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Water Woes Solution Through Traditional Conservation Route

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Abstract: *Water conservation is a known global public issue because water is everybody's concern. The misuse and overuse of water by humans lead to water conservation practices, which may be ineffective or effective. It acquires more crucial dimensions, especially where the water is scarce and at a time when demand is high. The traditional culture, old water conservation practices, and history have a lot to offer and teach us to realize their importance. These traditional practices and measures, in vogue, on the Indian peninsula provided long-term solutions concerning the saving of water and its requirements. The world cannot afford to lose precious commodity, namely water, that has to be conserved for the present as well as the future. Therefore, let us conserve and save it, make effective use of it for future generations either by learning. or through traditional conservation practices.*
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Introduction

India is among the top ten water-rich countries in the world. It is endowed with a large number of major rivers around which the number of ancient civilizations was developed e.g. *The Indus Valley civilizations*, *Gange's civilizations*, *Mesopotamia civilizations* etc., all emerged and flourished around rivers. But today India suffers from a scarcity of water. The main and important reason for this is water management and its real-time implementation in practice. Related to this is the management as well as mismanagement, which has close linkages with water conservation practices. Thereafter, comes the industrial sectors which consume it. Wherever water quantity or the magnitude is large, their involvement in water conservation matters a lot. How we conserve and manage our water resources for different needs, will define the present time civilization. At once, when we know or understand the need and requirement of water we can save aquifers and address the water stress issues of present civilization. It is well known that vagaries of weather/climate and socio-economic changes, occurring in recent time, is altering the spatial and temporal pattern of the water be it the flow regime, increasing flooding and drought events (disasters) or the water scarcity on earth's surface. This is the reason why in 2020, "Water and climate change" is the slogan of *World Water Day*, highlighting the importance of protecting our water resources in the face of climate change.

Water and its impact on various sections of society are visible these days and connected to these impacts are *water stress*, starting from the source to the supply chain therefore water resources conservation has tremendous significance. It is absolutely clear that human health is impacted and productivity is affected by its proper use meaning that we have to be careful and responsible, about how our water is utilized and recycled because it would help to reduce the suffering of many lives. A rational approach to conserving water by traditional route embeds solutions for the local or regional water requirements for the society or industry. Thus this discussion paper is an attempt to co-relate the old traditional water conservation practices with modern practices, citing examples from India. Both pros and cons, from management as well as its use perspective, has been discussed.

Traditional Water Conservation Practices

Some Indian Examples

Water has been conserved and managed in India since antiquity. Archaeological evidence shows that the practice of water conservation was deep-rooted in the ethos of perfecting the art of optimum water management. Earlier excavations show that the cities of the *Indus Valley Civilization* had excellent systems of water conservation, harvesting and drainage. The settlement of *Dholavira,* laid out on a slope between two stormwater channels, is a great example of water engineering. *Chanakya's Arthashashtra* mentions irrigation using water harvesting systems. *Sringaverapura,* near Allahabad, India *(now Prayagraj*) had a sophisticated water harvesting system that used the natural slope of the land to store the floodwaters of the river *Ganga*. Chola King *Karikala* built the grand anicut (or *Kallanai) across the River Cauvery* to divert water for irrigation while *King Bhoja* of Bhopal built the largest artificial lake in India. Drawing upon centuries of experience, Indians continued to build structures to catch, hold and store monsoon rainwater for the coming dry seasons. Our ancestors had years of experience and they used a particular methodology in an area (local technology) for a particular application e.g. *Bundelkhand,* where *Bundela* and *Chalukya* kings created thousand of 'talabs' (ponds). These provided water security to the region. In course of time, these were defaced.

In the Rajasthan state of India (Jaisalmer and Barmer areas of Rajasthan) specific traditional water conservation practices were developed in ancient times. Most of the water conservation structures developed were specific to the eco-regions and culture of the past. Some important traditional structures of the older days were - (i) Baoli or Stepwell ; (ii) Talab / Talao /Talai /Kohli / Cheruvu / Kere (Ponds) (iii) Bandh /Johad /Johadi/ Bandharas (Dams).

