



Water technology innovations in Nile Basin countries

Africa Water for Peace
Nile for Peace Initiative

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Introduction

Safe water and sanitation are vital to humans' life and their ability to thrive. Access to water and sanitation is a basic human right and water is essential to healthy ecosystems, agriculture and industry. The significance of access to water and sanitation is reflected in goal 6 of the United Nations Sustainable Development Goals, which is to "Ensure the availability and sustainable management of water and sanitation for all." However, Africa faces increasing water challenges regarding water supply and water quality due to the growing pressures from population growth, urbanization, the increasing industrial demand, climate change and water scarcity.

Moreover, the current water system in Africa is inefficient, wasteful and capital intensive. Given the above-mentioned pressures and the inefficient water system, water technology innovations must help address some of these water challenges. However, there is a limited amount of human and financial capital available to develop technological solutions to meet water challenges.

Globally, millions of dollars are invested in water technology research and development and most of these researches are not developed into products and technologies can be actually deployed. Of all water technology innovations, only 9% are successfully licensed. There are hundreds of water technology startups that work to develop new technologies; however, only a few of them succeed. Furthermore, the major water technology companies have in-house research departments and many of these researches do not make their way to the market and are not put into practice. If this is the current situation in developed and rich countries, so how is Africa?

The dynamics of water innovation in Africa are linked to a variety of trends and developments that have characterized the continent over the past decades. First, there is pressure on Africa to meet national and global commitments related to water (e.g. the Sustainable Development Goals), which drive governments and other actors in the water sector to introduce water innovations (e.g. new water service models to reach the millions of Africans who still have no access to safe drinking water). Second, the rapid spread of information and communication technologies in Africa plays a major role in the issue. Notably, the increasing use of mobile phones, the internet, computers and mobile networks has opened up opportunities for the implementation of smart water systems in Africa, which reflects the adoption of the innovation path for the water sector.

The third trend stems from the new perceptions of economic and demographic dynamics in Africa that have emerged over the past years through improvements in business environments in many countries, which had a positive impact on the business in Africa. This resulted in an increase of foreign direct investment and local entrepreneurship in the continent, encouraging innovations in the water sector. Large companies began to forge partnerships with actors in the African water sector (particularly water





Nile for peace Initiative

facilities), thus introducing several innovations in the field of water. There are also some water innovations by a growing number of small businesses, NGOs and consultancy firms in Africa.

The fourth trend relates to shifts in the international development arena, in particular the shrinking financial flows from donors, which posed many challenges for financing traditional water projects in Africa. As a result, Africa introduced emerging and cost-effective water technologies (e.g. on-site treatment systems and domestic water filters), in addition to innovative financing mechanisms (e.g. grants, revolving funds and pooled bond mechanisms)

Finally, the water sector in Africa faces major social and societal challenges that require innovative solutions. Events such as floods and water shortages in most cities in Africa as well as the rapid urbanization and population growth, which render traditional water methods ineffective, have increased the need for experimenting new water-management approaches.

But why does Maat focus on the Nile Basin countries?

The answer is simply because the Nile Basin countries are among the most African countries that are rich in water resources and suffer from high rates of the lack of access to water that can almost compete with arid countries. Therefore, highlighting the technological innovations in the field of water in the Nile Basin countries is the first step to realizing SDG 6 related to providing clean water. Some Nile Basin countries are rich in water resources, but they do not benefit from such resources in a way manner includes all citizens, as some suffer from drought and lack of access to water while others do not. On the other hand, there are countries in the Nile Basin that suffer from water scarcity and need to redouble their efforts to provide sufficient water for all and they are in need of those innovations that optimize water technology.

The concept of innovation

Innovation is often described as a complex and multifaceted phenomenon. In this study, Maat follows the simplest and broadest practical description of innovation, which is any attempt to use new or improved products, processes and methods for a certain purpose. Based on this definition of innovation, the term “water innovation” is used in this study to refer to any attempt to pilot new or improved products or processes to improve the development and management of water resources. This is in addition to any innovative solutions that may contribute to improving the performance of the water sector, such as water resource extraction, water treatment and distribution.

In this study, water innovators are individuals or for-profit entities such as small and medium enterprises (SMEs) and consulting or industrial firms (for example, ICT-focused companies and design





firms), in addition to non-profit organizations whose goal is to develop and deliver innovative solutions to the market to for any water problem to be identified.

First: models of water tech innovations in the Nile Basin countries

A. Wetland Rehabilitation Project (Egypt)

Funded by Coca-Cola and Replenish for Africa and in partnership with the Ministry of Housing and Urban Utilities and UN-Habitat, the “Supporting Innovation in Water and Sanitation in Egypt” Program aims to support innovative technologies that can provide rapid access to water and sanitation and cost-effective solutions for vulnerable communities.

