

ROLE OF INDIGENOUS IRRIGATION SYSTEM IN COMBATING ADVERSE IMPACT OF CLIMATE CHANGE IN BIHAR

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1.0 INTRODUCTION:

Ganga flows through Bihar in its middle reach and divides the state into two parts – north and south, which differ widely in topographic features, soil characteristics and climate features. North Bihar is worst flood affected region in the state and country, and there are a large number of low lying saucer shaped areas called “chaurs” in local language. Rain water accumulates in these “chaurs” and the area is not cultivated as they are water logged.

The region of South Bihar is characterized by steep ground slope, scanty rainfall, and shallow, non-perennial and flashy rivers draining the area. These characteristics have helped the evolution of indigenous irrigation system of “Ahar & Pynes”.

2.0 INDIGENOUS IRRIGATION SYSTEM OF “AHAR & PYNES”

The system consists of two components – Ahars and Pynes. They are described hereunder in brief:

2.1 PYNES:

The entire region of South Bihar, including the present command of Sone Canal System, prior to its construction, was intercepted by many channels off-taking from shallow rivers flowing from hill ranges to Ganga and distributing river water to agricultural fields. These channels are called “Pynes” and are in existence in large number in the region even today. These Pynes are in fact, small inundation canals constructed with practical skill to supply water only when the stage of the river was high. These Pynes often continue for a considerable distance, distribute water over the fields or flow back into the river. They perform the dual purpose of irrigation as well as drainage.

Pynes originate not only from the small shallow rivers; they also originate from Ahars (small reservoirs) and also terminate in another Ahar on downstream. Often a Pyne connects several Ahars in series located one above the other. Sometimes, to divert water into Pynes leading to Ahars, farmers even dammed the small rivers to raise water level at the time of low flows at several locations and utilizing the entire quantity of water available in the river through a cascade type arrangement. These dams (bunds) across the river were temporary earthen bunds of the river bed material and usually washed off at high discharges making available increased discharge to the Pynes in the downstream. Pynes originating from small rivers generally do not have control structure at their head. However, in case of Pynes originating from Ahars, they generally have an outlet provided with pipe or masonry structure, which may or may not be gated.

2.2 AHARS:

Ahars are embankments (small dam) constructed on mildly slopping land for harvesting, conservations and storage of rain water for irrigating crops. They were built by throwing embankments across small drainage or low lying lands having small catchment to hold rain water in the small reservoir created behind them. Thus the combination of Ahars & Pynes, become very effective and useful.

Generally a spillway is provided at Ahar to pass the surplus discharge and to provide protection to the Ahar against breaching in case of high floods. The spillway may be a pipe or open masonry structure with adequate

discharging capacity. These spillways are generally un-gated and their sills are located at a higher level so that the desired storage is maintained behind the Ahars.

The submergence under the Ahars is temporary. A part of the submergence area, very close to the Ahars, may not be cultivated during Kharif because of deep submergence. However cultivation of rice is practiced during Kharif season on the fringe of submergence area where the depth of water is very small, which suits the cultivation of rice as it requires stagnant pool of water for its growth and development. But during Rabi season, the most parts of the submergence area and/or in some cases the entire submergence area becomes dry and as such Rabi crops are cultivated. In the years of drought the Ahar beds were often used to grow paddy. Sometimes, the Ahar beds were also used to grow Rabi crops after draining the excess water that remained after Kharif cultivation. But cultivation of Ahar beds is not very common practice. Some restraints were possibly practiced not to use bed of irrigation works.

The residual moisture of soil available in the fringe of Ahars helps for the growth and development of Rabi crop. In most of cases, water is not available for Rabi irrigation. In rare cases water may be available in limited quantity for irrigation during Rabi and they can be utilized for irrigation, by lifting water through indigenous methods or by pumping. Residual moisture becomes available also in the area adjacent to the Ahar on the downstream side through underground flow of water, which facilitates cultivation of crops during Rabi season.

The length of several large Ahars extends up to one mile or more but the number of such large Ahars is not more than one tenth of the whole. Similarly the length of big Pynes extends to several miles. Several of these large Ahars & Pynes convey very large quantity of water during dry season; often more than that remains in the channels of the river.

