# RELEVANCE OF TRADITIONAL INDIAN METHODS OF WATER MANAGEMENT IN THE PRESENT ERA

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**ABSTRACT**

India's noteworthy achievement so far is that it became self-dependent from food security point of view in four decades of independence as against it had to depend on imported food grains of the worst quality in the pre-independence era. Increased water storage capacity by constructing large or medium dams on different rivers at different locations helped a lot in making India food secured. However, at present it has been facing crises of floods and draughts in different parts at the same time and also the issues like food security, water logging, deterioration of quality of soil, interstate disputes for water, etc. The paper focuses the fundamental question as to whether the same strategy i.e. constructing large or medium dams on rivers is worth continuing in the light of the present crises or there is any paradigm shift needed in order to address the crises. The journey up to the present scenario along with a rational evaluation of pros and cons of the strategies adopted so far has been appreciated but at the same time is pointed out that the breakeven point has now come which suggests a serious rethinking and also a need of strategic change. The strategic change in the form of promising and result oriented approach based on distributed resource management is underlined. Traditional Indian methods of water management and sharing how possessed the required qualities to address different issues without generating other byproduct ill-effects is discussed in order to guide the strategic change towards revival of them such that sustainable solutions are worked out without abolishing what has been done till date. It is a complementary and constructive approach rather than criticism or doom-saying. Case study of mass movement of Gujarat alongwith the results has been discussed in order to assure that the traditional Indian methods are promising even in the present era of technology.

## 1. POST-INDEPENDENCE ACHIEVEMENT

An overview of six decades of India’s post-independence period reflects spectacular profile in its water resources sector. During this planned development period, India has increased its water storage capacity from a meager 15 BCM to more than 200 BCM by constructing over 4000 dams. Consequently irrigation potential has increased five folds and food grain production by almost four and half times. One must appreciate the positive side of the water management of India that in a fairly short period of time, the production of food grains in the country went up from around 50 million tonnes (1950-51) to 234 million tonnes (2008-09). Roughly two-thirds of the increase in production came from irrigated areas - from groundwater-irrigation, ‘minor’ surface water irrigation, and ‘major’ irrigation (largely dams and reservoirs). Irrigation undoubtedly has played a crucial role in the dramatic increase in food grain production. The rise in food production has been sufficient to meet the pace of population increase in India as shown in Table-1. From 1951 to 2009 per capita per day availability of food grains has been almost the same.

**Table 1.** Per Capita Availability of Food Grains

| Year | Average (Gram Per Capita Per Day) |
|---|---|
| 1951-60 | 429.8 |
| 1961-70 | 447.5 |
| 1971-80 | 442.2 |
| 1981-90 | 464.2 |
| 1990-2000 | 475.5 |
| 2001-2005 | 454.2 |
| 2006 | 445.3 |
| 2007 | 442.8 |

| | |
|---|---|
| 2008 | 436.0 |
| 2009 | 444.0 |

## 2. SHORTCOMINGS OF THE PRESENT STRATEGY

So far over 4000 large and medium dams have been constructed on different rivers of India. Because of continuous irrigation for five or six decades, results of proper evaluation of advantages and disadvantages of the irrigation projects have started coming to our knowledge. They have compelled the policy makers to think whether the same strategy would benefit forever. Some of these issues that have become necessary to be addressed are following.

### 2.1 Low Efficiency

Irrigation projects actually function on a low efficiency, in most cases approximately 50 %. The main reasons are evaporation losses, seepage losses, water theft, silting in reservoir, conditions of canals, etc. If the actual returns are compared with the investment made, the scenario would be clearly indicating very high cost against the returns. The project report is never evaluated after commissioning of the irrigation project and hence people stay far off the reality.

### 2.2 Water Logging

In command areas of several irrigation schemes water logging has been a major problem. In Punjab and Hariyana there is a large area covered under the water logging. Now they are planning to spend huge amounts to drain the subsurface water for reclamation of soil. Other states have also started facing this issue and the saline land in India is increasing day by day.

