which the distribution of water among the villages from a common source (usually *pyne*) was regulated. Usually *parabandi* arrangements began in the month of *Aswin* (mid-September), when the demand was acute and the supply limited, and lasted for a month or two. At other times of the year it was usual to leave all branches of *pynes* open and let anyone use the residual water if one could. The *parabandi* arrangements consisted of more than one cycle of watering. Beginning from any one side of the *pyne* each village had its quota fixed either in the number of days or in the number of hours, thus assuring fair distribution to all the villages. After the completion of one cycle, the process was repeated in the same order (i.e. another cycle began) approximately after a gap of two weeks. In the principal *pynes* in Gaya district there were written regulations for *parabandi* arrangements. The Tikari Raj, the major *zamindar* family of Gaya, had in its possession an elaborate register called *lal bahi*, specifying the rights of each village enjoying irrigation facilities from such important *pynes*. For other smaller works, the regulations were mostly customary, until the beginning of this century. . . .