

Beyond Technology: Inclusive Innovation for Water Systems Transformation

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Abstract

Global water insecurity and the accelerating expansion of digital infrastructure represent two converging crises that governance frameworks have yet to address in an integrated manner. This policy brief argues that achieving SDG 6 in the digital era requires more than technological deployment - it requires Inclusive Innovation: an approach that embeds equity, transparency, and community accountability into the governance of water and digital systems alike. Drawing on evidence of AI infrastructure's growing water footprint and the systematic exclusion of marginalized communities from water technology design, the brief advances three governance-centered recommendations: establishing inclusive water data systems, strengthening water-sensitive AI governance, and strengthening community co-governance in water and digital infrastructure planning.

Introduction

The achievement of the Sustainable Development Goals is an inherently interconnected endeavor, with SDG 6 (Clean Water and Sanitation) serving as both a critical enabler and a litmus test for the entire 2030 Agenda. Yet the foundation it represents remains deeply unequal. Approximately 2.2 billion people still lack safely managed drinking water, 3.4 billion lack safely managed sanitation¹, and nearly half the global population faces acute water stress for at least one month each year². Progress must accelerate six-fold for water and five-fold for sanitation to meet 2030 targets.³ The climate crisis compounds these deficits further: floods have increased by 134% and droughts by 29% since 2000², disproportionately affecting the nearly 80% of the global poor concentrated in the most climate-vulnerable areas.⁴

We are at an inflection point. The digital transformation now reshaping water governance — through AI-driven analytics, IoT sensors, predictive forecasting, and real-time monitoring — carries genuine potential to accelerate SDG 6. Yet it also introduces a new and largely invisible risk: the very technologies designed to close water gaps may, if ungoverned, reproduce and entrench them. Meanwhile, governance frameworks have not kept pace.

There are no binding international standards for the water footprint of digital infrastructure, no mandatory equity assessments for AI-driven water systems, and no established mechanisms to ensure that communities most affected by water insecurity have meaningful voice in the digital systems being built in their name.

This is why the question of *how* STI is governed matters as much as *what* technologies are deployed. The sections that follow make the case for *Inclusive Innovation* as the governance response — and translate it into three concrete policy recommendations.

The Emerging Risk: Digital Expansion and Water Inequality

The rapid expansion of digital infrastructure is reshaping how water systems are monitored, managed, and governed. Artificial Intelligence, IoT sensors, predictive analytics, and satellite-based monitoring systems hold significant potential to accelerate progress toward SDG 6 by improving drought forecasting, leak detection, water allocation, and climate resilience. Yet this transformation also introduces a growing and largely invisible challenge: the digital systems designed to solve the water crisis are themselves becoming significant — and largely ungoverned — consumers of the very resource they are meant to protect.

This pressure is expanding rapidly. Data center water usage is expected to more than double by the end of the decade — from 560 billion liters to approximately 1,200 billion liters per year by 2030.⁵ Yet despite this massive and growing footprint, major technology firms routinely lack transparency regarding site-specific water consumption, making it nearly impossible for municipalities to execute effective hydrological planning.⁶ The communities that bear the local cost of this infrastructure — often in already water-stressed regions - have no standardized mechanism to demand disclosure, compensation, or consent.

At the same time, the benefits of AI-enabled water systems remain unevenly distributed. Predictive flood models, smart metering systems, and real-time monitoring technologies depend upon digital infrastructure, technical expertise, and institutional capacity that remain concentrated in higher-income settings. In sub-Saharan Africa, where over 411 million people lack access to safe drinking water⁷, many communities cannot yet access basic monitoring data, let alone AI-enabled governance tools. This creates a compounding gap: digital innovation improves water governance for already well-served populations, while vulnerable communities absorb both the resource pressures and governance gaps associated with rapid digital expansion.

These inequalities are not accidental. Technology systems reflect the assumptions, priorities, and data of those who design them. AI-driven leak detection systems trained primarily on formal urban infrastructure often perform poorly in informal settlements. Drought forecasting models calibrated to temperate environments may underestimate risks faced by smallholder farming systems across sub-Saharan Africa and South Asia. Smart metering platforms designed without consideration for low-literacy users can unintentionally create barriers to access for marginalized populations^{8 9}. Exclusion from system design ultimately produces exclusion in practice — and without deliberate governance intervention, these patterns will persist and deepen as digital infrastructure scales.

This is why governance matters as much as technological deployment. Inclusive Innovation, as advanced in this brief, refers to governance approaches that embed equity, participation, transparency, and accountability into the design and deployment of water technologies from the outset. It requires more than expanding digital infrastructure; it requires ensuring that communities most affected by water insecurity have meaningful voice in shaping how these systems are governed, deployed, and evaluated. The recommendations that follow operationalize this framework through inclusive data governance, water-sensitive AI accountability, and community-centred stewardship.