Most of these traditional conservation structures (or systems) are named after local languages e.g. *Cheruvu, Kohli, Johad, Bandharas* etc. Their numbers are very large and they are spread across the entire length and breadth of the country, hence it is difficult to list them. However, in places, they are still existing and functional [5,6]. Baoli (a stepwell) is one important traditional and ancient water conservation structure reported in Indian literature. These are *rainwater harvesting pits* that were built to conserve water and divert rainwater away from the storm drains on the ground. In India, several localities in Rajasthan, Delhi, Gujarat and Andhra Pradesh state reported the existence of *Baolis* [5]. The 'Chand baoli' near Jaipur extending almost 100 feet (30m) deep from the ground surface has nearly 3500 steps with 13 stories, making it one of the largest stepwells in India **(Fig. 1b).** Baoli at Patan, Gujarat, India is yet another example of a marvellous stepwell built by our ancestors **(Fig. 1a).**

(a) Baoli at Patan, Gujarat (India)

(b) Chand Baoli near Abhaneri village, Jaipur, Rajasthan (India)

(c) A traditional water conservation structure at Rampur Mandir, Maihar, M.P, (India)

***(d)* A *talao at* Baghuwar village, Narsinghpur, M.P. (India) (https://www.thebetterindia.com/61757/traditional-water conservation-systems-india)**

Fig. 1: Some examples of traditional water conservation practices in India

Similarly, the stepwells of Delhi are well known to many. *Baolis* have existed for at least 1,000 years and were constructed in towns and at various places alongside the hotels, sarais and Dharamshalas (a type of motels). *Baolis* carved into the earth has quite meticulous shapes and sizes. In these Baolis, groundwater is pulled up from a circular well at the bottom and rainwater is collected from above. A set of steps on one or more sides of the structure lead down to the water level, which fluctuates depending on the amount of rain. Extraction of the water from the *baolis* was manual in early times but these days, electric pumps have been installed. Likewise, many old water conservation structures are a part of Indian cultural heritage (Box 1). Some of them are still functional and existing in good shape as of now.

Box 1 : Baolis of Bhonsala Period at Nagpur, India

The Bhonsala kings who were the ruler in old period created water resources for the supply and management of water during 1730 AD to 1853 AD to the one and half million people of that time. Principal objective of these water structures was to quench the thirst of people as well as for farming and other daily activities. They constructed stepwells (about 9 in Nos.), big wells and talao (ponds) in several localities namely *Rajabaksha, Moti bagh, Khamla, Indora, Mahal and Nandanvan. Ponds at Ambazhari, Shukarwari, Sakkardara, Sonegaon, Telangkhedi, Lendi talao and Naik talao were prominent and operational* Britisher's who came to rule at quite a later date also appreciated the work of Bhonsale's. The special features of these wells were that they were connected with the lakes and hence never dried. Water distribution was through the principle of gravity. Natural pond were surrounded by the hills from all sides. Big wells were dug on the sides, at a distance from the Baoli to act as a feeder, to keep them charged with water all the time. The atmosphere near the ponds and baolis was able to keep the atmosphere cool thus escaping the scrotching heat of Nagpur city during summer. Some of them are still under use and some are abandoned e.g. Baoli at *Khamla, Nagpur.*

Many *baolis* have fallen prey to rapid urbanization and neglect. Significant points to be observed for these old structures is that they are now surrounded by buildings and the population all around, but are still being recharged naturally because they are engineered in such a way that the catchment area of these conservation structures is still intact and not yet damaged. Their siting/location is the key to their success. In urban areas, these traditional systems took a back seat after the 1990s when government agencies came forward with piped-water supply alternatives. The problem with their survival in hills was related to compartmentalization in respect of uses and functions. In recent times, rejuvenation of many such structures has been paid attention which resulted in a great positive impact on groundwater recharge, raising of water table heights (uplifting) and water conservation. If the status of traditional practices is alleviated, through their revival, the local water scarcity and depletion of aquifer water can be reduced substantially and a crisis averted. Some advantages, which these structures offer, may be taken for useful applications in the present time namely, low cost of maintenance (expenditure) and ease in practices (implementation). Correlating the water solution (handling & management) with old traditional practices and structures, it may be learnt that an ancient structure can co-exist with modern. Even today, with government support or people participation, these structures could be rejuvenated. They can be coupled or upgraded as modern rainwater-saving alternatives like 'percolation tanks', 'injection wells', 'anicuts', and 'sub-surface barriers'. It is possible to make them operational and economically viable, even today. Since the traditional systems are superior and cost-effective they will have better acceptability among locals and can be easily managed by communities for sustainable growth.

