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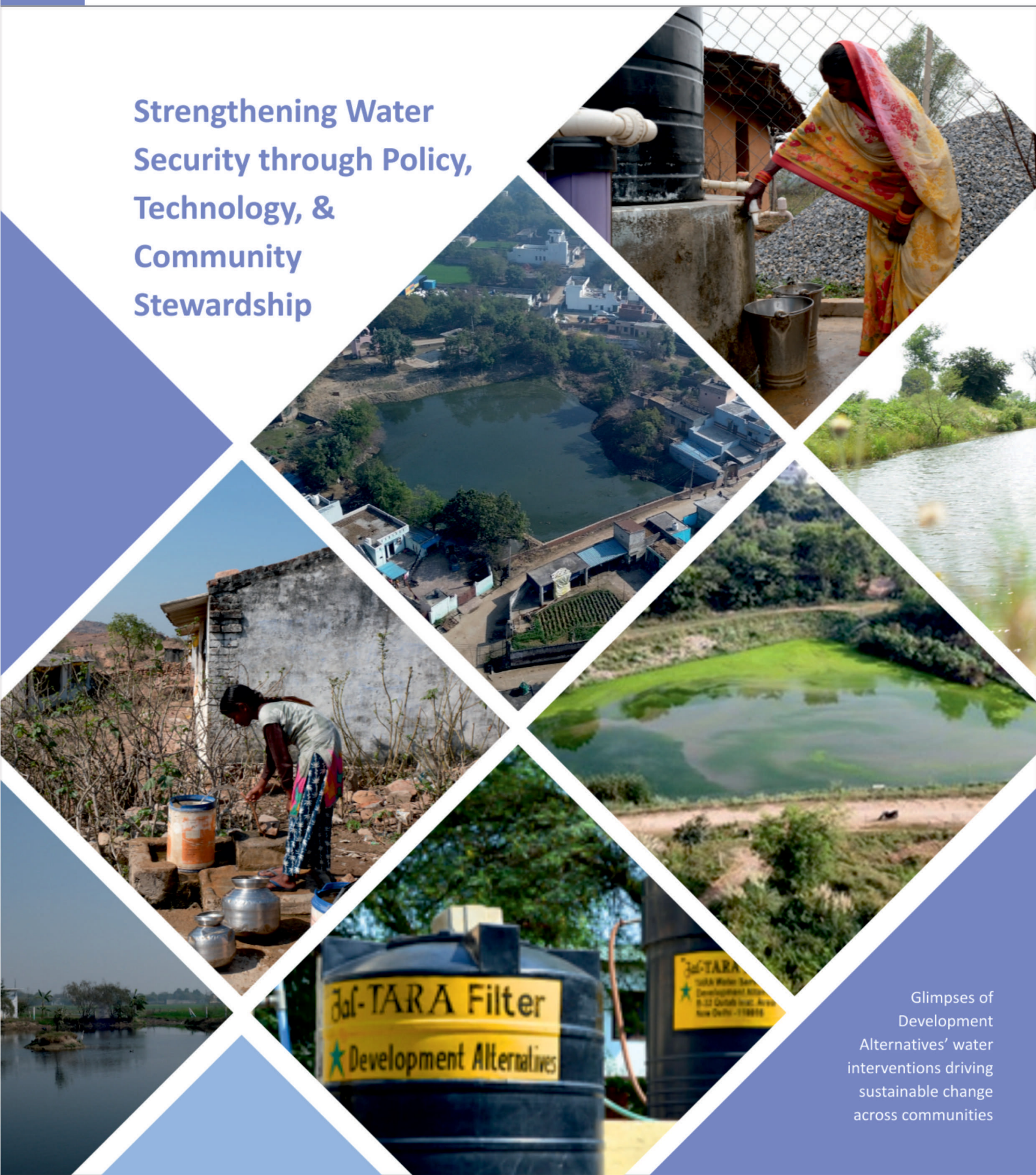
Strengthening Water Security through Policy, Technology, & Community Stewardship



Glimpses of Development Alternatives' water interventions driving sustainable change across communities

Content

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Water Governance: Recalibrating Institutions for Water Security