### 2.3 Uncontrolled Irrigation - Reduced Command Area

The government machinery has been diminishing in size and its quality is deteriorating day by day. On the other hand the Participatory Irrigation Management approach is being tried to be adopted by all the state governments but there is no headway till date. Therefore uncontrolled irrigation has been in practice in almost all the irrigation projects and the head reach farmers take undue advantage of their access to water and over-irrigate their farms by depriving the tail-enders and hence the full command area of the irrigation project is never served. State governments are not really serious about this issue.

### 2.4 Limited concept of design

Irrigation projects in general are conceptualized on the basis of river flow and demand pattern in the command area. Thus, only demand and supply of available surface water forms the major design philosophy. Water is not wholistically viewed and several concepts like groundwater recharge, effect of changes in cropping pattern after availability of water, aquaculture, riparian rights, environmental flow, etc. are missing at the planning stage.

### 2.5 Deprivation of Many to Benefit A Few - Genesis of Troubles

The basic philosophy of any irrigation project is stopping of flowing water and diverting the same transversely. Thus, the natural beneficiaries of the water i.e. the people in the downstream of the dam are deprived of their riparian rights and due to submergence the people in the vicinity of the dam are required to be displaced. If considered the total deprivers on the one hand and the real beneficiaries located far off in the transverse of the river on the other, perhaps several large dams would not be found just. The same way the water distribution is not judiciously managed in the command area of the irrigation projects and head reach farmers take undue advantage and usurp more water depriving the tail enders. Therefore, within command area there is inequitus which is not solvable an issue. Thus, within the command areas and along the rivers it is the injustice that prevails largely due to large irrigation projects.

Because of large submergence and construction of canal network, displacement and rehabilitation of people and land acquisition take very long a time to complete irrigation projects. There are several dams in India which were constructed some decades ago but canal network has not been completed till date. This phenomenon came to the notice in early seventies and therefore the schemes like Accelerated irrigation Benefit Programme and Command Area Development and Water Management Programme by the Government of India. In spite of these schemes to squeeze the gestation period of irrigation projects, many dams could not have their command areas fully developed is a fact. This issue results in to total mess of the project, cost hike and many a time the benefits envisaged at the time of approving the project are finally never achieved.

**2.6 Boiling States on Water Sharing**

Large irrigation projects have brought the stake holding states to struggle. A few examples are sufficient to understand the seriousness of the matter.

*2.6.1 The Cauvery Dispute*

The essence of the Cauvery dispute is a conflict of interests between a downstream state (Tamil Nadu) and an upstream state (Karnataka) in South India. Karnataka and Tamil Nadu both, depend heavily on the Cauvery River for irrigation and water supply of major cities. The dispute started in the second half of the 19th century when the (then colonial) Madras Presidency (today Tamil Nadu) and the then princely (independent) state of Mysore (today Karnataka) had their first negotiations over the sharing of the Cauvery's water. Several agreements, the most important ones from 1892 and 1924, tried to find solutions how the two states can share a scarce resource.

The Cauvery River Dispute has become a serious issue since 1974 when the 50-year-old agreement between the Madras Presidency and Mysore state ended. The dispute relating to sharing of Cauvery water among states of Karnataka, Kerala, Tamil Nadu and Pondicherry was referred to the Cauvery Water Disputes Tribunal (CWDT) constituted on June 2, 1990. An interim Order was passed in June, 1991 directing the state of Karnataka for releasing water from its reservoirs so as to ensure 205 Thousand Million Cubic Ft. (TMC) of water in Mettur reservoir of Tamil Nadu in a water year, in fixed monthly and weekly pattern. CWDT was the country's first water tribunal to give an interim order. The Central Government has in 1991 published the order of the Tribunal under Section 6 of the Inter-State Water Disputes (ISWD) Act, 1956; thus, making the order final and binding to the parties in dispute. Further, under the Provisions of Section 6A of the ISWD Act, 1956, the Central Government notified a Scheme called Cauvery Water (Implementation of the Order of 1991 and all subsequent Related Orders of the Tribunal) Scheme, 1998, consisting of Cauvery River Authority and Monitoring Committee.

