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Mission possible

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Overcoming challenges to bring clean water to rural India.

by Shashank Shah and Vijaya Sunder M

The United Nations Sustainable Development Goal (SDG) 6 emphasises the need for access to clean drinking water. Unfortunately, across the world, one in three people does not have access to safe drinking water; this is especially prominent in emerging economies.[1] Research shows that by 2025, 1.8 billion people would be living in countries or regions with absolute drinking water scarcity.[2]

For decades, both government bodies and non-government agencies in the development sector have been searching for and implementing solutions to resolve the water crisis particularly in rural areas. Such efforts often fail not due to lack of funding, but due to poor maintenance, contamination, or water source depletion in rural communities. Nearly two decades back, the World Bank Group had underscored this challenge: "The traditional approach of build-neglect-rebuild is unsustainable, inefficient, and largely responsible for the poor performance of an estimated US$500 billion worth of assets in water resources and irrigation infrastructure."[3]

In India, 91 million people lack access to basic water supply, and 600 million are under high or extreme water stress.[4] In this article, we will discuss the social innovation model conceptualised and delivered by the Sri Sathya Sai National Drinking Water Mission as a possible means to provide a self-sustainable solution to the country's drinking water crisis. With successful deployment of water purification systems in 108 villages across six states in India, the coping costs averted were about US$100 million, when calculated over a 15-year sustainability life cycle. To this effect, the success story describes how financial and operational dimensions of sustainability can lead to a self-sustaining system. We identify three key takeaways from this social innovation initiative that may have broad application for other countries confronting similar water crises.

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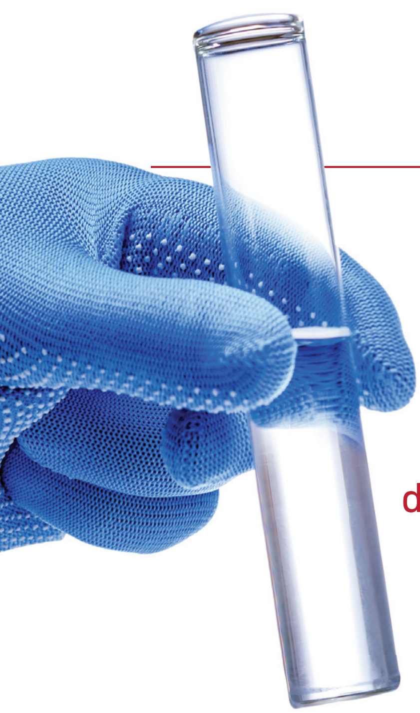
THE PROBLEM OF WATER

Every summer bears down heavily on India and most of its 1.3 billion citizens. As predictable as the rising temperatures are the water woes in much of the country. In rural areas especially, women often trudge many miles to fetch clean water for drinking and other domestic purposes. While walking to the water source during dark, cold mornings, they might step on snakes and scorpions, and some could even lose their lives to venomous bites.

For many, their fingers become twisted because of fluorosis, an abnormal condition caused by the excessive intake of fluoride from water. In fact, contamination of available groundwater with various chemicals, minerals, and other pollutants makes accessing clean drinking water in thousands of Indian villages daunting. It is estimated that more than 62 million people from 177 districts in 21 states across India consume excessive fluoride from their water supply. Other water contaminants include nitrates, arsenic, and other heavy metals.

Lack of access to quality drinking water also takes an economic toll. Time spent on fetching water or waiting for water to be released by government sources means less time spent on livelihoods and income-generating activities. Children may be pulled out of school so that they can help fetch water. The health and well-being of women and children are also at peril due to the long distances travelled to fetch water when there is poor access.[5]



There are four parameters of critical importance with respect to groundwater for drinking: availability and accessibility, quality, and affordability.

Reliance on groundwater

More than 60 percent of India's irrigated farms and 85 percent of drinking water supplies are dependent on groundwater.[6] Of the available groundwater, it is estimated that more than 90 percent is used for agriculture, and only the remainder is available for drinking and domestic use.

There are four parameters of critical importance with respect to groundwater for drinking: availability and accessibility, quality, and affordability.

Availability and accessibility

Severe depletion of aquifer levels, overdrawing of water due to irrigation and domestic needs, climate change, low rainfall, and drought in many areas of the country have reduced the volume of water available for drinking and domestic use.