UP-led water infrastructure project to improve safe drinking water supply
Source: upjn.co.in

Water is central to India's development agenda – it supports agriculture, sustains urban areas, drives industry, and underpins public health and wellbeing. While national and state policies are well laid out, the institutional framework often remains complex and fragmented, leading to challenges at the ground level. This editorial explores the structure of water governance in India and highlights the urgent necessity for convergence across agencies, sectors, and governance levels to enhance coordination and implementation. To anchor this analysis in practice, we draw on insights from the *Uttar Pradesh Jal Nigam*—a state water agency that seeks to balance supply needs with sustainability goals, and from Development Alternatives, which focuses on on-the-ground interventions.

The Fragmented Landscape of Water Governance

India's water governance system is complex. Multiple ministries, departments, and parastatals share overlapping, sometimes conflicting mandates: irrigation and agriculture departments are responsible for managing canals and rural water supply; urban local bodies oversee piped drinking water and sewerage; state water resources departments supervise reservoirs and inter-state agreements. The Ministry of Jal Shakti sets overarching policy, but implementation and delivery are highly decentralised. This fragmentation leads to adverse impacts on planning, investment, and service delivery.

Water governance in India is marked by a paradox. On one hand, the country has built an impressive range of institutions—such as *Jal Nigams, Jal Boards*, Water Supply and Sewerage Boards, Metropolitan Utilities, and Public Health Engineering Departments (PHEDs)—to provide drinking water and sanitation to a vast and diverse population. On the other hand, this very multiplicity of institutions has led to fragmentation, dysfunctional and frictional overlaps, and weak coordination, ultimately undermining efficiency and long-term sustainability. As climate

stress, urbanisation, and groundwater depletion intensify, the need for institutional convergence and integration in state water governance cannot be underscored.

National policies such as the **National Water Policy, Jal Jeevan Mission, and Atal Bhujal Yojana** have set broad goals and funding frameworks, but translating them into action at the local level is hindered by state prerogatives, uneven institutional capacity, and conflicting priorities. At times, fragmentation can pose challenges for coordinated planning, efficient infrastructure use, and stronger integration across institutions. Irrigation expansion may undermine groundwater sustainability, while urban bodies may struggle to maintain services despite large financial allocations. Data systems remain fragmented, restricting evidence based decisions. As a result, consequences become visible: chronic urban water shortages, rural schemes that falter after initial capital investment, and the continued over extraction of groundwater. Governance fragmentation lies at the heart of India's water crisis.

Strengthening Water Security through Institutional Convergence:

Each state has organised its water supply and sewerage functions differently. States like Uttar Pradesh have a state-level *Jal Nigam* with statutory authority across urban and rural areas. Others rely on metro specific boards—Delhi Jal Board, Chennai Metro Water Board, Hyderabad Metro Water Board—and leave the non-metro areas to PHEDs or municipal bodies. Then there are others that operate through boards or authorities with limited jurisdiction.

A compelling solution to this issue is the **consolidated institutional model**, as seen by the Uttar Pradesh Jal Nigam. As a dedicated state-level entity, it provides a single nodal structure for planning, execution, and coordination. Adopting this model has the following advantages:

- **Coordination:** Reduces duplication, aligns urban and rural planning, and integrates sewerage and wastewater management.
- **Standardisation:** Enables consistent technical standards, procurement, asset management, and service benchmarks.
- **Sustainability:** Pools resources, cross-subsidises weaker regions, attracts skilled manpower, and engages with national programmes and partners.
- **Data integration:** Enhances a unified platform for transparency, monitoring, and accountability.

Critics warn of centralisation, but decentralised operations within a unified framework can balance local responsiveness with strategic oversight. The principle is clear: every state needs a strong, consolidated nodal institution with statutory authority, professional capacity, and a mandate for convergence across water supply, sewerage, and sustainability.