Before the Supreme Court Bench headed by the Chief Justice on the deliberate non-compliance of its order by Karnataka Chief Minister, he had to tender an 'unconditional apology'. Similarly in November 2002, following strong objection by the Supreme Court against her remarks about the Cauvery River Authority and the Prime Minister terming as ‘insinuations’, the then Chief Minister of Tamilnadu had to withdraw her letter containing such remarks. Very simply, the squabble between the two states has raised questions that have cast the entire federal concept into doubt.

*2.6.2 The Ravi-Beas-Satluj Dispute*

Six years after the Indus Waters Treaty (1960) signed with Pakistan, which reserved the waters of the Ravi, the Beas and the Satluj exclusively for India, the State of Punjab was reorganized, and the new State of Haryana claimed a share of the waters. In 1976, the Union government announced that both the states would receive 3.5 million acre-feet (MAF) of water from the available annual flow of 15.2 MAF. Although Punjab had begun the construction of the Satluj-Yamuna Link canal in 1978 to facilitate this, it felt short-changed, and moved the Supreme Court. Haryana also went to court demanding implementation of the Union notification. Five years later, Chief Ministers of Punjab and Haryana arrived at a fresh agreement. This time the new flow data that were used pegged the water availability at 17.17 MAF. This gain enabled a generous redistribution to all the States, with Punjab getting 4.22 MAF, Haryana 3.50 MAF, Rajasthan 8 MAF and Jammu and Kashmir and Delhi 0.20 MAF each.

Punjab rivers as such are not inter-state rivers and hence this water sharing does not fall in the purview of Inter State Water Dispute Act. Pursuant to the Punjab accord, the Parliament inserted a new Section (Section 14) in the Inter State Water Disputes Act, 1956 to broaden its base to include dispute over Ravi-Beas and Satluj rivers, validity of which is also questioned by legal experts who found it in violation of Article 262 of the Constitution. The accord also stated that the SYL canal would be completed by August 15, 1986, allowing Haryana and other downstream users to utilize whatever share of water the tribunal would eventually allot them. Tribunal discovered that the use of Ravi-Beas water by farmers in the three States totaled 9.711 MAF, of which Haryana accounted for 1.620 MAF and Rajasthan for 4.985 MAF, while Punjab took up 3.106 MAF, including the 0.352 MAF that Rajasthan could not utilize. Against the quantity thus left unutilized (6.6 MAF), Tribunal made an interim order, giving Punjab 5.00 MAF and Haryana 3.83 MAF. The difference between the 6.6 MAF actually available, and the 8.83 MAF that Tribunal allocated was based on the water below the rim stations of the Ravi and the Beas, the lowest points at which flow data were recorded which was opposed by Punjab.

Having completed its portion of the SYL canal in 1980, Haryana sought the intervention of apex Court under Article 131 of the Constitution saying that if balance of federalism is upset by a recalcitrant state and the Union remains a mute spectator, then the Supreme Court should step in to preserve the basic feature of federalism. On January 15, 2002, Supreme Court passed a decree of mandatory injunction compelling Punjab to complete the construction of the SYL canal within the next 12 months as also to make it usable. In June, 2004 the Supreme Court directed the Centre to take over the construction of the Punjab portion of the canal after noting the State Government's continued reluctance to do it. Thereafter, under Article 143 of the Constitution and following the precedence of 1991 Karnataka Ordinance against the Interim Order of Cauvery Tribunal, the President of India referred the Punjab Act to the Supreme Court on July 22, 2004 for its opinion about the constitutional validity of this Act. Commenting on this an eminent journalist has said, “President (has been) used as a postman to refer the dispute to the Supreme Court.” By then claiming that Punjab had no surplus water to give to any neighboring state, Chief Minister of Punjab demanded setting up a new water dispute tribunal which was opposed by the Haryana Government.

## 3. APPRECIATION OF BREAKEVEN POINT

The strategy of dams and canals has been resorted to for over seventy years with only little attention at other approaches and now continuing the same could really be worth is a question to ponder over. Even the same infrastructure would continue delivering the same results in itself is a question.

