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THE COMING WATER CHALLENGE IN THE MIDDLE EAST & AFRICA

Outline

Introduction

The Middle East and Africa region is home to nearly **20% of the global population**, yet it has access to only about **10% of the world's renewable freshwater resources** such that 16 out of the 25 most water-stressed countries in the world lie in the Middle East and North Africa region.[1]

Further, the **temperatures in these regions have been rising** at a rate of **0.2°C-0.5°C** [2] [3] every decade during 1971-2020, which **exceeds the global average of 0.18°C temperature increase per decade.**[4]

This change in climate is fundamentally **altering the hydrological cycle and further intensifying the scarce availability of water in the region** in at least **3 ways**:

01 Through altered precipitation patterns

02 By drying up rivers and other water bodies

03 By causing accelerated desertification

Changing precipitation patterns have led to droughts. For instance, West Africa's Sahel region has witnessed an average **25% decrease in rainfall** over the past 30 years, leading to prolonged droughts.[5] Similarly, projections indicate that parts of the Middle East could experience **up to a 20% reduction in precipitation** by the end of the century, further intensifying the pressure on water resources and increased droughts.[6]

Further, rivers and other major water bodies are experiencing **severe depletion**:

The Euphrates -Tigris River Basin endured its second-worst drought in recorded history for 3 continuous years until 2023.[7]

The Euphrates -Tigris River Basin

Similarly, **the Nile River in Africa** - an indispensable water source for numerous countries - is projected to witness a **70% decline** in flow by 2100 due to climate variability.[8]

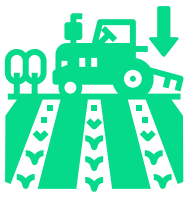
The Nile River in Africa

These reductions in water availability caused by droughts and water body depletions, pose multiple risks to agricultural productivity and food security. For instance, agricultural yields could drop by **50%** in the coming years owing to unavailability of traditional water resources.[9]

The reduced water availability compounded by the soaring temperatures is also causing **desertification** to advance at an alarming pace in the **Middle East and Africa region**. Currently, **90% of the Middle-East's land area is classified as arid, semi-arid and dry sub-humid zones**,[10] with similar conditions affecting **70% of Africa's landmass**.[11]

Introduction

Additionally, climate-induced water scarcity effects are expected to **diminish the region's GDP by 6 - 14%** by 2050,[12] primarily due to:



Reduced agricultural productivity

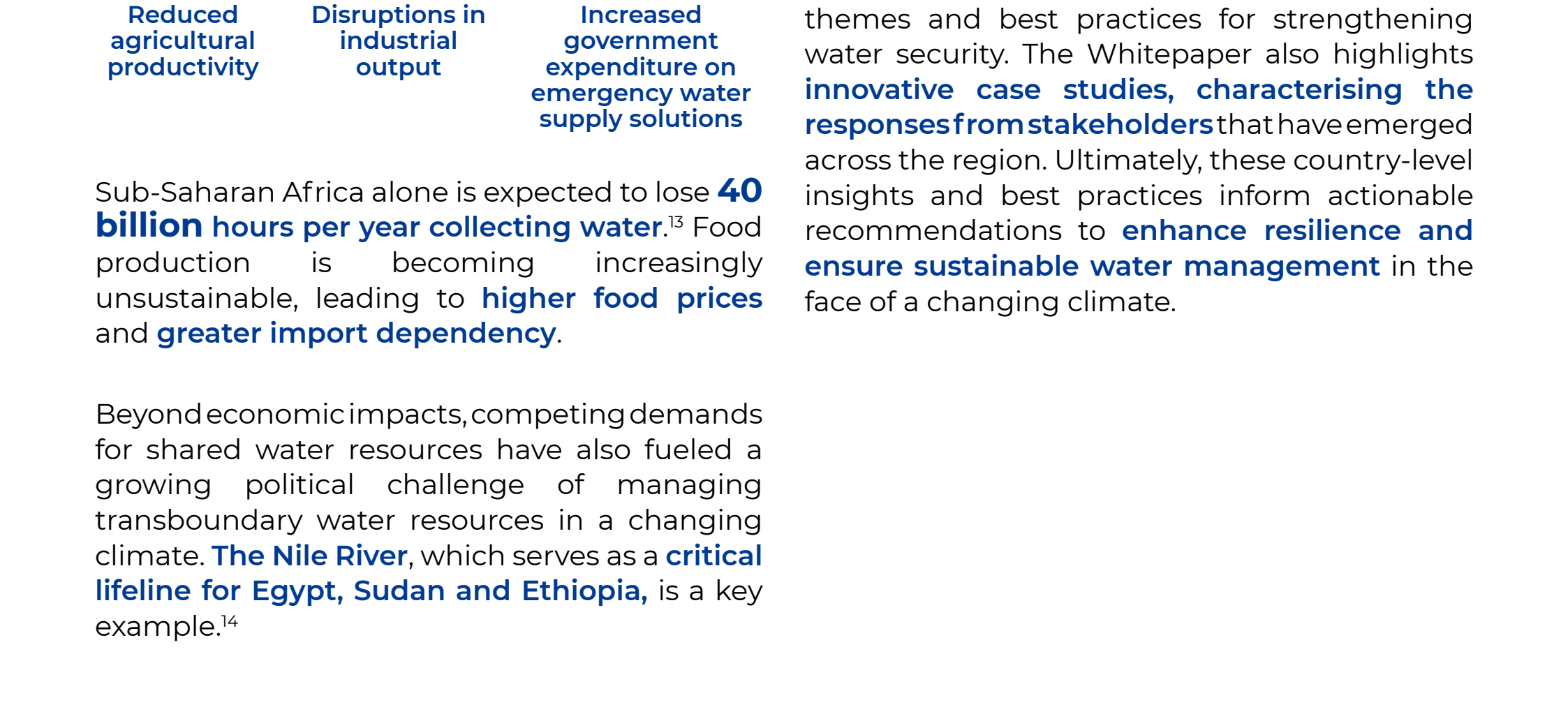
Disruptions in industrial output

Increased government expenditure on emergency water supply solutions

Sub-Saharan Africa alone is expected to lose **40 billion hours per year collecting water**.[13] Food production is becoming increasingly unsustainable, leading to **higher food prices** and **greater import dependency**.

