

Achieving Water Security In Africa: The Role Of Innovation And Emerging Technologies



Access to both water and sanitation are part of human rights popularized by the United Nations. It goes without saying that clean water is essential to human and animal life, and paramount for proper nutrition, personal hygiene, and overall health. Thus, the lack of access to clean drinking water is of greatest concern within the continent, as evidence suggests communities are progressively lacking access to clean and reliable water sources.

Goal 7 of Agenda 2063 aims at achieving environmentally sustainable and climate-resilient economies and communities. This goal calls for water security in Africa, which is defined as "the reliable availability of an acceptable quantity and quality of water for health, livelihoods and production, coupled with an acceptable level of water-related risks". Acting on this goal, African Ministers of Science met on 27th July 2016 to adopt a roadmap aimed at achieving sustainable and universal access to safe water and sanitation in Africa.

Further, recognising the role of science, technology and innovation in achieving water security, the AU Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024) has 2 priority areas that speak to the management of Africa's water resources using technology and innovation. Modern technologies can be utilized to address access to clean safe drinking water for communities facing water insecurity. For instance, technologies such as solar-powered ground pumps and 3D-printed filters can

be incorporated as emerging water treatment innovations to meet the demands of water supply and help Africa leverage the already existing water treatment technology infrastructure and improve water treatment technology capacities.

At present, there are numerous and complex water challenges that need urgent attention. This is further complicated by climate change and runoff variabilities, increasing population, and limited infrastructure for the water supply of domestic and industrial water usage. Furthermore, there is increasing water contamination and pollution of existing water bodies such as rivers, groundwater, and lakes. Most particularly, receiving water bodies from industrial and urban areas are increasingly being contaminated by numerous pollutants such as dye, humic substances, phenolic compounds, petroleum, surfactants, pesticides, and pharmaceuticals among organic pollutants but also antimony, radium, fluorides, nitrates, heavy metals among which arsenic, iron, lead and arsenic all part of inorganic pollutants.

Unfortunately, these above-mentioned bodies are sources of water to numerous communities without water treatment facilities. Moreover, historical legacies of countless shared river basins are resulting in conflicts and disputes; thereby, shunning water sharing within African communities. Thus, there is a need to improve strategic policy and regulatory frameworks, as well as effective and robust water technology infrastructure enactment that can promote effective water supply management.

It is crucial for African governments and the private sector to address the limited water treatment and supply infrastructure. They are encouraged to eradicate water pollution and address the scarcity of clean water. Decision-makers are further encouraged to urgently recommend and harness new and effective water treatment technologies. These new water technologies can be incorporated into existing conventional water treatment methods.

Currently, the commonly used conventional water treatment technologies across the continent include chlorination (antibacterial deactivation), solar water disinfectants, filtration (membrane and sand filters), water distillation, coagulants or flocculants, and adsorbents among which there are activated alumina, silica gel, activated carbon, molecular sieve carbon, molecular sieve zeolites and polymeric adsorbents. These water treatment technologies and methods are used to treat pollutants, deactivate microorganisms, and remove turbidity from water. These conventional water treatment technologies are increasingly being confronted with identification challenges of contaminants, fast population growth, ever-increasing industrial activities, and diminishing freshwater sources.

Notably, conventional water treatment processes can remove numerous chemical and microbial contaminants from water bodies. However, the effectiveness of these conventional water treatment technologies has been challenged and seen to come short over the last two decades because of new challenges such as population's better

understanding of the effects of water pollution. Consequently, there has been an increased public demand for better quality water. Harsher enforcement of regulations has been expanded to enhance regulation of contaminants and decrease the maximum contaminant levels set for drinking water and wastewater discharge. However, there still persists instances where because of infrastructural challenges, these pollutants are barely removed from water bodies before consumption, causing health challenges to the consumers.

Some modern water treatment technologies include nanotechnology, which is an emergent technology proven to be suitable and effective in water treatment processes. For example, nanomaterials can be incorporated and merged with existing adsorbents and membrane filters to deactivate microorganisms, and even remove micro-pollutants from water at low concentrations. In addition, nanotechnology is being utilised in bio-microelectronic devices to enhance water treatment processes. Furthermore, an automated variable filtration (AVF) technology, a state-of-the-art technology used for wastewater treatment, utilises an upward flow of influent to clean the downward flow using filter media. The AVF process is equipped with actuated valves, sensors, and programmable logic controllers to automatically switch from serial mode to parallel mode during wet weather conditions or other pre-set operating conditions.

Additionally, microbial fuel cells are a technology through which electrochemical energy is extracted directly from organic matter present in the waste stream. This is accomplished by utilising electron transfer so to acquire the energy produced by microorganisms. The new urban sanitation technology intends to utilise wastewater treatment by reclaiming energy and minerals combined with electro-flocculation and anaerobic digestion technologies.

Natural treatment systems combine physical, chemical, and biological processes to concurrently and meticulously eradicate numerous contaminants from water. The natural treatment systems are progressively being exploited to encapsulate, retain, and treat stormwater; thereby converting sheer wastage into a valuable source of water. In addition, the urine separating process technology can be incorporated into domestic wastewater systems. This technology can confine up to 90% of nitrogen and 50% phosphorus. Interestingly, the development of urine separating toilets and technologies can be adapted to produce fertilizer products.

In conclusion, these examples of modern water treatment technologies, among others, can be utilised to address water contamination and shortages across the African continent. African countries are encouraged to adopt and adapt emerging water treatment technologies to supply clean water for her citizenry. Most importantly, clean and sustainable water supply is vital for Africa's food security, health, survival, societal well-being, and economic growth of the African continent. Thus, with modern water technologies, Africa will thirst no more.

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