**Table 2.** Basin wise Water Distribution

| Sl. No. | Name of the River Basin | Average annual availability in Cubic Km per Year |
|---|---|---|
| 1. | Indus (up to Border) | 73.31 |
| 2. | a) Ganga | 525.02 |
| | b) Brahmaputra, Barak & Others | 585.60 |
| 3. | Godavari | 110.54 |
| 4. | Krishna | 78.12 |
| 5. | Cauvery | 21.36 |
| 6. | Pennar | 6.32 |
| 7. | East Flowing Rivers Between Mahanadi & Pennar | 22.52 |
| 8. | East Flowing Rivers Between Pennar and Kanyakumari | 16.46 |
| 9. | Mahanadi | 66.88 |
| 10. | Brahmani & Baitarni | 28.48 |
| 11. | Subernarekha | 12.37 |
| 12. | Sabarmati | 3.81 |
| 13. | Mahi | 11.02 |
| 14. | West Flowing Rivers of Kutch, Sabarmati including Luni | 15.10 |
| 15. | Narmada | 45.64 |

| | | |
|---|---|---|
| 16. | Tapi | 14.88 |
| 17. | West Flowing Rivers from Tapi to Tadri | 87.41 |
| 18. | West Flowing Rivers from Tadri to Kanyakumari | 113.53 |
| 19. | Area of Inland drainage in Rajasthan desert | NEG. |
| 20. | Minor River Basins Draining in to Different Rivers | 31.00 |
| | Total | 1869.35 |

### 3.1 Lopsided Natural Distribution of Surface Water - More Dams Unfeasible

Against estimated annual precipitation of about 4,000 Billion Cubic Meters (BCM) including snow fall, India's total annual renewable fresh water resources are estimated at 1953 BCM. Table-2 shows basin wise water distribution which clearly indicates that the natural distribution of surface water is lopsided and hence in some regions flood and in some the draught. In spite of exploring most of the sites for the dams neither the issue of floods and draughts has been possible to be addressed, nor can anyone claim that by constructing few more dams on the remaining feasible sites could be expected some effective solution. Therefore, continuation of the same strategy is not really feasible on several considerations.

### 3.2 Actual Encompassment of Benefits - Satisfaction or Sigh

Table-3 shows the land use details of India which suggests clearly that out of 328.83 Mha (Million Hectare) land, actual available land for cultivation is over 200 Mha but the net area sown is only 142.02 Mha. Actual irrigation potential created is little more than 100 Mha till date and actually utilized is much less. It is important that irrigation potential covers all types of irrigation and hence it also includes the lift irrigation schemes and minor irrigation schemes. Thus, rainfed agriculture and non utilized agriculturable land if considered, so far not even 50 % of the agriculturable land has availed resources for agriculture in spite of constant implementation of the modern methods of irrigation and exploring almost all the feasible sites.

**Table 3.** Land Use Details of India (Million Hectare)

| | |
|---|---|
| Geographical Area | 328.73 |
| Forest | 67.8 |
| Not available for cultivation | 41.56 |
| Other uncultivated land | 28.36 |
| Fallow Land | 24.10 |
| Net area sown | 142.02 |

## 4. STRATEGIC CONSIDERATIONS

Every breakeven point suggests a need for change in strategy rather than a sign of collapse; nor does it prove all the acts made so far deplorable. The root cause of the ills of the so far adopted strategy or the limitations of the same lies in the underlying principle - usurp, amass and distribute. If that principle is properly understood and strategically given up, the balance provides the direction of the next viable course. It inevitably provides for allowing the natural beneficiaries to enjoy their rights, passing on the rest to others, using judiciously and sharing magnanimously.

### 4.1 Traditional Indian Practices – A Viable and Complementary Solution

Indian philosophy does not permit hording of resources and preaches enjoying after dissemination and distributing what one has possessed. Therefore, in water resource management, local techniques appropriate to the topography, geology, rainfall pattern, climate, etc. had come in to vogue during the time immemorial and had been founded on the said philosophy and hence the sharing was not an issue. Basically distributed water resource management rather than accumulate and then distribute i.e. centralized management had been the fundamental principle. Many of traditional techniques are alive till date and their study has revealed some important advantages which are discussed below.