Beyond economic impacts, competing demands for shared water resources have also fueled a growing political challenge of managing transboundary water resources in a changing climate. **The Nile River**, which serves as a **critical lifeline for Egypt, Sudan and Ethiopia,** is a key example.[14]

While the challenges posed by climate change are significant, it has also driven **diverse responses** across the Middle East and Africa to address its impact on water scarcity. This Whitepaper examines the country-level responses undertaken by governments, businesses, and communities, assessing them through a structured framework to identify key themes and best practices for strengthening water security. The Whitepaper also highlights **innovative case studies, characterising the responses from stakeholders** that have emerged across the region. Ultimately, these country-level insights and best practices inform actionable recommendations to **enhance resilience and ensure sustainable water management** in the face of a changing climate.



The Nile River

01 Assessing Responses of Middle East & Africa Countries

The Whitepaper employs a structured framework to assess country-level responses through **6 action areas**:[15]

All **66 countries** in the Middle East and Africa region were assessed by the Whitepaper on these **6 aspects** to then analyse their response to climate change induced water scarcity.

Countries' actions using **technology** refers to the adoption of technology for innovative solutions for drinking water, irrigation, and storage. Actions leveraging **resource efficiency** principles focuses on practices such as wastewater treatment, recycling, and water harvesting. Actions taken by countries for building **infrastructure** refers to investments in water systems. Countries' actions for **preparedness** pertains to early warning systems, disaster response mechanisms, and other water management practices that prepare for climate change induced water challenges. Actions taken through **policy** include government-led initiatives for combating climate change induced water security. Finally, countries' actions reacted to **awareness** refers to public campaigns, community engagement efforts, or education initiatives in the country.

Each country is marked as emerging, advancing, or leading in each of these 6 action areas.[15]

02 Country-level Assessment, Emerging Themes and Case Studies

The following comparative assessment and visual representation provide insights into how Middle Eastern and African countries have progressed in addressing water security challenges, identifying emerging, advancing, or leading in each action area.

Emerging | Advancing | Leading

	Adaptation		Mitigation	Adaptation & Mitigation		
Country	**Infrastracture**	**Preparedness**	**Resource Efficiency**	**Technology**	**Policy**	**Awareness**
	Increased water infrastructure investments	Early warning systems & preparedness	Advancing waste water treatment & use	Innovative technologies for drinking, irrigation & storage	Govt. driven incentives to organisations in the field of water	Promoting responsible water use and practices
Middle East						
Bahrain						
Iran						
Iraq						
Jordan						
Kuwait						
Lebanon						
Oman						
Palestine						
Qatar						
Saudi Arabia						
Syria						
United Arab Emirates						
Yemen						
North Africa						
Algeria						
Egypt						
Libya						
Mauritania						
Morocco						
Sudan						
Tunisia						

Figure 1: Action taken by countries in Middle East and Africa on vmitigating and adapting to climate change induced water scarcity.

02 Country-level Assessment, Emerging Themes and Case Studies

Emerging | Advancing | Leading

	Adaptation		Mitigation	Adaptation & Mitigation		
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	Increased water infrastructure investments	Early warning systems & preparedness	Advancing waste water treatment & use	Innovative technologies for drinking, irrigation & storage	Govt. driven incentives to organisations in the field of water	Promoting responsible water use and practices
Sub-Saharan Africa						
Angola						
Benin						
Botswana						
Burkina Faso						
Burundi						
Cameroon						
Cabo Verde (Cape Verde)						
Central African Republic						
Chad						
Congo (Brazzaville) Republic of the Congo						
Comoros						
Democratic Republic of Congo (DRC)						
Djibouti						
Equatorial Guinea						
Eritrea						
Eswatini (Swaziland)						
Ethiopia						
Gabon						
Gambia						
Ghana						
Guinea						
Guinea-Bissau						
Ivory Coast (Côte d'Ivoire)						

Figure 1: Action taken by countries in Middle East and Africa on vmitigating and adapting to climate change induced water scarcity.

02 Country-level Assessment, Emerging Themes and Case Studies

Emerging | Advancing | Leading

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Sub-Saharan Africa						
Kenya						
Lesotho						
Liberia						
Madagascar						
Malawi						
Mali						
Mozambique						
Namibia						
Niger						
Nigeria						
Rwanda						
São Tomé and Príncipe						
Senegal						
Seychelles						
Sierra Leone						
Somalia						
South Africa						
South Sudan						
Tanzania						
Togo						
Ugunda						
Zambia						
Zimbabwe						

Source: Sustain Labs Paris, 2024

As seen in the comparison above of actions taken by countries in the region, it is clear that **economic resilience is both affected by and affects water security** - on one hand high income countries have greater budgets for initiatives that combat climate change induced water scarcity and on the other hand countries that prioritise water security tend to experience greater economic resilience. The UAE, for example, has made significant investments in water infrastructure and desalination, which not only ensures a stable water supply but also supports broader economic diversification efforts, reducing dependency on oil and enhancing overall national resilience.

Further, **there is variation observed in the leadership of countries across categories of actions taken for combating climate change induced water scarcity**.

- Countries such the **UAE**[16] lead the region on technology driven solutions for water security, through significant advancements in **desalination technology** and **modern irrigation systems**.
- On the other hand, the **UAE and Saudi Arabia** have made significant strides in leveraging **resource efficiency** for water security by investing heavily in **recycling infrastructure** and **developing comprehensive wastewater treatment facilities**.
- **Saudi Arabia**[17] stands out for their **robust infrastructure projects** aimed at **enhancing water distribution networks** and **ensuring long-term water supply**.
- Countries such as **Tanzania** and **Zambia** have demonstrated **strong preparedness** by building comprehensive **early warning systems** that are responsive to climate-induced water risks.[18]
- **Seychelles**[19] are exemplary in establishing **proactive policies** that not only support water conservation but also **encourage innovation** and **sustainable practices in water management.**
- **Seychelles**[20] and **Eswatini**[21] have successfully engaged their populations through **extensive awareness campaigns,** fostering a culture of water conservation that complements technical and policy.

Distinctive sub-regional trends in addressing water scarcity are also observed across the Middle East and Africa region, reflecting the diverse environmental, economic, and technological contexts.