Discussions and Analysis

Why do we have to emphasize water conservation? The reason for it is simple, the exponential water demand and everybody's concern for water. To ensure water availability, water conservation is essential as well as desirable because all sections of society are involved, directly or indirectly, in maintaining the hydrological water cycle on the earth's surface, be it from any sector - the domestic, industrial or agriculture [5]. An industrial activity needs water, causes land degradation on the surface and culminates in the form of urbanization, deforestation and land desertification. Such, land degradation will have an impact on both water quantity as well as quality. Deteriorating quality and diminishing water quantity certainly call for the need of conserving it. The water so conserved has plenty of scope for miscellaneous uses and even utility for drinking (potability of water).

In context with the water solutions through its conservation route, the followings point needs an attentive site-specific analysis that contains different aspects of the water science and engineering -

1. How do the old practices fit into the new and modern practices so that the local requirement of water is fulfilled or the water crisis is averted?
2. How the old systems were erected and what kind of principles were applied for water collection and conservation. Whether the traditional practices and measures are scientifically appropriate or not?
3. Whether the assessment of the hydrogeological set-up of the site area is required for its rejuvenation?
4. Do conservation practices have social acceptability from an industrial perspective?
5. Are there any bottlenecks concerning the regulatory framework?
6. Which type of management is required to augment them into practice?
7. What kind of gain or loss is associated with its implementation?

At once, when the answers to these questions are found satisfactory, the traditional water conservational practices, when applied to the water solution, can be turned into an opportunity.

The traditional water conservation practices are one of those systems which adjust to absorb the weather vagaries and are the best in crisis if maintained. In such systems, due consideration and emphasis have been given to the ecosystem's health and its overall improvement. Sharing of water resources and the equity of ownership among local communities are the most striking features of the traditional conservation culture, which led to the building up of a peaceful and sustainable rural society. Fractal geometry has been used in the architecture design of old structures in plan and elevation [7]. Many lessons in the architectural planning and designing of water structures, geometry, optimization of space, architectural beauty and water use, environmental ambience & water supply service, creativity in the ideation of new forms and testing harmony between old and new designs, can be learnt from these traditional structures [7].

Water conservation in both rural and urban areas are sharply different. In 'urban areas, 'rooftop rainwater harvesting' and 'Storm run-off harvesting' through # Recharge Pit # Recharge Trench # Tubewell # Recharge Well is a methodology whereas in 'rural areas', Rain Water Harvesting through # Gully Plug # Contour Bund # Gabion Structure # Percolation tank # Check Dam/ Cement Plug/ Nala Bund # Recharge shaft # Dugwell Recharge # Water Dams etc. has been the industry perspective of water conservation, being implemented by corporate social responsibility route. By applying traditional practices or by giving priority to such practices, local solutions for optimum use of water, of course at a cost, is possible. Old practices of water conservation are equally applicable to the new structures for artificial water conservation. The modern water conservation practices such as *recycling of water* and the *Circular Economy* concept [1,7] already known to many, must be used and considered because with the combined application, old and new practices of water conservation, better socio-economic gains can be dovetailed. This will solve the local water scarcity problem in remote areas. Amidst modern available approaches and techniques, the mention of water conservation through *water community participation* must be made as it is the most economic and effective way of its implementation (in Hindi it is referred to as 'जल बिरादरी') [2]. This approach involves all stakeholders and everyone either directly or indirectly.

