

OPINION

The water challenge: building water security together

Water Research Commission senior research manager, Dr Shafick Adams, unpacks the challenges currently faced by the South African water sector and offers some solutions towards achieving national water security.



In South Africa, the issue of water security has reached a critical juncture, exacerbated by climate change, population growth, rapid urbanisation, usage behaviours, and low infrastructure integrity, among others. The current strategy for addressing these water security challenges resembles a 'whack-a-mole' approach, where reactive problem-solving leads to the temporary resolution of one issue only for another to emerge.

This method is marked by fragmentation, resource inefficiency, and a focus on short-term fixes rather than sustainable, long-term solutions. Although the country has made some progress in tackling water insecurity for many, it is clear that we need alternative approaches, particularly adaptive systems approaches, to meet both current and future demands but also to tackle the root causes of many of our challenges. The water

challenges that we are experiencing. Does it point to a failure to adapt fast enough in an integrated manner?

Many of the challenges requires us to deal and investigate the direct and contributing factors using a systems approach. A systems approach goes beyond examining and responding to individual components or news cycle issues; it focuses on the interconnectedness of a system's elements and how their interactions shape overall outcomes. By embracing this perspective, we can better understand the complexities of our water systems and design interventions that are not only effective but also equitable.

The Water Research Commission's (WRC) thematic research areas provide a framework for ensuring sustainable access to water

across various sectors. It emphasises the importance of research, innovation, and collaboration – not only to secure water for today but also to protect it for future generations. However, a pressing question remains: ***Can South Africa rise to the challenge of building a water-secure future?*** The answer is yes, but we must recognise that our efforts have not kept pace with a changing climate and politico-techno-social-economic dynamics. We have been investing in increasing water supply, mainly using surface water resources, since the early 1970s—when we observed the shift from a wetter to drier period. Unfortunately, not for everyone, and many legacy issues remain.

Water availability is more than just the physical presence of water; it also encompasses water quality, operational reliability, storage capacity, distribution, competing demands, and human behaviour. At the operational level, infrastructure theft and vandalism further complicate service delivery. Poor water quality because of agricultural runoff, dysfunctional treatment plants, industrial discharges, and other pollutants continues to strain South Africa's water sources, posing health risks, increases treatment costs, and limiting safe usage.

While South Africa's water systems—such as aquifers, surface water systems, and desalination plants—provide crucial sources, increasing cross-sectoral demands are pushing these systems to their limits. This growing imbalance between demand and supply has left communities vulnerable to droughts, water outages, and even complete water shortages.

The challenges we face are compounded by ageing infrastructure, poor governance, and a lack of coordinated management. Infrastructure integrity is one of the major threats to water availability, with many systems operating well past their intended lifespans or just simply poorly maintained, leading to significant water and revenue losses. The global climate crisis adds further strain, with changing rainfall patterns, more frequent droughts and floods, and rising temperatures impacting both the quantity and quality of water.

Settlement patterns increase the vulnerability of people and infrastructure to disasters, such as flooding and landslides, related to intense rainfall events. A transformative systems approach is required. This must include innovative monitoring and modelling tools and adaptive management strategies that are essential for predicting and mitigating water-related risks.

Developing smart technologies for real-time water monitoring and early warning systems is not a luxury; it is an urgent necessity. However, the inter- and intra-institutional 'data politics' and will be hampering collection and sharing of data and information to achieve this. Knowing how a system behaves and our ability to predict allows for timely interventions. However, while technological innovation is critical, it must be complemented by appropriate governance provisions and societal behaviours. For instance, introducing in-home smart water devices that monitor consumption, detect leaks, and optimise water usage can empower households to conserve water, reduce costs, and contribute to sustainable resource management.

The transformation from incandescent lightbulbs to more energy efficient bulbs is a great example of interventions to reduce energy usage. The same shift is too slow in water. We have toilets that can flush with less than 2 litres but outscaling is not

achieved; a typical toilet uses 9-13 litres currently. Just think about the industrial activity (jobs) that can be locally created by this. Maybe the government, with its 80 630 facilities, should become the first large adopter?

The WRC's call to bridge the gap between research and practice, by co-creating solutions with stakeholders and fostering cooperation, provides a pathway for addressing the complex and multifaceted nature of water scarcity. Greater collaboration across sectors is essential; we must engage academia, industry, government, and civil society to develop solutions that are context-specific and scalable. Innovation must extend beyond technological fixes. South Africa's water challenges are intertwined with issues of equity and social justice. Access to water remains uneven, with rural and low-income communities are disproportionately affected by water shortages.

Integrating and protecting natural ecosystems within water management strategies—through blue and green infrastructure and nature-based solutions offers a sustainable path forward. Strategic Water Source Areas (SWSAs), which are regions that produce high volumes of water relative to their size, play a critical role in securing the nation's water supply. Although SWSAs comprise only 8% of South Africa's land, they provide water for half the population, drive two-thirds of the country's economic activities, support 70% of irrigated agriculture, and supply over 90% of urban consumers through rivers and dams. By safeguarding these land areas, we can enhance water quality and reduce sediment build up in our dams, and bolster resilience to climate change. Protecting these regions through pollution control, land management, and continuous water quality monitoring will bolster resilience and help secure cleaner water for the future—a responsibility that extends beyond the water or environmental sectors.

To re-emphasise, South Africa's water challenges are not only technical and climate change issues; it is fundamentally a governance issue. Effective governance is crucial for achieving water security. The lack of coordination between stakeholders and rigid institutional practices hinders the adoption of innovative solutions. Without a concerted effort to reform implementing institutions and practices, even the most advanced technologies and research breakthroughs will fall short. The reliance of many settlements on groundwater for their water supply is at significant risk, as only two municipalities in South Africa have in-house groundwater expertise—and no one has the appetite to change this.

Achieving water security requires more than short-term fixes (like the growth in water tanker services); it demands a long-term commitment to innovation, collaboration, and adaptive management. Water is a finite resource, and the stakes could not be higher. If we cannot act, the consequences will be dire (e.g. economic stagnation, social unrest, and environmental degradation). However, if we embrace this challenge together, we can build a water-secure future that supports both human and ecological well-being. The time to act is now and not only tackle the symptoms but also the root causes of our challenges. We need a united, cross-sector effort that bridges political, economic, technical, and social divides to build a resilient, water-secure South Africa. This, in turn, will strengthen other interconnected and dependent areas such as energy, health, and food systems.