Development Alternatives (DA) complements this model by treating water as part of an integrated socio-ecological system. By combining rainwater harvesting, recharge structures, wastewater reuse, and pond rejuvenation, it reduces pressure on conventional sources while enhancing resilience. Projects such as citizen science and water quality monitoring in Udaipur, check-dams in Bundelkhand, and pond rejuvenation in NCR Delhi and Uttar Pradesh underscore three highly relevant lessons:

(i) source sustainability must be embedded in service delivery,
(ii) data and planning must cross institutional boundaries, and
(iii) decentralised stewardship must strengthen systems and communities.

In effect, Development Alternatives' work provides the missing operational layers between national policy frameworks and local institutions, with state- and district-level entities serving as bridges. It shows that convergence is not only desirable—it is achievable, scalable, and already underway in pockets.

Future Forward: Towards Water Positive Systems

As India enters a decisive decade for water security, the question is no longer whether *Jal Nigams* should act as system stewards. Instead, it is how quickly these *Jal Nigams* can acquire the capabilities to do so. The future

Jal Nigam interventions in safe drinking water management
Source: upjn.co.in

of India's water security will not be determined by how many kilometres of pipelines have been laid; it will be by how effectively institutions have worked together across silos. Institutional convergence is not merely administrative reform—it is a prerequisite for water security that **realigns authority, incentives, and accountability** around public needs, hydrological realities, and service outcomes, especially fair, equitable, and affordable water access for all.

Jal Nigams, combining centralised (strategic planning, standards, and coordination) and decentralised functions (zonal, district, and municipal units), can become the backbone of a resilient, equitable, and climate-ready water future, and must be empowered to act as **system stewards.** Convergence is a prerequisite for resilience, equity, and sustainability. Empowered *Jal Nigams* can become the backbone of a climate-ready water future. Moving forward, aligning infrastructure expansion with equally strong and resilient governance systems will be essential to ensuring long-term impact. ❐

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Safe Water, Shared Responsibility: Bridging Technology and Awareness

"Vande Mataram
Sujalam, suphalam,
Malayaja shitalam,
Shasya shyamalam,
Mataram."

In our national song, *Sujalam* means 'rich with water'. India has long been celebrated as a land abundant in water, monsoons, and fertile landscapes. Yet, despite this natural wealth, access to safe water remains a challenge.

Rapid urbanisation, dense informal settlements, and persistent neglect of rural landscape demand a shift in how we talk about water. We must move beyond mere access to water and focus on the stewardship of safe water resources.

The Invisible Threat in Clear Water

For millions living in urban slums, rural areas, and low-income communities, survival takes precedence over safety. When daily life revolves around earning enough to meet basic needs—food, rent, and education—broader concerns about quality of life often become secondary. Water that looks clean is often assumed to be safe. However, the reality is far more complex and far more dangerous.

Women carrying pots of water through a settlement

Most forms of water contamination are invisible. Heavy metals such as arsenic and lead, excess fluoride, bacterial contamination, and chemical pollutants cannot be detected by sight, taste, or smell. Yet their impact is lifelong.

Leaking and corroded water pipelines

The Hidden Cost of Unsafe Water

India's water challenge is not only about scarcity but also about safety. According to reports by organisations such as NITI Aayog [1], around 600 million Indians face high to extreme water stress, and nearly 200,000 deaths annually are linked to inadequate access to safe water. The World Health Organization (WHO) has consistently highlighted that contaminated drinking water contributes to diseases such as diarrhoea, cholera, dysentery, and typhoid, illnesses that disproportionately affect low-income communities.

Yet the connection between unsafe water and illness often remains overlooked. When a child falls sick repeatedly, it gradually becomes accepted as normal. Medical expenses are seen as an unavoidable part of life rather than as the hidden cost of unsafe water.

Awareness: The First Turning Point

Awareness is the key to shifting this reality. When communities understand that clear water can still be contaminated, that repeated illness has a root cause, and that medical expenses often exceed the cost of prevention, behaviour begins to shift.

Studies across India have shown that households in low-income communities may spend a significant portion of their earnings on treating water-borne diseases. In urban areas, too, every household has a water purifier and an air purifier! When these costs are openly discussed in community meetings, a powerful realisation emerges: **prevention is not an expense—it is an investment.**

Trust, however, is crucial. Communities must believe that the information is credible, that there are solutions, and that the benefits are long-term. Without trust, even the best technology fails.