3.0 HISTORICAL BACKGROUND:

There are statistical and historical accounts of their evolution in Kautilya's "Arthshastra". Well-developed systems of Ahars and Pynes were in existence during Mauryan period (327-297 BC) and Chanakya's magnus opus "Arthshastra" gives very detailed description of the system including rules for their operation and distribution of water and punishment for not following the rules. Megasthenes, the Great ambassador in the court of Chandragupta near Patna in 300 BC, has described the well-developed irrigation system contributing to the prosperity of the region. Historical records show the extensive expansion of indigenous irrigation system during the Sultanate and Mughal period (1100-1800 AD). Detailed descriptions of indigenous irrigation system in South Bihar are available in the reports/ books by Francis Buchanan (1810-11) and W.W.Hunter (1876) and various district Gazetteers of Bengal Presidency. Col. Dickens, who planned Sone Canal System (1855), has also mentioned the existence of well-developed and organized system of indigenous irrigation system of Ahars and Pynes in the command of Sone Canal System. Col. Dickens in his report of 1855 stated that excluding the hills and the jungles bordering them about 5/6th of Shahabad District appeared to be under cultivation and perhaps 2/3rd were under spring crops and about 2/3rd of the spring crop was irrigated more or less.

According to the report submitted to the then Lt. Governor of Bengal by Col. H. W. Gulliver, Officiating Chief Engineer, Bengal, about three fourth of area of Patna, Gaya and Shahabad Districts were cultivated; and about half of that area was irrigated by some means, either by wells, small reservoirs, or water courses led from the drainage lines; and all these except some wells were managed by beneficiaries.

The report dated 31st December, 1870 from the Superintending Engineer, Sone Canal Circle to the Chief Engineer, Bengal showed an area of 50,847 ha was being irrigated through Pynes from the four rivers Morhar, Jamuna, Phulgu, and Punchane flowing through Gaya & Patna districts.

Ahars and Pynes were extensively used in Gaya district. The Irrigation Commission of 1901-03 noted that these systems irrigated about 676,113 ha – more than half of the area of the district. Nearly three-fourths of the total irrigated area in South Bihar, excluding the Sone Command, was irrigated in this way.

Several other British writers have praised the Ahar-Pyne system. LSSO Malley mentioned in the Gaya district gazetteer in 1919. "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 scantiness of rainfall. Rice a plant which needs to be submerged in water for about three-quarters of its period of growth- was being cultivated in a land which received nearly half the rainfall available in eastern Bengal, but where water drained out very quickly. Yet, rice was the staple crop in South Bihar and was known possibly at a much earlier date than in east Bengal. It is mostly to the credit of the indigenous device of the Ahar-pyne system that rice cultivation has been possible in this tract. About 90 percent of winter (aghani) rice was cultivated in irrigated land, and the major sources of irrigation were the Ahars and Pynes".

4.0 Present Position:

It is relevant to note that during the implementation of Sone Canal Project, the well-established traditional irrigation systems of Ahar and Pynes were existing. However, they were damaged due to carelessness of the implementing engineers, notwithstanding the concept of Dickens of utilizing already existing system of Ahar and Pynes for kharif irrigation supplementing the same from Sone Canal System in case of shortage during critical period and/or years. Subsequently enquiry was held after the strong complaints by the farmers against the damage of the traditional irrigation system of Ahars and Pynes and the report of the enquiry committee, consisting of two British engineers and one local engineer, confirmed the damage to the system as alleged by the farmers.

The historical records show that they were nicely maintained up to early twentieth century (1920) and after that their deteriorations started.

With the abolition of Zamindari system, those indigenous and traditional irrigation systems of Ahars and Pynes came under the administrative control of Revenue Department of the state government. The systems continued to deteriorate due to lack of proper maintenance and attention. Presently the systems are in much deteriorated condition; Ahars and Pynes are silted; embankments of Ahars are breached; the spillways are generally damaged; and their potential has vastly reduced. During 2006 these irrigation systems of Ahars & Pynes have been transferred under the administrative control of Minor Water Resources (MWR) Department. The MWR Department is maintaining these systems and the Department is also preparing a very ambitious plan of extensive restoration, renovation and modernizations of Ahars and Pynes. According to the available information there are about 20,938 such irrigation structures out of which about 17,683 are functional. They are mostly concentrated in historical “Magadh Region” consisting of eleven districts of Patna and Magadh Divisions and “Ang Region” consisting of Bhagalpur & Munger Divisions. The Culturable Command Area (CCA) covered under these schemes is 4, 83,033 ha and total irrigation potential is 5, 45,784 ha. According to the present report about 3, 25,000 ha area is being irrigated presently through Ahar and Pynes annually.