Policy Recommendations

Establish inclusive water data governance systems

Current national reporting systems rely heavily on aggregate statistics that obscure inequalities in water access and sanitation services, particularly in informal settlements, rural communities, and climate-vulnerable regions. The UN-Water GLAAS 2025 report reveals a stark data divide: while 71% of countries have established national water data systems, a mere 28% actively track equity-specific indicators.¹⁰ Without inclusive datasets disaggregated by gender, age, income, disability, and geographic location, policymakers cannot identify hidden

service gaps or design targeted interventions for marginalized populations.

Member States should strengthen national water information systems by integrating digital monitoring technologies, geospatial tools, and AI-enabled analytics with equity-based indicators. Open and interoperable data systems should be promoted to support evidence-based planning, improve transparency, and strengthen accountability across institutions. UN-Water and international financing institutions should provide dedicated technical and financial support to ensure that low- and middle-income countries can develop locally responsive and equity-centered water governance systems.

Strengthen Water-Sensitive AI Governance

AI is rapidly transforming water management, yet the governance frameworks needed to ensure its equitable and sustainable deployment remain largely absent. Governments and international regulatory bodies should require Algorithmic Impact Assessments (AIAs) for AI-driven water management systems and large-scale digital infrastructure projects. Such assessments must evaluate localized water consumption, environmental impacts, risks of discriminatory resource allocation, and potential socio-economic consequences for vulnerable communities. Technology companies should publicly disclose site-specific water footprints and adopt measurable efficiency targets aligned with SDG 6. International cooperation is further needed to establish common standards for sustainable digital infrastructure and responsible AI deployment. Ensuring that digital expansion strengthens — rather than undermines — equitable and climate-resilient water systems is not a constraint on innovation; it is a prerequisite for it.

Promote Community Co-Governance in Water and Digital Infrastructure Planning

Technologies and data systems, however well-designed, cannot achieve equitable outcomes without institutionalized local participation and legitimacy. Water infrastructure is not solely a technical issue, but also a question of public health, equity, and social resilience. Inclusive and resilient water systems require meaningful participation not only in implementation, but in the governance decisions that shape what gets built, where, and for whom. This is particularly important for women and marginalized communities, who are often disproportionately affected by water insecurity yet remain underrepresented in technical design, policy discussions, and infrastructure governance processes.

Governments and development partners should establish mandatory participatory impact assessments for water infrastructure projects above a defined scale threshold, ensuring that affected communities have a formal role in decisions related to water allocation, infrastructure

planning, and digital resource management. National and subnational authorities should create dedicated community water stewardship funds to finance locally-led initiatives and build long-term governance capacity. Public-private partnerships should prioritize collaborative approaches that support wastewater reuse, circular water systems, and community benefit-sharing mechanisms. Inclusive governance ultimately requires putting people and community resilience at the center of technological transformation. Strengthening participatory governance is essential for building public trust, improving long-term system resilience, and ensuring that innovation reaches those most vulnerable to water insecurity and climate change.

Conclusion

The 2030 deadline is approaching, and the water crisis will not wait. The question is no longer whether AI and data systems will reshape water governance — it is whether that reshaping will be equitable. The recommendations advanced in this brief offer a starting point — not to slow innovation, but to ensure that digital transformation supports equitable and climate-resilient progress toward SDG 6 and the broader 2030 Agenda.

¹ United Nations. (2025). *Goal 6: Ensure Access to Water and Sanitation for All*. United Nations Sustainable Development; United Nations. <https://www.un.org/sustainabledevelopment/water-and-sanitation/>

² United Nations. (n.d.). *Water – at the center of the climate crisis*. Climate Action. Retrieved from <https://www.un.org/en/climatechange/science/climate-issues/water>

³ UN-Water. (2023). *Blueprint for Acceleration: SDG 6 Synthesis Report on Water and Sanitation 2023*. United Nations.

⁴ United Nations Development Programme (UNDP) & Oxford Poverty and Human Development Initiative (OPHI). (2024). *2024 Global Multidimensional Poverty Index (MPI): Poverty and climate change: Uncovering the intersection*.

⁵ International Energy Agency. (2025). *Energy and AI*. IEA. <https://www.iea.org/reports/energy-and-ai>

⁶ Privette, A. P., Barros, A., & Cai, X. (2026). Data centers water footprint: The need for more transparency. *AGU Advances*, 7, e2025AV002140. <https://doi.org/10.1029/2025AV002140>

⁷ Nkatha, K. (2024). *Water woes: 13 undeniable facts about Africa's water scarcity*. Greenpeace Africa.

⁸ IPCC. (2022). *Climate Change 2022: Impacts, Adaptation and Vulnerability. Summary for Policymakers*. Cambridge University Press, doi:10.1017/9781009325844.001.

⁹ UNESCO. (2021). *Recommendation on the Ethics of Artificial Intelligence*. Paris: UNESCO

¹⁰ World Health Organization (WHO) and United Nations Children's Fund (UNICEF). (2026). *State of systems for drinking-water, sanitation and hygiene: Global update 2025 - Key findings (GLAAS)*. Geneva.