Making the Invisible, Visible

This is where simple and affordable innovations can make a difference.

Tools such as JalTARA water testing kits and TARA filters allow communities to test their own water rather than relying solely on distant laboratories or external reports. These easy-to-use kits measure parameters such as

Awareness through wall painting in Khagaria, Bihar

contamination levels, turbidity, and the presence of harmful substances.

The power of such tools lies not just in data but in democratising knowledge. When a mother sees a test strip change colour in her own hands, the invisible becomes visible. Doubt turns into evidence, evidence builds trust, trust drives action.

Technology alone cannot solve the crisis. But affordable, easy-to-use, locally deployable, and supported by community training can bridge the gap between awareness and action.

From Beneficiaries to Custodians

Infrastructure without community ownership risks long-term sustainability. True success is achieved when communities demand safe water, monitor water quality, hold systems accountable, and maintain and protect their local water sources. This represents a shift—from viewing communities as passive beneficiaries to recognising them as **custodians of their own water resources.**

When residents understand the health risks, measure quality themselves, and participate in oversight, safe water becomes a shared responsibility rather than merely a government

service. For families living on daily wages, missing a day's work due to illness directly impacts survival. Children missing school affects long-term mobility. Healthcare costs, though small in individual instances, accumulate over the years.

The Path to Community Stewardship

Technology succeeds only when embedded in community engagement. The journey typically unfolds in stages:

1. **Awareness:** Understanding contamination and its consequences
2. **Demonstration:** Showing proof through simple testing
3. **Adoption:** Households begin using safer water practices
4. **Ownership:** Community members monitor and safeguard water quality
5. **Advocacy:** Communities demand systemic improvements

This is not just about safer water; it is about empowered citizens.

Safe Water as Shared Responsibility

Safe water is not merely an engineering challenge. It is equally a social, behavioural, and trust challenge.

In India's dense settlements and underserved communities, the real breakthrough lies at the intersection of awareness, trust, affordable technology, and community ownership

When awareness kicks in, and simple tools like *JalTARA* place knowledge directly into people's hands, the narrative changes. Water is no longer just something that flows from a tap or pump. It becomes something protected, monitored, and valued.

Moving the narrative from access to stewardship is not optional—it is essential. Because safe water is not only about survival. It is about health, dignity, and shared responsibility. ❐

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The Jal TARA water testing kit designed by Development Alternatives group helps people understand how safe the water is.

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India's Evolving Water Policies from Scarcity to Sufficiency and Sustainability

A rejuvenated pond in Bishnoli, Gautam Budhha Nagar

India's water situation is at a crucial turning point. With 16% of the world's population relying on only 4% of global freshwater resources, the country faces a stark imbalance between demand and supply [1]. The World Bank notes that rising challenges, including climate variability, groundwater depletion, industrial and household waste affecting rivers, and competing demands from agriculture, cities, and industry [2].

These issues have pushed water from being a sectoral concern to a major development and climate challenge. Over 600 million people globally experience high to extreme water stress, and nearly 70% of available water is contaminated [3]. Addressing these challenges is essential not only for the environment but also for national development, food security, public health, and climate resilience [4].

In response, India's water policies are evolving—shifting from merely managing scarcity by increasing supply to promoting sufficiency and sustainability through conservation, efficiency, ecosystem restoration, and community involvement. This transformation places water security at the core of well-being, ecological health, and resilient livelihoods. A key initiative in this transition is the ***Jal Jeevan Mission*****,** which aims to provide safe and adequate drinking water to every rural household. This mission emphasises both sustainability and accessibility. Village-level water security plans include rain water harvesting, aquifer recharge, and water quality monitoring, all supported by community institutions and women's leadership [5].

Case 1: Water Harvesting for Source Sustainability

In the drought-prone regions of Bundelkhand and central India, Development Alternatives has helped build large-scale water-harvesting systems, including over 300 check dams and other structures. These initiatives have increased water potential by over 24,000 million litres in the past decade, improved ground water recharge, stabilised drinking water sources, and boosted irrigation availability, directly supporting the *Jal Jeevan Mission's* sustainability goals.