(1) In distributed water resource management, the scale is small and hence restricted water is available which provides protective irrigation rather than productive one. Protective irrigation provides watering in case of delay of rainfall and hence economical use of water becomes essential for the farmers ensuing several benefits. Protective irrigation eschews water logging as water is not allowed to be used economically and judiciously. This avoids socio-economic disparity and the small scale avoids technical complexity and large expenses on social cause like rehabilitation of displaced persons, etc.
(2) With the cropping pattern the balanced requirement is fulfilled and hence cropping pattern remains sustainable and people are not enticed to crop unsuitable to the climate or soil type. Environmentally healthy practices in agriculture is the key to sustainability.
(3) Small scale obviously results in to low cost of construction and maintenance. Large irrigation projects if studied properly would suggest that construction cost is much higher than envisaged at the time of designing the project and maintenance cost is almost unviable over a period of time. Small traditional system are such that the beneficiaries can afford to maintain without being dependent on the government.
(4) Small scale ensures no encroachment of riparian rights. This is a critical aspect for socio-economic health and no large irrigation project can effectively address this issue associated with it.
(5) Small scale avoids complexities and hence the gestation period is very short. Life cycle cost analysis of such small traditional systems and major irrigation projects would reveal that the former are much more profitable on every consideration. There are several irrigation projects which have not been completed in stipulated time because of technical and legal issues. So many dams have been constructed decades ago but the canal network has not been completed till date. Thus, the advantages envisaged at the time of designing the project takes decades for actualization.
(6) Water is treated as one entity and hence wholistic concept of design is reflected. In traditional practices, surface water, groundwater, rainfall, etc. are treated as a part of system rather than separate components and therefore most efficient use of water is done. They do not reveal technical jargons but they do reflect sound knowledge and wisdom.
(7) Water is viewed as a community resource and hence no individual or the ruler has his exclusive right on it. Perhaps this is not only a sign of healthy society but also a reason for a coherent society governed by a sense of joint responsibility rather rights on resources. Water as a commodity has put several challenges on the way to establishing human values in the society. Water as a community resource is the concept that helps justice prevail.
(8) Water is a recyclable resource and hence integrated water resource management maybe on small scale is the core theme in the traditional Indian systems. All water experts appreciate at present the significance of integrated water resource management.
(9) Pollution of water resources is more dangerous than consumption is an important aspect of the traditional system and hence sense of responsibility is instilled in the community in course of water management and is long lasting. Value adherence in the people gets strengthened with generations.

## 4.2 Revisiting Some Traditional Practices

### *4.2.1 Bamboo Drip Irrigation System*

Bamboo drip irrigation system is practised mainly in the Jaintia and Khasi Hills of Meghalaya for the last 200 years. This is a useful irrigation system in a place where there is water scarcity and soils are poor in water holding capacity, the topography is rocky and undulating and irrigation is required for crops that need relatively less water.