This project aims to use innovative technologies that are in line with capacity building and the best industrial practices to provide affordable drinking water and sanitation services in rural and Upper Egypt by using Riverbank Filtration (RBF) technology as a clean, reliable and cost-effective water source to fill the gap in the current water network. This technology is cost-effective compared to conventional large-scale water treatment plants, can be built quickly and is an environmentally friendly process that relies on natural soil filtration to treat water, produce clean, potable water approved by the Egyptian Ministry of Health and Population, and install anaerobic reactors to improve Nile water revenues¹.

B. The use of a new irrigation system depending on sensors to track moisture levels in the soil (Egypt)

In 2017, Egypt embarked on a 20-year strategy to address water challenges, which, according to experts, is becoming increasingly urgent in the light of a growing population, drought association with climate change and Egypt’s concerns of losing much of its water share of the Nile. The project aims to reduce water use, increase crop productivity and reduce production costs as Egypt continues to face increasing pressures on water.

Thus, this technology was invented, which uses sensors to allow farmers to know exactly when the soil is dry and how much water it needs through a mobile application. The initial results of this project indicate success in saving large amounts of water and reducing production costs and the Egyptian government is still collecting data on the effects of such project².

¹ Wetland Rehabilitation Project, <https://bit.ly/334a45K>

² Egypt's farmers tap new technology to save water and boost crops, Thomson Reuters Foundation 2021, <https://tmsnrt.rs/3B2QV0t>





C. Solar Energy and Water Supply for Blue Nile State (Sudan)

The UNICEF WASH team worked to make the water supply in Blue Nile state more accessible by improving the efficiency of the water delivery system using solar energy technology. One of the innovations that the team decided to implement was the use of Hybrid Solar Hand pumps (SHP), which are cost-effective, sustainable and need less maintenance, as they do not require fuel or batteries. These solar hand pumps provide a sustainable water supply system for rural communities in Blue Nile State³.

D. Harvesting of rainwater to improve water quality (Ethiopia)

One way to improve water quality in Ethiopia is to implement rainwater-harvesting techniques. Rainwater harvesting initiatives have helped those facing drought in India, China and Mexico and they could be the solution to improving water quality in Ethiopia on a large scale. Rainwater harvesting helps in providing people with access to clean water from reliable source that can last even in the driest seasons.

Rain harvesting is a technique through which rainwater is collected and stored for future use. The process includes the collection and storage of rainwater with the help of artificially designed systems for storage, purification of water impurities and periodic water cleaning⁴.

E. WaterKit technology in Uganda

This technology aims to ensure that the community always has access to clean and safe water and that in the event of a failure in the water supply system, all responsible parties can be informed in real time to remedy the losses. This technology is simply a mobile application that records and monitors the daily performance, hygiene and reliability of local water resources such as water pumps and wells. In 2020, WaterKit identified 47 broken wells and water pumps, 60% of which were repaired as a direct result of the technology's monitoring and reporting system⁵.

F. Innovative drinking water supply networks in Kenya

The innovative project for supplying drinking water to small towns and rural areas, implemented between 2011 and 2017 in Kenya, helped improve the quality and sustainability of these services for about 567,000 people. The project included small water networks for a number of poor municipalities in Kenya and purification channels. Therefore, cases of water-borne diseases, such as diarrhea,

³ In Blue Nile State hybrid solar handpumps provide a sustainable water supply system, unicef, 2020, <https://uni.cf/3gtvjxo>

⁴ RAIN HARVESTING TO IMPROVE WATER QUALITY IN ETHIOPIA, borgen project, <https://bit.ly/3GuGeVF>

⁵ ITU Innovation Challenges: Ugandan tech solution helps deliver clean water for all, 2019, <https://bit.ly/3gpLFdI>





Nile for peace Initiative

dysentery and cholera, decreased by 50%, in addition to a decrease in maternal mortality by 47%, from 362 to 171 deaths per 100,000 live births. Furthermore, the proportion of population using clean water increased from 55% to 70%⁶.

G. Rwanda as an honorable example of national efforts

The Ministry of Infrastructure has announced an investment spending of \$440 million over the next three years to build water treatment plants that use advanced hydro technology and supply systems in urban and rural areas to accelerate the efforts made to ensure that all Rwandans have access to clean water by 2024.

The Ministry also stated the current techniques will be improved in a number of water treatment plants that are expected to increase the supply water to rural areas, including the one in the Ngoma River in Nyagatari and the other in Lake Muhazi, to provide water in the Gatsipo and Kayonza regions and reduce the water costs for citizens. The initial phase of this water strategy has already begun⁷.