Complementing this effort is the ***Jal Shakti Abhiyan*****,** which reframes water conservation as a collective responsibility. Initiatives like 'Catch the Rain' prioritise the rejuvenation of

traditional waterbodies, watershed development, and the reuse of treated wastewater, promoting convergence across sectors [6].

Case 2: Reviving Traditional Water Bodies

Development Alternatives has collaborated with village institutions to restore over 120 degraded tanks, johads, and village ponds. Their efforts included desilting, repairing embankments, and treating catchments. These efforts not only restore storage capacity but also revitalise local ecosystems, enhance groundwater recharge, and re-establish community stewardship over shared water resources, demonstrating how traditional systems can effectively support modern water security goals.

Groundwater, India's most vital and stressed resource, has become a focal point of policy due to the ***Atal Bhujal Yojana.*** This programme promotes participatory aquifer management, connecting local water use with hydrological realities [7].

Case 3: Community-Led Groundwater Stewardship

In water-stressed areas, Development Alternatives has empowered local institutions to monitor groundwater levels, plan seasonal water use, and encourage demand-side measures. By combining community data, capacity building, and livelihood planning, these efforts align with the *Atal Bhujal Yojana's* focus on local groundwater governance.

Agriculture, which accounts for 80% of freshwater withdrawals, remains essential to India's water future. ***The Pradhan Mantri Krishi Sinchayee Yojana*** promotes the idea of 'more crop per drop' through micro-irrigation and effective watershed management [8]. To address urban water security and ecosystem protection, the **AMRUT 2.0** [9] initiative focuses on wastewater management and reuse [10]. Various civil society organisations are implementing community-based water purification systems and decentralised, nature-based wastewater treatment solutions integrated with WASH (Water, Sanitation, and Hygiene) initiatives. These systems improve access to safe drinking water, reduce pollution, and enable local reuse—advancing the principles of a circular water economy at the community scale [11].

RJ Varsha, Radio Bundelkhand, in discussing water conservation with community members

Case 4: Community-Led Groundwater Stewardship

In water-stressed landscapes, Development Alternatives has strengthened local institutions' ability to monitor groundwater levels, plan seasonal water usage, and promote demand-side measures. By integrating community data, capacity building, and livelihood planning, these interventions complement *Atal Bhujal Yojana's* emphasis on decentralised groundwater governance.

Together, these evolving policies and practice-led innovations reflect a deeper transformation in India's water governance from managing shortages to ensuring sufficiency within ecological limits [12]. As climate risks intensify, India's experience provides a crucial global lesson: lasting water security emerges when policy frameworks are reinforced by community-led action, ecosystem restoration, and locally grounded solutions moving decisively from scarcity to sufficiency and sustainability.

India's water crisis is not a distant threat; it is an urgent reality. The *Jal Shakti Ministry's* vision of a water-secure nation by 2047 is laudable, but it will remain aspirational unless there is investment in decentralised water harvesting, the revival of traditional systems, promoting water-efficient agriculture, community empowerment, and recycling wastewater. The above schemes are not isolated programmes; they are foundational to a water-secure India and must be actively implemented. ❐

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One of our checkdams in village Budhpura, Jhansi

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Strengthening Urban Water Systems in Odisha through Climate-Smart Digital Governance

As cities grow, the challenges posed by rapid urbanisation, pollution, and climate change are reshaping how water is managed. In coastal Puri and the rapidly growing city of Bhubaneswar, these challenges are unfolding quietly beneath the streets, within the pipes that supply water to millions of residents. For a climate-vulnerable state like Odisha, ensuring a reliable urban water supply is no longer just a matter of convenience; it is essential to avoid future 'Day Zero' water crises. As Odisha advances towards its vision of a ***Viksit Odisha 2036 and 2047[1],*** strengthening water systems is emerging as a strategic safeguard against the risk of future 'Day Zero' crises.