Water quality

Even when there is availability of water and access is reasonably good, the quality of water may be highly compromised. Groundwater contamination could be due to the discharge of toxic effluents, salinity, pollutants like fertilisers and pesticides, and discharge of untreated sewage. The presence of arsenic, nitrates, and excess fluoride can also lead to highly toxic and unpotable water. In India, high concentrations of fluoride, nitrate, and arsenic in the water contribute to many health hazards, including fluorosis, weak bones and teeth, anaemia, and even death in several cases.[7] Consuming contaminated water can lead to short-term waterborne illnesses like cholera and gastroenteritis, and chronic and irreversible musculoskeletal disorders (seen in areas with fluoride levels of higher than 3 mg/L in water for example).[8]

Affordability

The urban-rural divide, where about 65 percent of India's population reside in rural areas, poses the affordability problem: only 10 percent of rural Indian residents have the financial means to buy water from commercial vendors, and the rest, who cannot afford to do so, consume unclean and unsafe water.[9]

One solution for procuring drinkable water is through the open market where purified water is sold in bottles and cans. The market is replete with many companies that sell bottled water. However, from a development perspective, it is known that buying water at market rates is a huge burden for much of India's population, especially in the rural areas.[10] Buying water is a recurring expense, and where water distress already leads to economic distress, buying water for daily consumption is an added burden. The average daily income of a farmer in India is about INR 70 (US$0.92) per day,[11] so a bottle of drinking water costing INR 20 (US$0.26) per litre is just not affordable.

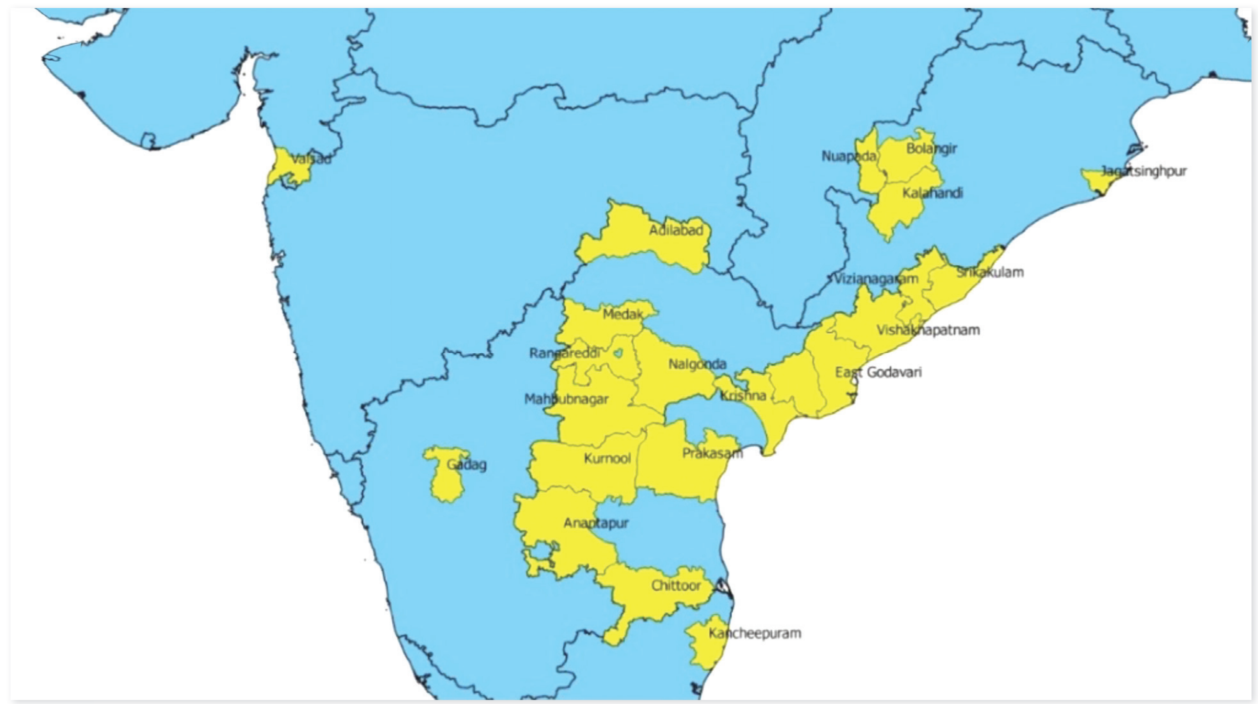
THE SRI SATHYA SAI NATIONAL DRINKING WATER MISSION

In view of the challenges that rural citizens face in obtaining clean and safe water, the Sri Sathya Sai National Drinking Water Mission attempted to provide an innovative and impactful solution that addressed all four parameters mentioned above. Between 2006 and 2020, the Mission installed 108 water purification systems in villages spanning six Indian states–Andhra Pradesh, Telangana, Odisha, Tamil Nadu, Karnataka, and Gujarat (refer to Figure 1).

Over a 15-year period, the Mission enabled an uninterrupted supply of pure drinking water to over 40,000 families (more than 200,000 direct beneficiaries) in areas of chronic water distress. Most of the installations were in the states of Andhra Pradesh (68) and Telangana (24), where fluoride contamination of drinking water is high, leading to severe health issues.