In the **Middle East**, countries majorly focus on **technological solutions**, particularly **desalination** and **advanced irrigation systems**. Countries such as the UAE and Saudi Arabia are leading in deploying large-scale desalination plants powered by renewable energy, alongside smart water management systems. In contrast, **North Africa balances traditional practices with modern technology**. For instance, Morocco's use of fog harvesting and wastewater recycling exemplifies how the region leverages historical water management practices while integrating them with newer technologies. The region also emphasises transboundary water cooperation, particularly within the Nile Basin, to manage shared water resources effectively. Whereas, in **Sub-Saharan Africa**, **community-based and decentralised solutions** are proven to be effective due to its vast rural areas and infrastructural needs. Initiatives like rainwater harvesting, groundwater management, and the use of low-cost technologies like solar-powered water purifiers are common. Moreover, there is also a strong emphasis on international collaboration and development aid to build infrastructure and improve water security.

Across Middle East & Africa, adaptation practices are observed to be the primary focus, with significant investments in desalination, improved irrigation, and community-based water management particularly in the Middle East. Countries such as Saudi Arabia lead in desalination technology, while Kenya and Ethiopia prioritise community involvement and early warning systems to manage water-related disasters. In contrast, mitigation practices, such as integrating renewable energy into water infrastructure, are less common, though countries such as Morocco are making progress by using solar energy for water pumping and treatment. Waste management through wastewater recycling is a key mitigation strategy in countries like Saudi Arabia and Kuwait.

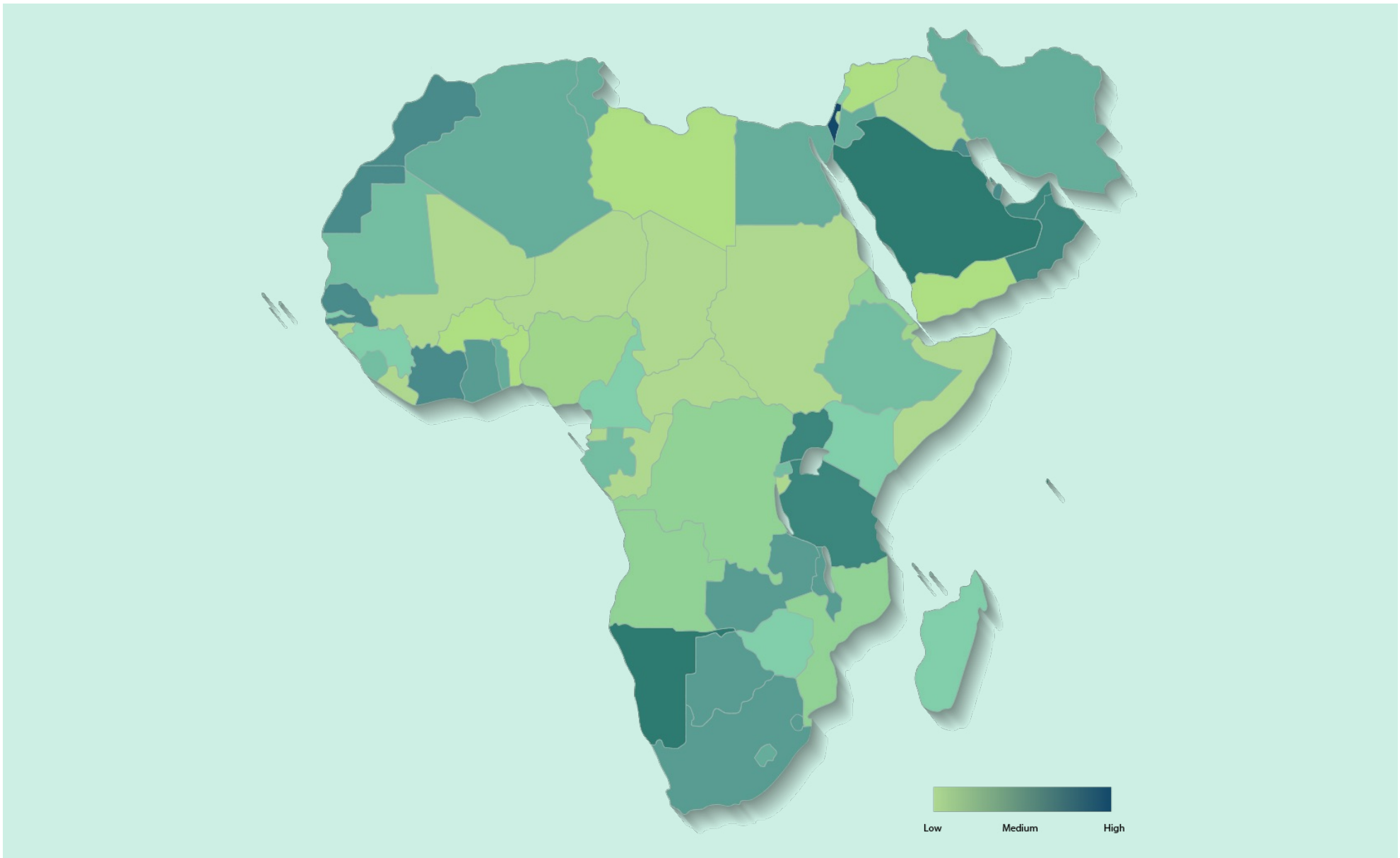


Figure 2: Water Scarcity Intervention Index in the Middle East and Africa[22]

Source: Sustain Labs Paris, 2024

The Water Scarcity Intervention Index heat map reveals significant regional disparities across the Middle East and Africa, with **North African countries and wealthier Middle Eastern countries** such as the **UAE** displaying stronger capacities in **combating water scarcity**. In contrast, many **Sub-Saharan African countries** face challenges such as **weaker infrastructure** and **less access to advanced technologies**. **Coastal and wealthier countries** tend to perform better, underscoring the benefits of investment in **technologies** like **desalination** and **water recycling**. However, regions with lower scores, particularly in central Africa, remain vulnerable to water scarcity, indicating a need for **targeted interventions** to enhance resilience.

Overall, the heat map underscores the diverse capabilities and needs across the Middle East and Africa region in addressing water scarcity amidst climate change.