For decades, urban India has experienced 'intermittent supply', with water availability limited to just a few hours each day, regardless of its quality. However, Odisha is changing this narrative through the **Drink from Tap[2] *(Sujal)* *Mission*[3]**, shifting towards a 24/7, performance-oriented, and digitally enabled reality. Launched in 2018, the *Sujal Mission* marks a significant shift in policy, moving from **'Asset Creation'** to **'Performance Optimisation'.** It is no longer sufficient to simply install pipes; the state is now focused on ensuring that these multi-billion-rupee investments provide reliable, safe, and continuous service.

The Ground Story: Where Data Meets the Doorstep

The *Sujal mission* features a focused pilot programme that covers approximately 485 households and integrates digital tools with community engagement. SCADA systems, along with smart and mechanical meters, provide real-time visibility of water flows and pressure, allowing for early detection of leaks and system stress. This generates reliable, household-level data on consumption and non-revenue water (NRW)—which refers to water lost through leaks or unauthorised use. Additionally, it builds trust through local, on-the-ground interfaces.

However, the technology is only half the story. Collecting data alone is not the end goal; the real value emerges when this data is transformed through advanced analytics,

The BMC Smart City Command and Control Centre

AI-driven insights, and predictive models which can support the preventive action and informed decision-making.

The Digital Engine: Predictive Governance

To enable this transition, **Development Alternatives (DA),** acting as the implementation partner, is advancing a Climate-Smart Informatics approach to support an integrated and well-governed urban water system. Moving beyond basic monitoring, the initiative combines AI-enabled data analytics with on-the-ground institutional processes. This synergy supports a shift from reactive maintenance to predictive and preventive system management, allowing for the anticipation of leaks, pressure losses, and asset failures before service disruption.

Ongoing discussions with WATCO (Water Corporation of Odisha) indicate that strengthened monitoring and operational discipline under the Sujal Mission have helped reduce NRW from levels exceeding more than 50% to nearly 20% in several service areas. This progress is significant. Both international and national benchmarks also reinforce the potential of this direction. For instance, Singapore has maintained NRW below 5% through integrated monitoring and disciplined

system management. In India, cities such as Navi Mumbai and Nagpur have demonstrated that centralised oversight combined with operational reform can reduce losses and improve 24×7 service delivery. These examples demonstrate that when digital systems are combined with operational discipline and institutional alignment, cities can improve efficiency and service delivery at scale.

From Analysis to Action: Building an Integrated Decision Platform

DA's engagement in Odisha also builds on a strong foundation of prior work in the state. In the past, DA conducted a detailed Water–Energy Nexus[4] studies for Bhubaneswar, generating critical insights into system inefficiencies and energy consumption. The current initiative marks a deliberate shift from analysis to action, moving beyond standalone studies to develop an integrated, decision-support and decision-making tool for government agencies. This will enable real-time optimisation of water systems and lead to stronger governance outcomes.

By using spatial analytics and advanced forecasting, the system predicts demand shifts and identifies infrastructure vulnerabilities in real time. In a climate-vulnerable state like Odisha, such foresight is a necessity. By specifically addressing the water–energy nexus, these digital operations align pumping schedules with actual demand. This precision not only reduces carbon emissions and operational costs but also significantly reduces NRW, effectively strengthening water security without placing additional stress on the state's natural resources.

The vision is to integrate the entire urban water cycle onto a single integrated dashboard. DA aims to make this vision a reality, allowing system operators and decision-makers to monitor the network end to end, act in real time, and address risks before they escalate into service failures.

By combining data-driven planning with institutional coordination and citizen engagement, Odisha is positioning itself to develop a scalable blueprint for the Global South. This initiative proves that achieving a water-secure future involves not just increasing the number of pipes but also smarter ones.