Second: Challenges facing the utilization of water technologies in the Nile Basin countries

A. Lack of investment in the water sector and finance

In most Nile Basin countries, engineers' designs are not the main obstacle to water technology. There are many projects and innovations in the water sector that have not been implemented due to the lack of funding sources for these innovations. Designs are not the biggest challenge facing engineers and policy makers in Africa even in a changing climate. In fact, the most difficult task is securing revenue to maintain and adapt infrastructure to climate change once it is built, which requires policy action to support investment in incremental improvements and to get people to pay for water services, while sparing the most vulnerable groups the high costs of water through well-targeted subsidies. Environmental changes, such as floods or rains, require proactive technology to avoid the risks of these climatic fluctuations in the water sector.

In South Sudan, decades of civil war hindered the development of water infrastructure. Investments in the water sector are no longer pursued or financed even by private companies; therefore, more than half of the population do not have access to clean drinking water and few people have access to

⁶ In Kenya, a water project results in unexpected increase in property development, African Development Bank Group, <https://bit.ly/3LfdDlq>

⁷ RWANDA TO INVEST \$440 MILLION IN WATER SUPPLY PROJECTS, mininfra, 2020, <https://www.mininfra.gov.rw/updates/news-details/rwanda-to-invest-440-million-in-water-supply-projects>





adequate sanitation. As a result, most of the population are forced to use untreated water from rivers, wells and springs⁸.

B. Lack of national effort to increase water technology

Many citizens of the Nile Basin countries still suffer from crises in the water sector despite the availability of water resources. In fact, this challenge is similar to the previous challenges related to financing and investment in water technology in these countries. The absence of investment development plans supported by the state and the lack of funding sources for water technology are due to the lack of the state's national efforts. If countries have national plans through which they can supervise and follow up technological innovations in the water sector according to the needs of the country, this will encourage investors to focus on this sector and adopt technological innovations by providing the appropriate production environment. This leads us to the third challenge that will be tackled in detail regarding innovations being only supported by international organizations without the state. To demonstrate the importance of the state's efforts to support water technology, we find that a country like Eritrea sometimes face difficulty in accessing fresh and safe water, in addition to the climatic fluctuations therein, which lead to arid drought and floods. About 42% of Eritreans live without access to enhanced drinking water and they rely on untreated water that has not been separated from human waste, which can cause illness and mortality from diseases such as diarrhea and cholera.

However, the water technology in Eritrea is limited to building dams. Eritrea does not have the necessary ingredients to establish projects and reliable technological entities in order to improve water quality or even exploit the available water to meet the basic needs of water in the country. Development efforts to support water technological innovations are only made by private companies without any involvement of the state⁹.

C. Limiting water technology to certain areas within the country

This is another problem with regard to water technology, as even the countries that were able to translate their efforts in water technology into a real and tangible work, the technologies made are often limited to certain geographical spaces within the country. In the Democratic Republic of the Congo, there are a number of water technology projects that were established in order to improve the quality and quantity Water, the latest of which is the Ndjili plant, established in 2020. Ndjili produces 110,000 cubic meters per day of improved water, but this is limited to the capital, Kinshasa, and the rural population in the State of Congo is unable to benefit from such technology. As such, a wide range of international and national NGOs, Civil society, religious organizations, private sector companies, the

⁸ Development of the Urban Water and Sanitation Sector, giz, 2017, <https://bit.ly/3uulb3k>

⁹ Solving Water Security and Sustainability in Eritrea, 2021, <https://bit.ly/3gtqzLQ>





Nile for peace Initiative

United Nations and development agencies play the state's role by gradually providing these water technology services to the countryside¹⁰.

Many people living in Ethiopia do not have access to clean water outside the large cities, meaning that those living in rural areas get water from unclean rivers and lakes, which put them at risk of waterborne diseases such as cholera and typhoid.

D. The failure to ensure the sustainability of these innovative projects

This is attributed to the state's major and perhaps complete dependence on international organizations that finance water technology innovation projects. International organizations are entirely responsible for all water treatment programs and its supply to isolated areas without any involvement of the state.

This challenge is evident in some countries such as Sudan, South Sudan, Burundi and the Democratic Republic of the Congo, whose budgets are not sufficient to finance water treatment projects and improve the technologies used in such projects. Multinational companies and international organizations with large funding oversee water projects. Governments in these countries exert more efforts in water technology projects other than digging wells and building bridges in order to maintain their sustainability.

E. Technical issues

The technical issues are related to the plants that are established for the purpose of treating water with an updated technology. There are no technical solutions available to address any of the current projects if they are damaged. This is in addition to poor productivity of water technology in the Nile Basin countries. In Tanzania, there was a failure in the water system in remote Kasongo city that did not get repaired for several years and people were left without running water. Residents had to walk three miles to get water from the nearest stream, which can take up to two hours. This is the case in the rural towns of Tanzania.