Innovative Responses to Water Scarcity: Case Studies From the Middle East and Africa

As part of the **analysis**, a number of case studies are also identified showcasing how public and private organisations in the Middle East and Africa are innovatively addressing the impact of climate change on water scarcity. These organisations are implementing a range of **strategies**, from **cutting-edge technological solutions** to **community-driven initiatives**, each tailored to the region's **unique environmental and socio-economic contexts**. Through these cases, **key trends** emerge, highlighting the **diverse and adaptable approaches** being used to enhance **water security** and **resilience** in a rapidly changing climate.

01 Integration of Technology and Tradition:

Harnessing Fog: Dar Si Hmad's Pioneering Solution to Water Scarcity[23]

Institution: Dar Si Hmad

Type: Not-for-profit

Region: Morocco (North Africa)

Drawing inspiration from ancient water harvesting practices, Dar Si Hmad has established the world's largest functional fog collection project to address ongoing water scarcity in areas where fog is plentiful. As fog is carried by the wind, water droplets accumulate on nets and drip into containers below. Additionally, Dar Si Hmad has founded a Fog Research Center on Mount Boutmezguida to scientifically monitor fog and the nets. This innovative solution provides a replicable model for other regions facing similar challenges. Moreover, the system requires minimal land use, making it feasible for urban and rural settings alike. Governments and local organisations can explore this model to supplement water supply in areas experiencing chronic droughts.

Manhat's Solar Distillation: Revolutionising Coastal Water Solutions[24]

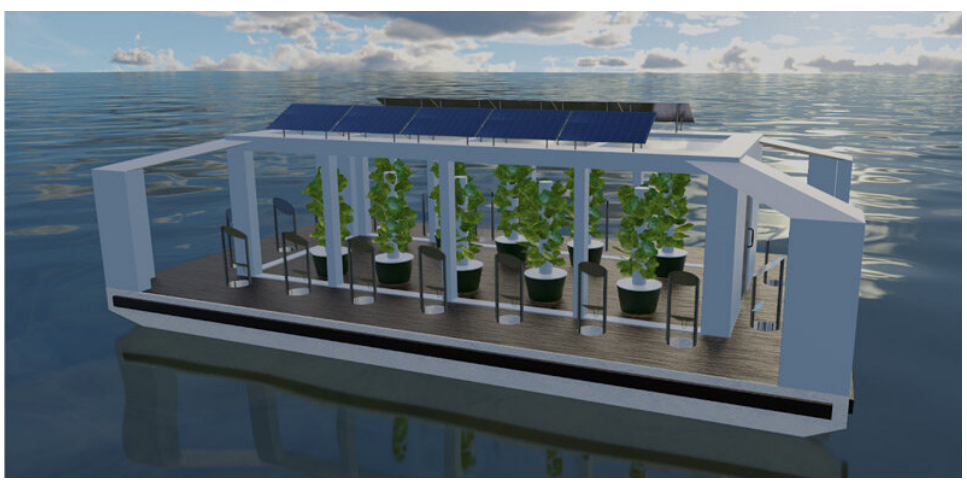
Institution: Manhat

Type: Deeptech Startup

Region: UAE (Middle East)

UAE-based deep tech startup, Manhat, uses a greenhouse-like structure on the seashore, employing solar energy to evaporate seawater, which is then condensed and collected as distilled water. Deployed around Abu Dhabi, the technology mimics the natural water cycle with a zero-carbon footprint, providing an eco-friendly irrigation solution and reducing reliance on environmentally harmful grid water sources. Manhat's innovation offers a sustainable approach to water production, helping mitigate climate change impacts and reducing environmental harm from traditional water sources.

This scalable, off-grid solution is particularly applicable for coastal regions in Africa and the Middle East, where desalination remains expensive and energy-intensive. With lower operational costs, governments can explore pilot projects to provide affordable, sustainable drinking water for remote and underserved coastal populations.



02 Innovative Financing as a Catalyst:

Tanzania's $15B Water Investment Drive: Closing The Gap With Green Bonds and Sustainable Growth.[25]

Institution: Government of Tanzania

Type: Government

Region: Tanzania (Sub-Saharan Africa)

In 2023, Tanzania launched the $15.02 billion Tanzania Water Investment Programme to enhance water access, economic development, climate resilience, and institution building. In 2024, the Tanga Urban Water Supply and Sanitation Authority further issued green bonds, raising $20.3 million by May 2024. By leveraging innovative local finance instruments, the government aims to enhance water infrastructure and address scarcity.

This approach demonstrates how governments can leverage innovative financing to scale water security investments, particularly in developing nations. Green bonds lower borrowing costs while attracting private sector participation, making such programmes replicable across other African nations facing water shortages.

DBSA: Driving Climate-Resilient Infrastructure and Water Reuse in Africa.[26]

Institution: Development Bank of Southern Africa (DBSA)

Type: Banking & Financial Company

Region: Sub-Saharan Africa

The Development Bank of Southern Africa (DBSA) is mobilising private investments for low-carbon, climate-resilient infrastructure across Eswatini, Lesotho, Namibia, and South Africa through its Climate Finance Facility. DBSA is also coordinating a National Water Reuse Programme in South Africa, partnering with government departments and experts to enhance water security and climate resilience. This initiative supports municipalities in implementing water reuse and reclaiming resources from wastewater.

This initiative highlights how public-private partnerships can fund large-scale water projects, helping governments bridge financing gaps in infrastructure development. Countries with water scarcity issues can adapt similar models to attract long-term investment in sustainable water solutions.

03 Private Sector Engagement in Water Security:

Almar Water Solutions: Driving Water Solutions For a Sustainable Future.[27]

Institution: Almar Water Solutions

Type: Private Sector

Region: Bahrain (Middle East)

Almar Water Solutions manages significant projects like the Muharraq wastewater treatment plant in Bahrain, which turns used water into high-grade reclaimed water, and the Shuqaiq 3 Desalination Plant in Saudi Arabia, which produces potable water from seawater. These initiatives meet immediate needs and bolster long-term regional resilience against climate change. This demonstrates how private sector initiatives can effectively address water scarcity and enhance climate resilience, supporting sustainable development goals in the Middle East.