The design, planning, and implementation of the systems were carried out by the Technology Group of Sri Sathya Sai Seva Organisations, a public service ecosystem with a volunteer base of 600,000 people across 25 states and union territories of India, and which was supported by Sri Sathya Sai Central Trust, a public charitable trust headquartered in Andhra Pradesh.[12] Based on extensive research, the Technology Group concluded that a Reverse Osmosis (RO) system was more efficient in reducing water toxins to the desired levels. Retaining essential minerals during the

LOCATION OF WATER PURIFICATION PLANTS



6 States	22 Districts	108 Villages	Over 40,000 Households	Over 200,000 Users

FIGURE 1

Source: Technology Group of Sri Sathya Sai Seva Organisations process could be done by controlling feed pressures and flow rates, so the RO system was adopted in the 108 installations.

The RO water purification systems were designed to cater to the daily needs of nearly 2,000 residents. This involved purifying water at the rate of 1,000 litres per hour, resulting in 10,000 litres of pure drinking water per day (at five litres per person). It was assumed that electricity would be available for 10 hours per day to run the plant. The plant and equipment, including electrical and civil works, cost about INR 500,000 (US$6,617). Maintenance costs amounted to approximately INR 450 (US$5.95) per day, and included the operator's salary, electricity charges, and the replacement cost of cartridges, membranes and other equipment used in the system.[13]

The design of the water purification system was such that it ensured that the plant was self-sustainable. The original model proposed by the Technology Group involved giving each household in the village that opted to use water from the purification plant a membership card and a container. The membership card could be topped up each month for INR 60 (US$0.80). This amount would provide beneficiaries with 20 litres of water per day for a nominal cost of INR 2 (US$0.03). This was 1/200th of the price of the existing commercial drinking water available in the market. If 80 percent of the village signed up for the service, the system would generate enough resources to pay for the costs of running the plant, and the rest of the money could go into a welfare fund to serve the needy in the village when required.

POSITIVE IMPACT OF THE WATER MISSION

Studies by eminent multilateral agencies in the water sector are replete with data on coping costs–where citizens incur costs to cope with inadequate and unclean water. Coping costs can be direct, such as the money spent to buy water or install borewells and water tanks; or indirect, such as time spent to fetch water, and loss of wages due to ill health or caregiving.

Direct gains

Based on wage data for the region, cost of water, and healthcare expenses, if purified drinking water was not available through the water purification plant, the coping costs incurred by members of the 40,000 households in 108 villages would add up to the tune of INR 490 million (US$6.5 million) annually! For a one-time investment of INR 54 million (US$714,071) by Sri Sathya Sai Organisations, the villagers could avoid incurring losses of INR 490 million (US$6.48 million) annually. A whopping 77 percent of these coping costs were due to potential losses in women's wages on account of waterborne illnesses and workdays lost due to water-fetching duties. If they could be avoided, it would be a phenomenal boost for the socio-economic empowerment of women in these villages. The other savings included men's loss of wages due to waterborne illnesses, household healthcare costs, and the cost of buying water. To avail itself of all these benefits, each household paid just INR 720 (US$10) per year. Over the 15-year life cycle of the 108 water purification systems, the coping costs averted were INR 7.38 billion (US$100 million).

Indirect gains

The indirect gains experienced by the households in the 108 villages have been much more than monetary in nature. For example, the time gained due to fewer sick days for the entire household and the savings in caregiving days and workdays together add up to nearly 100 days each year for the household members to engage in other activities–be they economic, social, physical, or religious. Venkateshwarlu, Village Head of Bahadoorpet in Telangana, shared his experience, "The government paramedical staff that used to visit this village every week for treating patients now come once in three months. Such is the positive impact of the water from this plant on villagers' health."

In another example, after her village was covered by the Mission, Subbamma could tap the water facility for drinking and cooking. Within six months, her fingers and joints, which had become twisted because of fluorosis, became normal, and she was able to milk her cows without any problem and earn her livelihood. Women like her could spend more time on family, leisure, skills-building, learning and other productive activities. Even children benefitted as they could spend more time playing and learning. Keshav Patra, Village Head of Pradhangiri in Odisha, observed, "Since the plant installation, 400 school children benefitting from this purified water no longer suffer from ailments like frequent colds, stomach aches and headaches."

THREE KEY TAKEAWAYS

The system implemented by Sri Sathya Sai Organisations was a welcome social innovation. We highlight three key takeaways from this model that may be applicable to other infrastructural projects in other developing economies.

Beyond covering operations and maintenance costs, there was a surplus that could be used to fund local village welfare activities.