1.1 Despite knowing all these facts, several factors that have remained responsible for the decline of traditional practices are - (a) Growth in population and water demand. (b) Availability of a more convenient water supply system from governments. (c) Promotion of modern water supply system. (d) Gradual fall in the active community interaction etc. Hence, the water conservation perspective should be - to encourage those projects which support the conservation of freshwater. However, at the site, the effective results may vary on a case-to-case basis and from one site to another. e.g. Considering the mine pit as a traditional storage system of the old type, the mining organization can conserve water in such pits. During the decommissioning phase of the mine, when the open pit is abandoned and mining is closed, the development of a mine pit into a 'pit lake', as an end-use of mine, is a novel way. Mined out pits filled with water, are called 'pit lakes' in mining terminology. Such pit lakes have their value as a resource for miscellaneous purposes e.g. recreation, fisheries, water supply, wildlife habitat etc. The mine pit lakes are artificially formed and are one of the best forms of ecological restoration to compensate for the environmental damages caused due to mining and also to provide commercial benefits (value addition) to the mining company owning it. Pit lakes, with rocky bottoms, are typically in a non-equilibrium state to their surroundings but are brought into their natural and balanced equilibrium state with human interventions [3].

Guiding Principles**:** Connecting history, culture and tradition with the water systems, it is evident that the 'stepwells' are one of the best examples which stood the test of time and had built sustainability. These were designed for multi-functions for the common person's needs hence, needs to be brought back (revived). Some guiding principles, through which, they can be brought are - Modernize processes, benchmark water use through an audit, encourage recycling, reduce wastewater generation at source, apply the concept - Save water is equal to the water conserved and take advantage of surface features and topography. [4].

From the discussed points it is clear that the water solutions must be targeted around the abovementioned issues and guiding principles. In water-scarce areas and in areas where groundwater is overexploited, conservation practices are useful measures. Implementation of the conservation practices can improve the water supply chain management in the long run and prove as an added advantage beckoning toward water conservation practices. Thus, water conservation as a whole is extremely important for both general and the industrial sector [8]. If water conservation practices are in place the water demand of the future, is secure. In brief, *water conservation* seems a good and elaborate topic for exploring the record and current situation. Traditional sources have a long history that can play a major role in providing sustainable water security in remote areas where the government provides partial coverage.

Conclusions

When we discuss South Asian history, culture and archaeology these structures draw the public attention because water is everybody's concern. Therefore, it is concluded as well as learnt from ancient knowledge that *water* is not a mere economic asset, to be milked without due regard. We shall be accountable for its conservation and leave it in a better shape than we met it. To learn from these practices we came to know - How to save water for future generations through conservation routes?. Such water conservation practices not only save water but also teaches the global community worldwide. Indeed, water should be regarded as a legacy bequeathed to us, which we will have to leave for posterity. To emulate the model of water conservation on a traditional pattern, large/big water sources or logged water sources shall be targeted and advantages of traditional knowledge of water conservation and structure shall be taken. 'Catchment area management' is the key to the success of ancient traditional water conservation structures. The traditional water conservation practices, though not the only source, may influence our attitude towards the new and modern way of life but it is also true that water conservation can meet our energy consumption and reduce the overall cost expenditure on water-related industrial operation of any sort. The old traditional practices shall be utilised by the industry as well wherever feasible for the water scarcity solutions and the development of new water conservation practices because traditional structures are capable to increases the level of the water table to act as a groundwater recharge measure and practice for effective water conservation. Such structures can co-exist with modern structures hence, it is concluded that 'conserve water' should be the mantra irrespective of its immediate water uses. We should change our general perception of the water and evoke a re-awakening spirit to examine the traditionalist approach practically. A holistic and trans-disciplinary approach, with the involvement of all stakeholders and a combination of the old and modern practices, will make the water woes solutions more cost-effective, particularly in the long run. Being site-specific, the conservation practices have a proneness to invite more discussions either on the practice front or on the technology front.

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