Kuwait's Water Innovation: Sulaibiya Plant Sets the Standard for Reuse.[28]

Institution: Veolia Water Technologies

Type: Private Sector

Region: Kuwait (Middle East)

Kuwait is diversifying its water sources beyond desalination. To meet its wastewater treatment, recycling, and reuse objectives as part of the country's long-term water security strategy, a consortium including Veolia established the Sulaibiya wastewater treatment and reclamation plant in 2001, initially processing 100 million gallons per day (MGD). The facility has since expanded to 160 MGD, using advanced ultra filtration and reverse osmosis membranes for one of the largest membrane-based water reuse projects globally. The plant's reclaimed water now supports all dairy and vegetable farming in Kuwait. This initiative not only reduces freshwater demand but also enhances Kuwait's long-term food and water security strategy, offering a replicable model for other water-scarce nations.

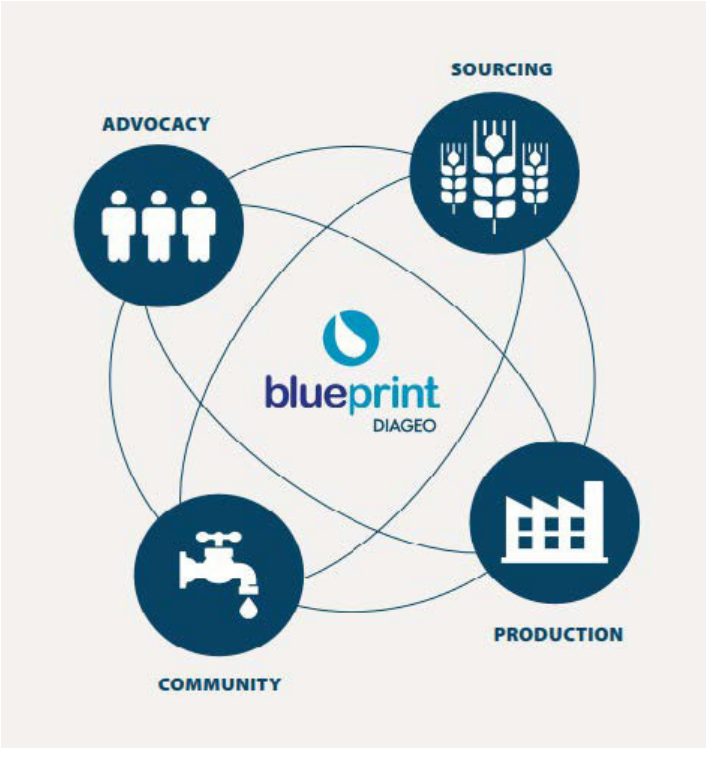
Diageo's Water Blueprint: Leading Sustainable Water Use.[29]

Institution: Diageo

Type: F&B (Private Sector)

Region: Sub-Saharan Africa

Beverage company Diageo has launched a 'water blueprint' to minimise water use and tackle global water challenges throughout its value chain. Since 2019, Diageo has replenished 60% of the water used in its products in water-stressed regions like India and East Africa through initiatives such as water, sanitation, hygiene, aquifer recharge, and other replenishment activities. Diageo's comprehensive approach not only reduces its water footprint but also enhances water security in vulnerable regions, demonstrating a commitment to sustainable water management and community wellbeing.



04 Community-Centric Approaches:

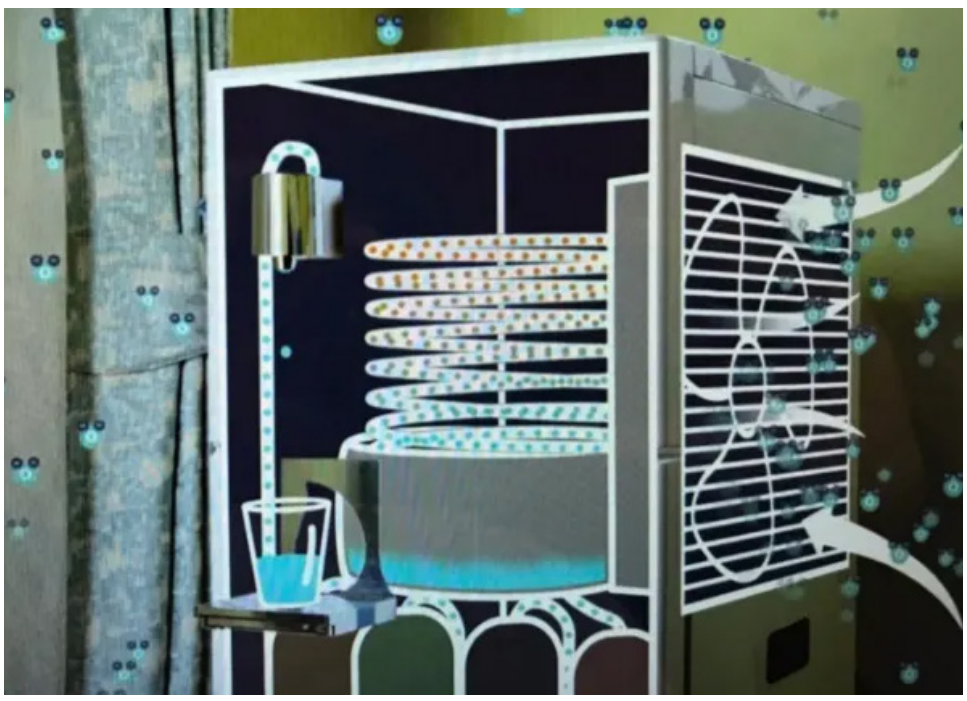
Majik Water: Harvesting Water From the Air to Combat Kenya's Water Crisis.[30]

Institution: Majik Water

Type: Social Enterprise

Region: Kenya (Sub- Saharan Africa)

Majik Water addresses Kenya's water crisis by capturing clean water from moisture in the air with affordable, easy-to-use devices that work like dehumidifiers. The enterprise operates 40 atmospheric water generators across arid regions. Majik Water serves NGOs, Fortune 500 companies, and communities, producing up to 500 litres of water daily. Majik Water's technology provides a sustainable and scalable solution to water scarcity, empowering local communities and expanding access to clean water in regions facing severe water stress.