Key Work Done By DA

1. **Climate-Smart Informatics Approach:** DA is advancing a comprehensive approach that integrates digital tools with community engagement to manage urban water systems effectively.
2. **Pilot Programmes:** The initiative includes focused pilot programmes that leverage technology to monitor water flows and pressure in real-time, helping to detect leaks and system stress efficiently.
3. **Data-Driven Decision Making:** Transforming data collected from various systems into actionable insights through advanced analytics.
4. **Reduction of Non-Revenue Water:** Significant improvements in the water supply system, helping to reduce NRW levels from over 50% to nearly 20% in several service areas.
5. **Collaboration with Local Agencies:** Working with the Water Corporation of Odisha (WATCO), DA has strengthened monitoring efforts, aligning operational practices to achieve better service delivery and operational efficiency.
6. **Integrated Decision-Support Tools:** DA is moving towards creating integrated decision-support systems that provide real-time optimization of water systems. ❐

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Where the Ponds Once Whispered, Water Speaks Again

A rejuvenated pond in Duajana Prajapati in Gautam Budhha Nagar, UP

In many peri-urban stretches of India, ponds once played a central role in community life. People cherished these waterbodies, which collected the generous rains of the monsoon and replenished shallow aquifers. Farmers relied on them to support their livestock and irrigation, and these ponds quietly fostered small pockets of biodiversity. However, over time, these ponds began to disappear. Silt accumulated gradually, leading to the erosion of the edges, and as urban areas expanded, the clear water was replaced by grey water. What was once a living, breathing waterbody slowly turned into a dumping ground, reflecting neglect and piles of waste.

At Development Alternatives, we hold a fundamental belief: if waterbodies are carefully restored with community involvement, they can once again thrive as living ecosystems. Together with our partners, we have committed to this mission, actively working to revitalise these vital resources.

Over the past few years, Development Alternatives has focused on restoring 98 ponds in various districts, including Gautam Buddha Nagar in Uttar Pradesh, Solan in Himachal Pradesh, Jhajjar in Haryana, and the peri-urban belts of Navi Mumbai in Maharashtra. The geographical landscapes vary widely, from rapidly urbanising plains to hilly terrain. Each pond presented a different set of challenges. In some areas, construction altered drainage channels, leading to reduced natural inflows. In other locations, agricultural runoff and unmanaged wastewater compromised water quality, turning once vibrant ponds into shallow pits.

Before restoration, these 98 ponds combined had a capacity to store 57,670 m^3 of water. After planned interventions, their capacity increased to 118,628 m^3. This means an additional 60,958 m^3 of water can now be held in those ponds. Furthermore, more than 60,858 m^3 of silt were removed, allowing the ponds to breathe again.

But this story is not only about the numbers.

We began by gaining a deep understanding of each pond. We used satellite tools and scientific assessments to study water flow and catchment patterns. At the same time, we engaged with local residents, who shared their observations about how the pond behaved during different seasons, where the water entered, and when it dried up. Their insights were invaluable in shaping our solutions.

In many ponds, untreated grey water was entering daily. Instead of blocking it off indiscriminately, we introduced nature-based methods to clean it. We installed floating treatment islands that naturally absorb pollutants. Decentralised chamber systems were introduced to slow down and filter wastewater before it reached the pond.

Additionally, we created vegetation buffers around the edges to reduce runoff and improve biodiversity.

Most importantly, communities became integral to the journey. Pond-based groups were either revived or newly formed. Simple checklists and sustainability tools were developed in local languages so that Panchayats, block officials, and residents could easily understand what needed to be monitored. The aim was not just to revive a structure, but to foster collective responsibility around water and resources.

Gradually, change became visible. Water stayed longer after the monsoon. The surroundings became greener. In some areas, birds returned. People began to view the pond not as a dumping site, but as a shared asset.

For us at Development Alternatives, natural ecosystem restoration means respecting both science and local wisdom. Every pond is unique, and every solution should be tailored to its landscape and people.

When a pond fills again, it holds more than just water. It symbolises hope. It serves as a reminder to the community that restoration is possible. And it shows that when people and nature work together, resilience emerges effortlessly. ❐

Key Highlights

- **98 ponds restored** across Uttar Pradesh, Himachal Pradesh, Haryana, and Maharashtra.
- **Water storage capacity nearly doubled,** increasing from 57,670 m^3 to 118,628 m^3.
- **60,958 m^3 of additional water storage created** through scientific restoration.
- **60,858 m^3 of silt removed,** reviving pond depth and functionality.
- **Nature-based wastewater treatment solutions implemented,** including floating treatment islands and decentralised filtration systems.
- **Community-led monitoring systems established,** with tools developed in local languages for long-term sustainability.
- **Improved biodiversity and longer post-monsoon water retention,** transforming degraded ponds into thriving ecosystems.