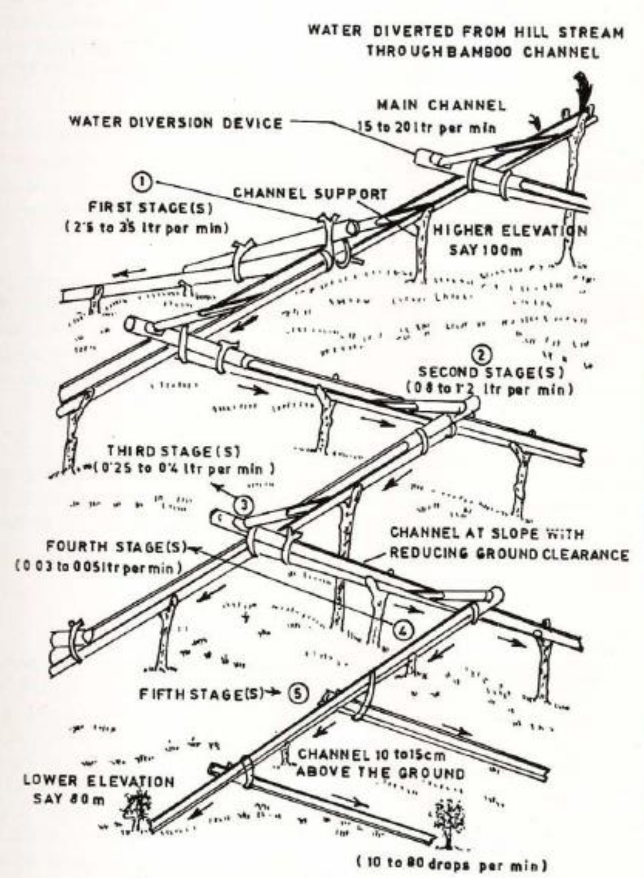


**Figure 1.** Bamboo Drip Irrigation System

Objective of this system is to provide just required water to the crop and water logging is completely avoided. This is a gravity based drip requiring no energy input. Complex technical aspects are skillfully implemented in this system.

*4.2.2 Zabo System*

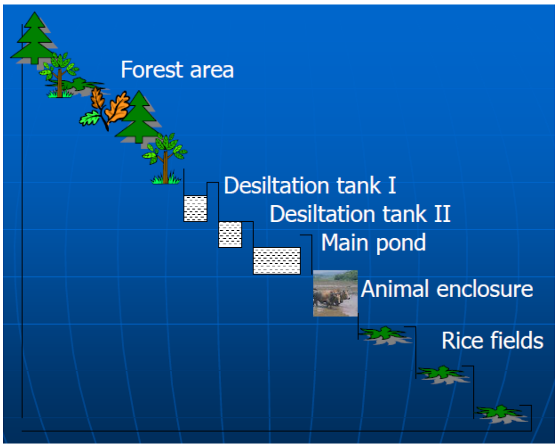


**Figure 2.** Concept of *Zabo* System

The *zabo* (the word means 'impounding run-off') system is practiced in Nagaland in north-eastern India. It consists of a protected forestland towards the top of the hill, water-harvesting tanks in the middle and cattle yard and paddy fields at the lower side. Near the catchment area (mid-hill), silt retention tank and water harvesting tank are dugout with the formation of earthen embankments.

Silt retention tanks are constructed at two or more points and the water is kept for 2 or 3 days in these tanks before being transferred to the main tank. The silt retention tanks are cleaned annually and the desilted materials, which have good amount of organic matter and nutrients, are transferred in the terrace fields. In constructing the water-harvesting tank, the bottom surface is properly rammed and sidewalls are plastered with paddy husk to minimise the loss of water through seepage. The water from the pond is passed through the cattle yard before taking it to the rice field for irrigation. The water carries with it the dung and urine of the animals to the fields through split bamboo channels. This serves as good source of nutrition for the crops.

**Figure 3.** Rice Fields

Paddy fields, which are generally 0.2 to 0.8 ha in size, are located at the lower elevations. The fields are thoroughly rammed at the time of puddling through human treading, cattle in-group and wooden sticks to create a hard pan in order to avoid percolation of water. Using of paddy husk checks seepage losses from shoulder bunds. Two supplementary irrigations are given from the water-harvesting tank. Majority of the farmers practice fish culture in their wet rice terraces. A small pit is dug in the middle of the rice field and fish fingerlings are put in the fields. When the water is drained out from the fields before intercultural operations and harvesting of the paddy crop, the fish remain in the pit.

The Zabo farming system has an inbuilt water harvesting and recycling systems with well founded management base to control soil erosion, proper management of soil fertility and available water. It is a viable practice of resource management and maintenance of ecological balance.

*4.2.3 Oorani*

In southern India, every village had more than three water bodies that met the needs for drinking, farming and for cattle and birds. The tanks, in south Travancore, though numerous, were in most cases *ooranis* containing just enough water to cultivate the few acres of land dependent on them.