World Food Programme: Empowering Vulnerable Women Due to Disproportionate Impact of Climate Change in Mozambique.[31]

Institution: World Food Programme

Type: International

Region: Mozambique (Sub-Saharan Africa)

The World Food Programme's (WFP) targeted interventions help vulnerable women adapt to climate challenges and secure sustainable livelihoods, strengthening community resilience in the face of ongoing climate threats. In Mozambique, WFP collaborates with the government to support displaced women on Ibo Island by offering training in shellfish harvesting, food processing, and small business management, along with small desalination plants. WFP's broader efforts extend to Malawi and Zambia, enhancing women's skills through irrigation, savings groups, and access to climate-resilient programmes.

PepsiCo Foundation: Bringing Clean Water to Rural Ethiopia.[32]

Institution: PepsiCo Foundation **Type:** F&B (Private Sector) **Region:** Ethiopia (Sub-Saharan Africa)

The PepsiCo Foundation, in partnership with WaterAid, is delivering clean water to over 10,000 people in two rural towns in Ethiopia's North Mecha District. This 18-month project is part of PepsiCo's pep+ agenda, focusing on sustainability and positive change. Efforts include repairing water points and building a school water system, complementing the existing Ethiopia-based Sustainable WASH Program. In addition to improving infrastructure, the program funding has empowered community members to establish Water User Associations (WUAs) to manage the water systems after they have been built or rehabilitated. Community members have also been trained as Local Area Mechanics to operate and maintain the infrastructure, ensuring long-term functionality beyond the project's completion. PepsiCo Foundation's initiative highlights how corporate philanthropy not only improves access to clean water but also fosters community ownership, agency, and sustainable impact, enabling local communities to take charge of their own well-being.

Cyclone Idai's Lesson: CBFEWS Transforms Flood Warning in Malawi.[33]

Institution: Malawi Department of Disaster Management Affairs

Type: Government

Region: Malawi (Sub-Saharan Africa)

Cyclone Idai's devastation in 2019 underscored the need for better early warning systems in Malawi. The inadequate forecasting resulted in 1,500 deaths and over 2,300 missing. In response, Malawi and SERVIR developed a warning system that improved warning times from hours to days. By 2022, CBFEWS had helped to prevent $40 million in losses. CBFEWS demonstrates the power of advanced warning systems and international collaboration in reducing disaster impacts and saving lives.

05 Regional And International Collaboration:

GaFa: Unlocking Groundwater Potential for Building Resilience in Horn of Africa.[34]

Institution: Africa Groundwater Access Facility (GaFa)

Type: Government

Region: Ethiopia (Sub- Saharan Africa)

In 2024, Ethiopia and the Netherlands launched GaFa to sustainably harness untapped groundwater resources in the Horn of Africa. This cross-border initiative focuses on pre-feasibility analysis and project pipeline development in borderland areas, enhancing regional knowledge through a comprehensive groundwater database. GaFa also fosters public-private partnerships for climate-resilient groundvwater investments, supporting domestic use, agriculture, and industry. GaFa represents a critical step towards sustainable water management in the Horn of Africa, promoting resilience in vulnerable regions and securing water resources for future generations.

WaterWorX: Expanding Access to Sustainable Water Services Globally.[35]

Institution: Water Operator Partnerships (WOPs)

Type: Not-for-profit partnerships

Region: Sub-Saharan Africa

The WaterWorX programme aims to provide sustainable water services to 10 million people by 2030. The programme has already improved water access for thousands across Africa, Asia, and South America. It also enhances utility staff skills, management systems, and funding capabilities, fostering long-term partnerships for a more inclusive, climate-resilient water sector. WaterWorX is a significant global effort to improve water access and sustainability, strengthening local capacities and building resilience in water-scarce regions. The WaterWorX programme aims to provide sustainable water services to 10 million people by 2030. The programme has already improved water access for thousands across Africa, Asia, and South America. It also enhances utility staff skills, management systems, and funding capabilities, fostering long-term partnerships for a more inclusive, climate-resilient water sector. WaterWorX is a significant global effort to improve water access and sustainability, strengthening local capacities and building resilience in water-scarce regions.

06 Adoption of Renewable and Low-Energy Solutions:

Desolenator: Solar-Powered Water Desalination for Sustainable Solutions.[36]

Institution: Desolenator **Type:** Startup **Region:** Middle East

Desolenator's technology addresses water scarcity with a renewable, eco-friendly approach by using solar energy to desalinate seawater and brackish water. The system combines solar thermal, photovoltaic, and heat exchange technologies for efficient, low-energy operation. Ideal for remote or off-grid communities, it offers scalable deployment with minimal maintenance and consistently provides high-quality drinking water. Desolenator's innovative technology ensures a sustainable, low-energy solution to water scarcity, particularly benefiting underserved and isolated areas.

07 Capacity Building and Institutional Support:

MEDRC: Empowering Oman's Water Future Through Desalination Innovation.[37]

Institution: MEDRC **Type:** Research, training & development centre **Region:** Middle East

MEDRC is dedicated to advancing desalination technologies and building capacity to address water scarcity and climate change in the region. In 2020, MEDRC launched the Tahlya programme, aimed at supporting local SMEs in the water treatment sector, in partnership with BP Oman, Oman's Public Authority for Water, the Public Authority for Small and Medium Enterprises Development, and Sharakah. This initiative not only fosters innovation in sustainable water solutions but also boosts job creation and economic growth in Oman.

Key Lessons

There are best practices in the Middle East & Africa region that have helped countries combat climate change induced water scarcity. In order to chart country specific actions to combat the region's endemic water scarcity exacerbated by climate change, policy makers in the region can benefit from the best practices and case studies observed amongst the 66 countries' in the Middle East & Africa region.

- **Effective implementation planning and capabilities are vital.** While many countries in the Middle East and Africa have developed robust water management policies, the effectiveness of these frameworks has often faltered at the implementation stage. For instance, despite having strong water laws, South Africa[38] faces challenges with enforcement, leading to unequal access to water. Conversely, the UAE illustrates how strong governance and consistent policy application can lead to significant improvements in water security, emphasising the importance of effective implementation.