1. Treat community development as project outcome

Unlike commercial firms that sell water as a market commodity in villages, the project model presented here demonstrated the possibility of providing clean and safe drinking water at an affordable price, where the intent is to cover only the cost of operations and maintenance. Beyond providing safe, purified drinking water at a nominal cost, the project also puts in place a revenue model that benefits community development by design.

Another facet of community development that the project presents is the multiplier effect. With the successful deployment of water purification plants, the project sought further buy-in from village residents to bolster their confidence for the better welfare of villages. With community participation going hand in hand with community development, the project presents a non-linear bouquet of benefits. Beyond covering operations and maintenance costs, there was a surplus that could be used to fund local village welfare activities. The Technology Group reported that in some villages, the welfare fund had accumulated nearly a million rupees (US$13,224) over a decade. For example, the Borivelli village in the Kurnool District of Andhra Pradesh, where the water purification system was installed in 2009, accumulated a fund of INR 800,000 (US$10,579) by 2020, which was being used for the welfare of the most deprived sections of the village. At Chelluru, a village in the Nalgonda District of Telangana, the INR 400,000 (US$5,288)-fund accumulated through the water system-related savings was used for children's education, senior citizens' medical needs, and food supplies for the destitute. Bahadurpet, another village in Telangana, used welfare funds generated from the water purification project to construct a primary school and a healthcare clinic.

2. Incorporate community participation into decision-making

A critical success factor is ensuring that the local community is involved in the decision-making process for the water project implementation. The decentralised and community participation mechanisms at the villages enhanced transparency, created stakeholder ownership, and provided operational sustainability, i.e., sustained self-managed water resource systems. Furthermore, the model improved the implementation process as the village residents could provide more timely and candid feedback.

The project model is novel as it offers a management structure to ensure the continued functioning of plants in the long run. In each of the villages, the Technology Group helped to set up a village committee solely responsible for the operation, maintenance, and financial record-keeping of the water purification system. Srinivasulu Huggahalli, Head of the Technology Group, suggested, "The village committee should represent the diversity in terms of the gender and age of the village residents." As a result, a typical village committee comprised two men, two women and youth members, chosen by the villagers themselves. A bank account was opened with the village committee's name, and a person from the village was employed to take care of the plant's complete operations on a daily basis.

Once a plant was installed by the Technology Group and declared functional, the Group ceased to have a role in the system's operation and maintenance, so the village committee was fully empowered. The Technology Group also conducted periodic audits to ensure that the water purification systems were fully functional.

3. Make the system self-sustaining

A valuable insight shared by the Mission's founder, Sri Sathya Sai Baba, with the Technology Group, is that a broader solution is needed to avoid the build-neglect-rebuild trap of social projects. He said, “First, we should use the water purification project for broader rural welfare. For this, the net revenues that result from the pricing of INR 0.10 (US$0.001) per litre should be used for rural welfare. Second, village residents should be considered as key stakeholders with ownership, and not merely as beneficiaries, at every stage of the project. This would enable operational sustainability and long-lasting social impact.”

The novelty of the design encompasses both operational and financial sustainability dimensions, especially in response to the concern of ‘build and neglect’ by the World Bank. The self-sustaining and self-funding nature of the business model resulted in the smooth running of the water purification systems, as funds to pay the electricity bills, spare parts, and operator salaries were available from the user fee deposits. No external funding was required to keep the plants running. Villagers were also aware that the user fees were important to keep the plant operational.

Sustained management thus involved complete buy-in from the community, management by users and multiple stakeholders through a village committee, and a self-sustaining financial model. On June 24, 2020, the United Nations Economic and Social Council recognised the sustained management model and consequently granted special status to Sri Sathya Sai Central Trust for its exceptional humanitarian work.

CONCLUSION

The shortage of drinking water is an enduring challenge that will only become more acute as the world population explodes. Shrinking and polluted waterbodies, and the fast-depleting groundwater situation in most agri-based economies like India, coupled with a burgeoning rise in the global population by nearly 30 percent over the next 25 years, present a gloomy picture for the planet and its residents. This is because water is the very life force for human beings and the larger socio-economic ecosystem, as it is vital for good health and community well-being.

In this context, it can be said that the self-sustaining model of water purification systems set up by the Water Mission in 108 villages is replicable and could be scaled up in many more villages within India. The lessons gained through this impactful initiative over nearly one-and-a-half decade are insightful and could serve as a useful model for other water-stressed developing economies in Asia that are facing similar problems. Its social innovation model for community development and participation, as well as its self-sustaining system, can also serve as a resource for implementing infrastructural projects with positive societal outcomes in rural regions.

The key takeaways are applicable to managers and development sector practitioners working on sustainability initiatives, government and non-government organisations, and policymakers to install a self-sustaining social system that could not only serve its purpose of enabling a solution for the communities in the short run (a water purification system in this case), but also create a platform to promote long-term community participation. AMI

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