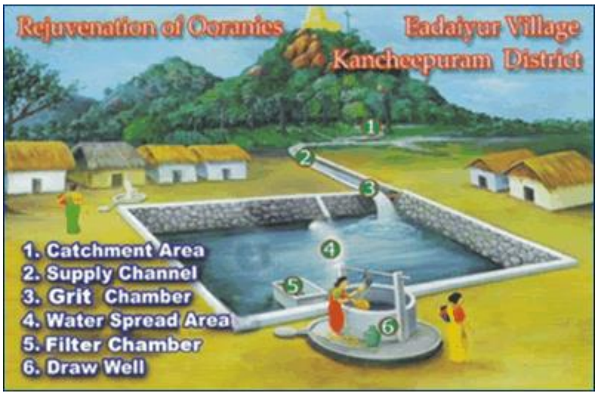


**Figure 4.** Concept of *Oorani*

The irregular topography of the region and the absence of large open spaces facilitated the construction of only small tanks unlike large ones seen in the flat districts of the then Madras Presidency, now Tamil Nadu. Traditionally, the village assemblies built the *ooranis*. The local community also maintained these structures. Donating land for ponds or assisting in digging a pond was considered virtuous. The maximum benefit from using *oorani* water was to women who usually fetched water for domestic needs. Attainment of socioeconomic balance and coherent communities are the biggest benefits of this system.

## 5. REVIVAL OF TRADITONAL SYSTEMS - CASE STUDY OF GUJARAT

Scenario of Gujarat is also not much different from overall scenario of India. Out of its 1,96,000 square Kilometer of total area of the state, 96,000 square Kilometer is agriculturable land but irrigation potential created by major and medium irrigation projects is only 28,000 square Kilometer till date. Variation in availability of surface water in river basins and rainfall variations do not allow sizable expansion. Government of Gujarat launched Sardar Patel Participatory Water Conservation Scheme in 2001 and got constructed about 40,000 checkdams in about 5 years with the traditional concept and with participatory approach i.e. 60 % of the cost of each checkdam was borne by the government and 40 % by the beneficiary farmers. The Indian Institute of Management, Ahmedabad conducted the detailed study of the results of this scheme. Important achievements of the scheme are following.

- Average 7 wells in surrounding could be recharged.
- Ground Water Table came up between 3 and 9 meters.
- Soil fertility was improved.
- Quality of drinking water was improved.
- Electricity consumption for drawal of water was reduced.
- Overall prosperity increased in villages.
- The government had to make less expenditure compared to contract approach.
- Instant results were found.
- Change in attitude of people as well as government officers was witnessed.
- Where checkdams are constructed, land prices have gone up by 20 %.
- Crop Yield has been improved by 35 %.
- Approximately 10 hectors of land is benefited by each checkdam.
- 8 to 10 families sould sustain.
- Control on salinity has been effectively done.

**Figure 5.** Checkdam

Some checkdams on rivers were also constructed with the help of industries. Overall results proved that traditional approach yielded very good results and especially the areas which were not supplied any irrigation water from large or medium irrigation projects could be sustained and no migration was needed.

**Figure 6.** Well recharged in vicinity of checkdam

## 6. CONCLUSION

India is a country of masses but that does not mean every solution devised to address its need should be massive. India has survived the test of the time which means it has already obtained the solutions for different crises. In the present time when Western systems are believed to be the modern and most relevant, so far as the water sector is concerned, they have started exhibiting serious limitations and it is sure that they are not sufficient at least if not absurd or inappropriate now. The paradigm shift to distributed resource management system which is the most important basis of the traditional Indian water management and sharing methods is a viable wayout and resurrection of the traditional Indian system is feasible and promising in the given situation. Case study of Gujarat is worth considering. They are not only sustainable but more effective, wholistic and without any ill effects. They are also healthy for the social fabric and India needs that today much more than it did ever in the past. Revival of traditional Indian systems is possible even today in the time of technology is proven by the case study of Gujarat.

## REFERENCES (9PT BOLD AND ALL CAPS)

S. Mahendra Dev and Sharma, Alakh N. (2010): Food Security in India: Performance, Challenges and Policies, pp-5, Oxfam India

Kapadia Vivek P., Indian Water Sector : Critical Analysis of the Present Crisis and the Roadmap Towards the Solution, India Water Week 2012