- **Public-private partnerships enhance technological effectiveness.** Technological innovations in water management, particularly those driven by private sector initiatives, have been most effective when supported by strong government infrastructure. UAE's success in deploying desalination and efficient irrigation technologies demonstrates the importance of public-private collaboration in the UAE in overcoming water scarcity challenges.

- **Capacity building is essential for enhanced water security.** In Jordan, development aid has proven most effective when paired with capacity-building initiatives that equip local institutions with the skills and knowledge needed to maintain and expand water projects over the long term. This trend emphasises the need for aid programmes to focus on building local capacity and providing technical support alongside financial assistance. Similarly, in Senegal, the African Development Bank has allocated significant resources to enhance agricultural water infrastructure, which is expected to boost food security and improve water management practices in rural areas.

- **Public awareness is critical for successful water management.** Public awareness and education are vital components of any water management strategy. In Seychelles, government-led initiatives to educate the public on water conservation have led to significant reductions in water wastage, highlighting the importance of fostering a culture of conservation through community engagement.

- **Indigenous knowledge enhances water management.** In the Middle East and North Africa, water has been a critical resource for centuries leading to a substantially rich bouquet of local traditional methods for water management. Integrating these traditional water management practices with modern technologies, as seen in Tanzania, can improve water conservation efforts and make solutions more culturally appropriate and effective. This approach highlights the value of leveraging indigenous knowledge to complement modern water management strategies.

- **International collaboration is vital for managing shared water resources.** Effective water management often requires collaboration across borders, especially in regions with shared water resources. The Nile Basin Initiative, which involves multiple African countries, exemplifies how international cooperation has led to better management of transboundary water resources, although it remains fraught with political challenges.

03 Recommendations

The Middle East and Africa region stands at a critical juncture where the escalating impacts of climate change are intensifying water scarcity, necessitating both urgent action and innovative solutions. Drawing from the assessment, it is evident that a forward-looking and implementable strategy is required to address these pressing challenges, while also providing opportunities to develop and deploy tech-driven and community-driven solutions at scale. The interconnected recommendations and possible approaches outlined below focus on leveraging technological advancements, fostering regional cooperation, and ensuring that policies are both actionable and sustainable.

01 Accelerate Deployment of Advanced Water Technologies

Recommendation: Prioritise the deployment and scaling of advanced technologies such as desalination, solar-powered water distillation, and smart irrigation systems, which have proven effective in addressing water scarcity in arid and semi-arid regions.

Approach: Establish innovation hubs and technology incubators that facilitate public-private partnerships, providing access to cutting-edge technologies, funding, and expertise. Moreover, governments should incentivise the adoption of these technologies through tax breaks or subsidies, especially for projects that demonstrate scalability and long-term sustainability. Pilot projects in vulnerable communities can serve as models for broader regional implementation.

02 Mobilise Innovative Financing for Water Infrastructure

Recommendation: Develop and expand innovative financing mechanisms to support the significant investments needed for sustainable water infrastructure. These include green bonds, climate finance, and public-private partnerships that are specifically tailored to the region's needs.

Approach: Collaborate with international financial institutions to develop tailored financing solutions that attract substantial investments into water security projects. Middle East and Africa countries should issue green bonds specifically for water infrastructure projects, ensuring alignment with climate adaptation and other development goals. Establishing a regional climate finance facility can pool resources and attract private investment, ensuring that projects are financially viable and aligned with national development objectives.

03 Strengthen the Implementation of Policy Frameworks and Governance

Recommendation: Establish and empower independent regulatory bodies with the authority to enforce water management policies, ensure compliance, and drive continuous improvement in governance. These bodies should be instrumental in integrating local contexts with global best practices, ensuring that water management strategies are both effective and sustainable.

Approach: Regulatory bodies should be structured to include cross-sectoral representation, incorporating expertise from government, academia, private industry, and civil society. These bodies should focus on continuous monitoring and evaluation, leveraging advanced data analytics and digital technologies to track water usage, pollution levels, and conservation efforts in real-time. By employing tools like remote sensing, IoT, and blockchain, these bodies can provide more accurate and timely data, allowing for swift policy adjustments. Moreover, these regulatory bodies should align water management policies with international frameworks like the Sustainable Development Goals (SDGs) and foster a culture of innovation through regular updates and adaptations based on emerging challenges and technologies.

04 Build Local Capacity and Engaging Communities

Recommendation: Focus on building local capacities and actively engaging communities in water management practices. Empowering local institutions and communities is crucial for the sustainability and effectiveness of water projects, particularly in areas most affected by climate change.

Approach: Governments and international development agencies should collaborate to implement comprehensive capacity-building programs. These programmes should equip local authorities and communities with the necessary skills and knowledge to manage water resources effectively, integrating local traditions and knowledge with modern practices. Public awareness campaigns should be launched to educate communities on the importance of water conservation and climate adaptation. Additionally, involving communities in the design and implementation of water projects will foster ownership, ensuring that solutions are both sustainable and tailored to local needs.

05 Enhance Regional and International Collaboration

Recommendation: Foster stronger regional and international collaboration to manage shared water resources and coordinate responses to climate-induced water scarcity. Collaborative efforts are essential for addressing transboundary water issues and ensuring that all stakeholders have equitable access to water resources.

Approach: Establish regional frameworks for water management that facilitate joint investments, knowledge sharing, and coordinated policy actions among Middle East and Africa countries. These frameworks should be supported by international organisations, which can provide technical assistance, facilitate dialogue among stakeholders, and offer platforms for sharing best practices and technological innovations. Furthermore, creating regional centres of excellence in water management can enhance cooperation and foster a unified approach to addressing the region's water challenges.

06 Integrate Local Traditional Practices for Water Management with Modern Technologies

Recommendation: Leverage local traditional water management practices by integrating them with modern technologies to enhance water security. This approach can create culturally relevant and sustainable solutions that resonate with local communities.