5.0 FUNCTIONS OF AHARS & PYNES

The system fulfills the functions of flood moderation, irrigation, drainage and ground water recharge. The major functions are discussed hereunder in brief:

5.1 FLOOD MODERATION:

The system of Ahar-Pyne played very significant role in moderation of flood in South Bihar, where they existed in abundance. The storage of flood water in the small reservoirs of large number of Ahars and large scale dispersion of torrential flood water into Pynes minimized the rush and spread of flood water passing through South Bihar. Some of the small rivers of South Bihar could never reach any of big rivers like Ganga and Punpun because their water was completely dispersed through Ahars and Pynes. In the aftermath of deterioration of old system of Ahar – Pynes, recalling their role in flood moderation/mitigation the Flood Advisory Committee of old Gaya district observed in 1949 as follows:

“The committee is of the opinion that the fundamental reason of occurrence of floods (in Gaya District) was the deterioration of the irrigational system in the district. The ground was sloppy and rivers run more or less in a parallel line to the north. The earth was incapable of absorbing water. The existing irrigational arrangements which have been of the nature of chess board, strewn over the whole district and were intended to impede untrammelled flow of water. The district was immune to flood, which has been now lost owing to the deterioration of indigenous system of Ahars-Pynes”.

5.2 DRAINAGE OF SURFACE WATER:

Apart from the function of distributing water to the agriculture fields for the irrigation of crops and carrying a part of flood water away from the river and thus helping in moderating/ modulating flood, Pynes also function as a drainage channels. Thus multi-functional use of Pynes makes them very unique. The existence of large number of Pynes has helped the region to remain completely free from water logging due to surface water drainage congestion. The network of Pynes had modified the drainage system, thereby improving the same.

5.3 A MEASURE AGAINST DROUGHT:

The level of protection against drought provided by the Ahar-Pynes system can be gauged from the fact that the old Gaya District (comprising all the present districts of Magadh Division), where the system reached its highest

level of development remained practically immune to famines while rest of India suffered. In 1866, the year of Orissa Famine, 1873-74 during Bihar Famine caused by the failure of rain and during the famine of 1896-97, the then Gaya district required practically no relief. This immunity began to disappear once the traditional irrigation system of Ahar-Pynes began to deteriorate. There were several years of scarcity during 1930s. Old Gaya district in particular Nawada sub-division (which is now Nawada district) was in the grip of severe drought and famine in 1950-52 and 1957-59. The famine of 1966 struck Gaya district with the same severity as it struck other districts of Bihar. To-day, parts of Gaya district (including Nawada district) are regarded as drought prone area due to deterioration of the traditional irrigation system and lack and/or delay in implementation of reliable irrigation schemes.

6.0 SOME IMPORTANT FEATURES:

A close study of the different aspects (like planning, construction, operation & maintenance) of the indigenous & traditional irrigation system of Ahar-Pynes reveals its beauty, ingenuity and its appropriateness to meet the requirement / demand. The system has two most important features viz supply oriented and totally maintained and operated by the beneficiaries with very effective methods for resolution of conflict besides several others. It also shows that most of the concepts of modern planning and management, which have evolved over time in the sphere of water resources, are well incorporated in these old indigenous and traditional irrigation system of Ahar&Pynes, while the major & medium irrigation projects being implemented during present time lack all these ingredients; there is simply loud thinking, suggestions and / or talk of incorporating them. These are discussed here under in very brief.

6.1 SUPPLY BASED SYSTEM:

One of the most important features of traditional irrigation system of Ahar and Pyne, which distinguishes it from the modern major and medium irrigation schemes, is that the traditional system is supply based whereas the modern irrigation schemes are demand based. In the traditional system there is no control over the supply so both the sub systems - agriculture & irrigation - are based and tuned to availability of water. Whenever and whatever quantity of water becomes available with occurrences of rainfall, the same has to be carried to command area and distributed to the fields immediately and the agricultural activities have to be planned and undertaken accordingly. Under the circumstances the Pynes are having larger capacity compared to the design capacity of canal in modern major & medium irrigation schemes. It is significant to note that while planning and implementing the proposed scheme for restoration, renovation and modernization of Ahars &Pynes, care should be taken to retain these special characteristics. These should not be lost and destroyed.

6.2 WATER MANAGEMENT:

In the government operated and managed major and medium irrigation schemes, there is much talk about water management which relates to distribution of canal water among the farmers, delivery of canal water to individual field and actual application of water for irrigation of the crop. Water management is considered very important as it holds the key to improvement of water use efficiency and increasing the productivity of irrigated agriculture. However, there is hardly any effective activity relating to water management visible at field level and hardly there is any sign of improvement in water use efficiency in major and medium irrigation schemes. But on the contrary, very high level of water management measures were practiced in providing irrigation through Ahars &Pynes as they ensured very economical use of water, partial irrigation was provided in case of scarcity in order to save the crop from complete failure and above all equitable distribution of available water was ensured in accordance with well-established and well documented water rights over long period.