Third: Future scenarios for implementing water technology innovations

After all this, the question remains: What is the future of water technology innovations? Will the coming years for the Nile Basin countries witness the end of these innovations and the exacerbation of the water scarcity crisis in the region, or will the situation remain the same, existing projects faced by certain challenges, but are slowly moving towards providing clean water to the Nile Basin countries and realizing SDG 6. Or will the coming years witness major developments that will enable these

¹⁰ Water Issues in the Democratic Republic of the Congo Challenges and Opportunities Technical Report, United Nations Environment Programme, https://postconflict.unep.ch/publications/UNEP_DRC_water.pdf





countries to improve water quality and ensure sustainable access to water resources for rural and poor areas?

Therefore, to study the future of water technology innovations in the Nile Basin region and predict this, Maat presents three scenarios:

The first scenario: These countries will continue to lag behind the developed countries in the field of water technology and rely on primitive infrastructure to exploit water resources, such as dams and bridges, without introducing modern technology in the field of water treatment.

The second scenario: Technological innovations in the water sector in Nile Basin countries will continue at the same pace with the continuation of the current proportions of the residents who do not have access to clean water and depend on the projects provided by international organizations and private companies that do not meet the requirements with regard to the infrastructure in the water sector.

The third scenario: There will be major advancements in the field of water technology innovation in coming years and the issue of water technology will be actually included within the national plans of the countries in order to benefit from developed water projects to improve water quality and the scope of its use to include rural, urban and poor areas.

Which of these scenarios is more likely to happen?

One cannot be certain about the issue of water technology in the future, because it is a multi-dimensional issue. In some period, the state may have access to sufficient funding sources, enables it to invest in and contribute to the water technology sector. A state may also be the center of attention for civil society organizations and major companies in the field of water treatment, prompting it to implement several water infrastructure projects and introduce new patterns of technology.

However, the exact opposite might happen in the event of a severe drought that may prevent citizens from benefiting from such projects because of the lack of water resources.

Although it is difficult to predict the future of water in the region, there are number of evidence suggesting that one of these scenarios is likely to happen in the future. This evidence include the investment movement made by the Rwandan government in 2020 in the water sector, in addition to the improvements in the current water treatment projects by introducing new innovations for treatment methods.

Moreover, the national water Ppan in Egypt, which was announced in 2019 to address the water shortage in the country at a cost of 50 billion dollars and will continue until 2037, confirms that the





Nile for peace Initiative

Egyptian government views investment in the water sector and its development as one of its most important priorities.

In Kenya, despite the several aforementioned limitations in water technology, the Kenyan government decided to mobilize commercial financing to help fill the financing gap for investments in water infrastructure. The government cooperated with the World Bank Group and international development partners in raising the level of financial and operational performance of water service providers.

All of these evidences indicate that despite the Nile Basin countries suffering from many challenges in implementing innovations in water technology, we cannot follow the pessimistic scenario and expect the current situation to remain as is. There is always hope that the governments of the Nile Basin countries will adopt development plans one after the other in order to pay attention to and implement research and innovation in the field of water in these countries. Thus, the third scenario is likely to happen. The Nile Basin Countries are expected to make successive achievements with regard to the provision and treatment of water through modern technologies.

Conclusion

Humans depends entirely on water, as it linked to all aspects of human development and it is the major force driving industrialization, health and gender equality. Access to clean water remains a major challenge in the Nile Basin countries, with dire consequences for health and hygiene, as each part of the continent faces its own challenges associated with the water crisis. Rural communities in Africa are the most affected by the lack of clean drinking water. People walk several miles a day in search of water that meet their daily needs and most of the water they find is polluted; therefore, these rural communities are often hotbeds of disease.

In this context, “Nile for Peace” Initiative provides a set of recommendations for the Nile Basin countries in order to benefit from innovations in water technology:

First: The need to devise environmentally friendly technologies in treating and saving water in order to ensure the sustainability of water projects. Environmentally friendly technologies do not affect the climate and are less expensive and more productive.

Second: The need to direct the private sector towards investment in the field of water by promoting water technology as one of the pillars of investment within countries just as we promote other sectors such as industry, transport and tourism.

Third: The need to improve operation and maintenance, in addition to providing training on water technologies and promote expertise for the operation and maintenance of water and





Nile for peace Initiative

wastewater treatment facilities, otherwise these facilities may not function effectively. Capacity building is necessary to improve the knowledge of workers in this sector.

Fourth: Access to energy is one of the most important motives for innovation in water technology. Solar energy may be a good alternative to fuel as a source of energy since the Nile Basin countries lack energy sources.

Fifth: The need to improve water governance and management. The low priority given to the water sector leads to poor water quality. Governments usually do not have the political will to stress the importance of water treatment because this causes them to “lose votes”. Therefore, local planning processes need to be reformed for the politicians to be more committed to improving the water supply. Establishing good governance with a better institutional mechanism and framework is the key to increasing the political will and commitment to water and wastewater treatment.

Nile For Peace Initiative