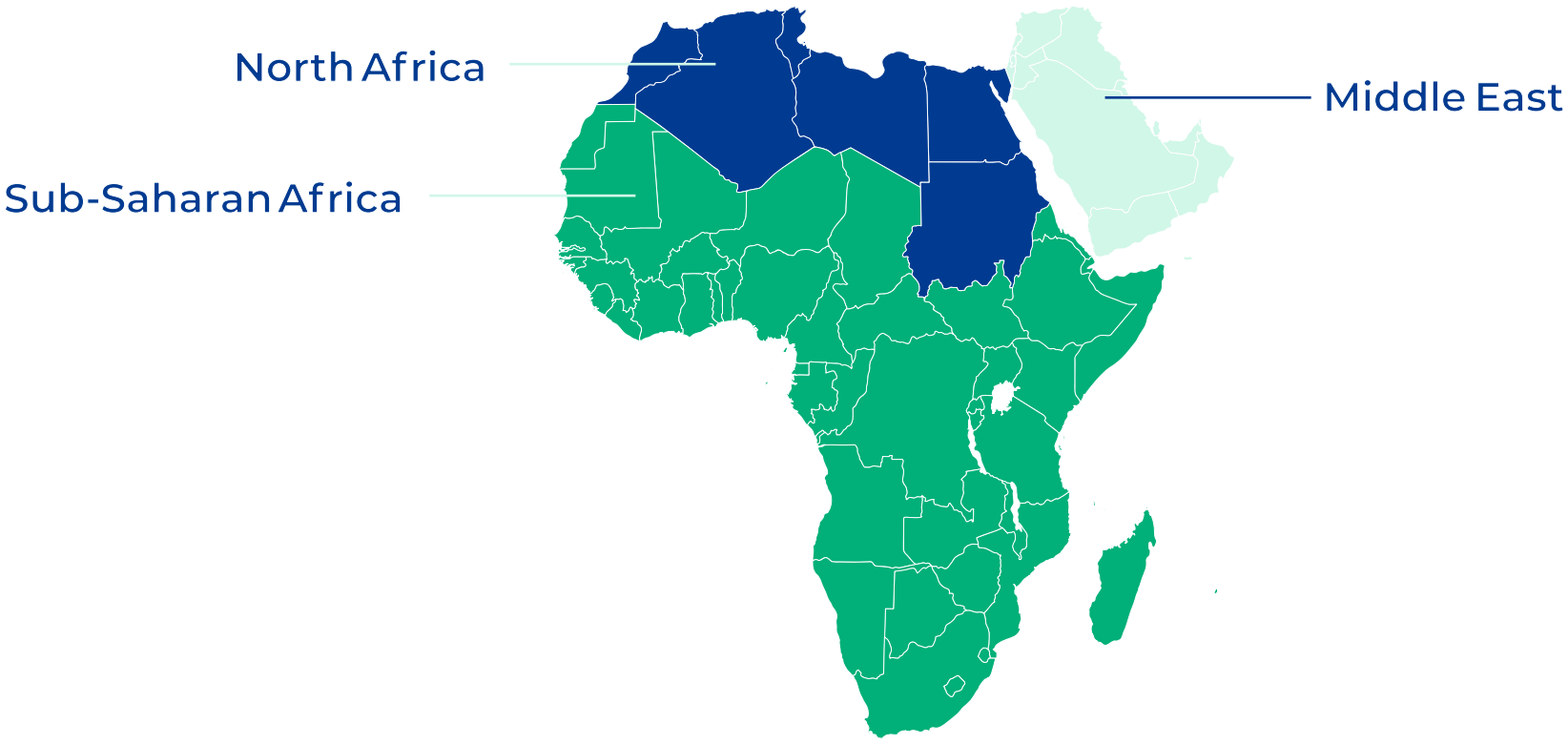
Approach: Identify and document traditional water management practices across the region, and explore how these can be enhanced with technologies such as automated water distribution systems, solar-powered pumps, and data-driven water usage analytics. Pilot projects should be launched to test these hybrid solutions, with support from both governmental and non-governmental organisations, ensuring that they are scalable and adaptable to various local contexts. Moreover, knowledge exchange and demonstrations within countries would further enhance the adoption and adaptation of these integrated solutions, allowing communities to learn from successful implementations and tailor these practices to their specific local needs.

07 Prioritise the Set up of Early Warning Systems and Communicating Effectively

Recommendation: Establish and enhance early warning systems for water-related disasters such as droughts and floods, utilising advanced technologies to ensure accuracy and timely communication to vulnerable communities.

Approach: Invest in the development of early warning systems that incorporate technologies like remote sensing, AI-based predictive analytics, and satellite monitoring to detect and forecast water-related disasters. These systems should be integrated into national and regional disaster management frameworks, supported by robust communication networks that ensure warnings reach all at-risk populations in a timely and effective manner.

The way forward for the Middle East and Africa region must recognise the diverse challenges and opportunities present across its countries. A one-size-fits-all approach is not feasible; instead, a tailored strategy that builds on regional strengths and addresses specific vulnerabilities is essential.



- **Middle East:** The region's reliance on desalination and limited freshwater resources make the deployment of renewable energy-powered desalination and smart water grids a priority. Collaboration on transboundary water management, particularly for shared rivers, is also critical.

- **North Africa:** North Africa should leverage its rich history of traditional water management practices, such as fog harvesting, while integrating these with modern technological advancements. The region must also strengthen its cooperation within the Nile Basin to ensure sustainable water use that benefits all riparian countries. Wastewater recycling and reuse should be prioritised to bolster water availability, particularly in agriculture.

- **Sub-Saharan Africa:** The priority here should be on deploying decentralised, affordable water technologies for remote, off-grid communities. Moreover, cross-border collaboration on groundwater management is essential for regional stability. Strengthening local governance structures and empowering community-based water management will be key to ensuring the sustainability of these initiatives. The international community needs to provide greater financial support to the region for water security.

The **Middle East and Africa region** is **diverse**, and its approach to combating the **impact of climate change** on exacerbating water scarcity must also reflect this **diversity**. By fostering **regional cooperation** and leveraging **both local and global expertise**, the Middle East and Africa region can ensure the **long-term sustainability** of its water resources. Ultimately, this will require a commitment to **continuous learning, adaptation, and innovation** by leveraging **technology solutions**, ensuring that the region can meet its **water challenges** head-on and secure a **sustainable future** for all its inhabitants. These efforts must be underpinned by **robust administrative structures** that engage **multiple stakeholders**, ensuring **cohesive and effective implementation.**

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