6.3 RESOLUTION OF CONFLICT AND WATER RIGHTS:

Very effective and well established system for resolution of conflicts, not only among the farmers of one village, but among the farmers of several villages, being served by the system, was in practice. This system of resolution of conflict was in practice even during Maurya Period, which continued through British Period. They are still in practice (though not so well) in the systems which are at present in operation.

6.3.1 MAURYA PERIOD:

The following rule, which is mentioned in Chanakya's Arthshashtra, shows that even at such an early period, care was taken to take appropriate action for the resolution of the conflicts and for ensuring smooth operation of the system.

“A tank on lower level constructed afterwards shall not flood with water a field irrigated by a tank at higher level. A tank constructed on a higher level shall not prevent the flooding with water of a lower tank except when the use has ceased for three years. For transgression of that the punishment shall be the lowest fine for violence and emptying of tanks”.

6.3.2 BRITISH PERIOD:

The repeated practice of distributing the waters of Ahars by making breach in the embankment and irrigating their fields formed water rights for use of Ahar water for individual farmers, which was later recorded in the Government records. The disputes among the farmers were resolved according to these water rights; similarly the construction of temporary dam across the river to divert total surface flow from the river into the Pynes was also fixed regarding its location and date of construction and removal. These bunds were constructed all along the length of the river and dispute among different villages regarding utilization of water during water scarcity condition (Hathia Nakchhtra during the month of October) was resolved according to the well-defined water rights. This is the practice even now in a few of rivers in the districts of Gaya & Patna.

6.3.3 SYSTEM OF PARABANDI:

Allocation of water, which was a major source of conflict, was managed by the farmers. The system of Parabandi (which was quite similar to Warabandi being practiced in Punjab, Haryana & western UP and efforts are being made to introduce in major and medium irrigation schemes in Bihar also) was evolved and was practiced to distribute water among the farmers from the common source (Pyne/Ahar/tank). The Zamindars would appoint proper persons to divide water among farmers. Usually Parabandi arrangement was followed strictly in the month of Ashwin (mid-September) when demand was more and supply limited. During rainy season all branches of Pynes were left open as there was surplus water in the system. Each village has its share of water fixed either in the number of days or hours, thus assuring their distribution to all villages in a two week cycle. A detailed register called “Lal Bahi” specifying the irrigation rights of each village was maintained by the Zamindars.

6.4 ALIGNMENTS OF AHARS & PYNES:

The beauty of planning aspect of Ahars & Pynes is reflected in the location of Ahars and the alignment of Pynes as they fit very appropriately into the existing topographical features. Their efficient functioning is a testimony to it. It must be appreciated that it has been done entirely on the basis of judgment by naked eye and based on practical knowledge of the topographical features as contours were not available; these are not available even today.

6.5 THE CONCEPT OF WATERSHED DEVELOPMENT:

In the modern planning for water resources development much stress is being given to watershed development for harvesting and conservation of rain water especially in drought prone area. The study of the traditional irrigation system indicates that the concept of watershed development and management is very well enshrined in them. The Ahars and Pynes have been aligned after identifying the different major/ minor/ mini and micro watersheds in the region.

6.6 LAND USE AND CROP PLANNING:

The general slope of ground in South Bihar is from hills located on the south to the north towards Ganga. Ahars are generally located at higher elevation in the southern side of villages and irrigated fields were in the northern side of the village. All along the gentle declivities at some distance from the villages have been drawn ditches which serve as reservoirs receiving the water from above and collecting it for the supply to the fields below in occasional droughts. The fields are, therefore, usually cultivated with rice while those between the reservoirs and the villages are cultivated with crops that come to maturity in spring and do not require so much water as rice does. The whole of South Bihar had huge terraced fields on gentle slope. Given this terrain each village had Dhanhar (paddy growing) land and Whit (high land) suitable for growing crops (other than paddy) during Kharif which require less water and also for growing Rabi crops. This arrangement shows the best use of land and available water.

7. CONCLUSION:

The historic documents, which bear the testimony of the successful glorious past of the indigenous irrigation systems of “Ahar&Pynes” in South Bihar in mitigation of both flood & drought, show the potential of the system. If the system is properly restored and improved, it may play significant role in combating the adverse

impact of climate change, when in future more severe floods & droughts are expected more frequently. While restoring the system care should be taken to see that the original characteristics of the system viz supply oriented, totally maintained and operated by the beneficiaries with its own methods of resolution of conflict are not changed; they are retained rigidly. Besides, the large number of Chauris existing in North Bihar may be developed for conservation and storage of rain water for use during Rabi season in conjunction with surface water from other sources and ground water.