Aerial view of a pond in Gubhana, Jhajjar, Haryana

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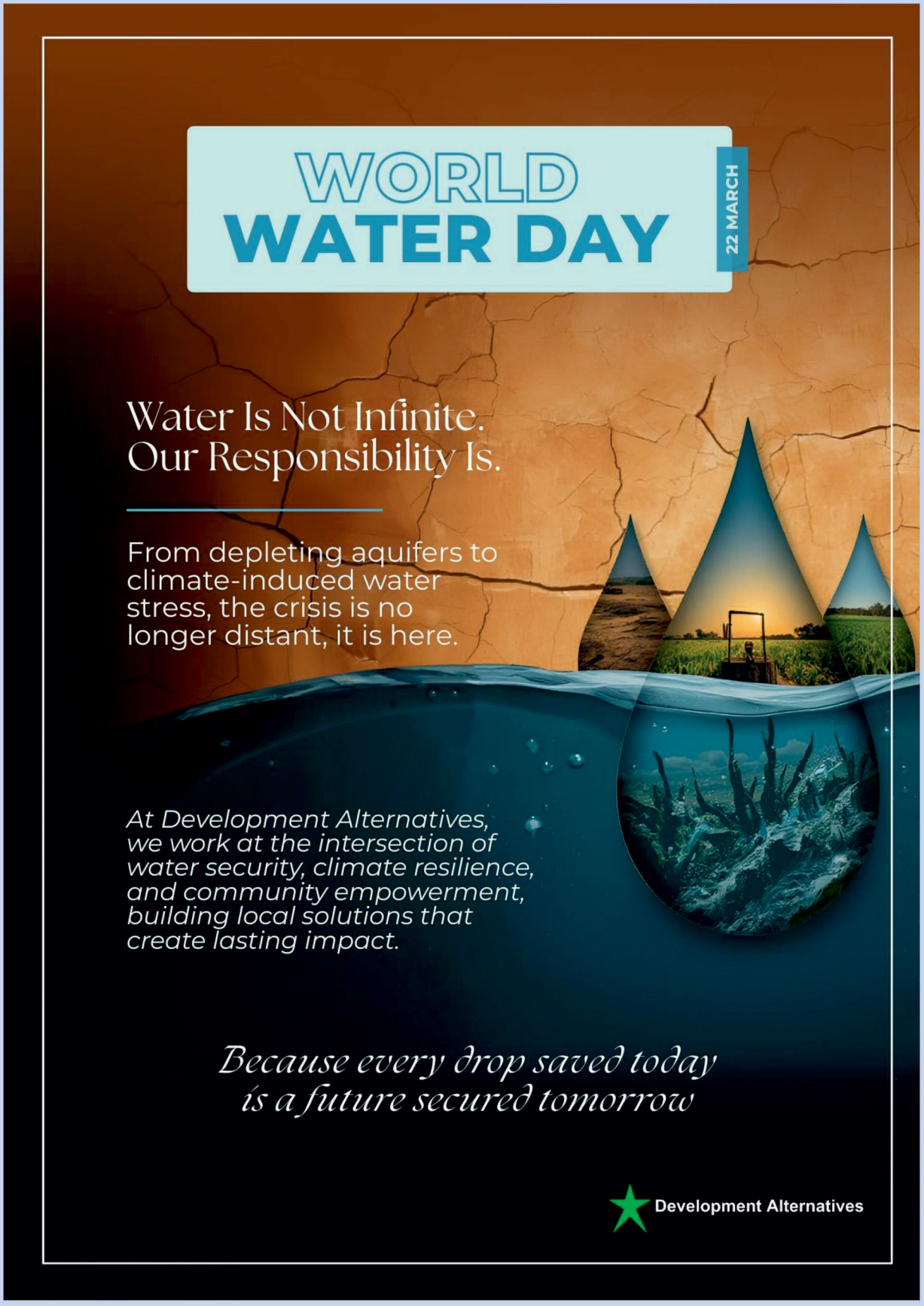

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