

QNDCC 2023 White Paper

Water and Food Security

November 19, 2023



White Paper
QNDCC
15-16 October 2023

Water and Food Security

November 19, 2023
Prepared by Strategy Hub

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Earthna Center for a Sustainable Future (Earthna) is a non-profit policy, research, and advocacy organization, established by Qatar Foundation to promote and enable a coordinated approach to environmental, social, and economic sustainability and prosperity.

Earthna is a facilitator of sustainability efforts and action in Qatar and other hot and arid countries, focusing on sustainability frameworks, circular economies, energy transition, climate change, biodiversity and ecosystems, cities and the built environment, and education, ethics, and faith. By bringing together technical experts, academia, government and non-government organizations, businesses and civil society, Earthna fosters collaboration, innovation, and positive change.

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Report Team

Dr. Soud K. Al-Thani

Director, Earthna, Qatar Foundation,
Doha, Qatar

Sheikha Amna Al Thani

CEO, Strategy Hub,
Doha, Qatar

Francis Antony Jacob

Earthna, Qatar Foundation,
Doha, Qatar

Mohamed A. Mohamed

Earthna, Qatar Foundation,
Doha, Qatar

Editorial board

Dr. Gonzalo Castro de la Mata

Earthna, Qatar Foundation,
Doha, Qatar

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Doha, Qatar

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Earthna, Qatar Foundation,
Doha, Qatar

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Strategy Hub,
Doha, Qatar

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Strategy Hub,
Doha, Qatar

Umaima Ahmed

Intern, Georgetown University
Doha, Qatar

Naeema Halim

Intern, Hamad Bin Khalifa University
Doha, Qatar

Nihal. Mohamed Al-Saleh

Earthna, Qatar Foundation,
Doha, Qatar

Dr. Mona Matar Al-Kuwari

Earthna, Qatar Foundation,
Doha, Qatar

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P.O. Box: 5825, Doha, Qatar
Telephone: (+974) 4454 0242; internet: www.earthna.qa

PI: ETCC-2024-004



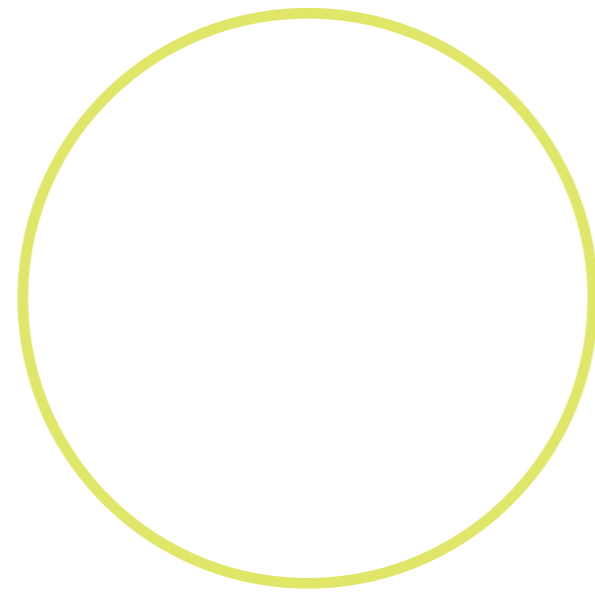
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Executive Summary

Both globally and for Qatar, water and food security hold significant implications for the livelihoods and wellbeing of all individuals. To better understand how water and food security affects people, one must underscore the impact of climate change on these vital resources, emphasizing the cyclical relationship between insecurity and climate change. The paper delves into international climate pacts and agreements, recognizing their significance in addressing challenges specific to Qatar's context. It further examines current trends, frameworks, and solutions, with a focus on sustainable resource management and innovative practices. It acknowledges the challenges, such as funding, political conflicts, and the unique positioning of Qatar. The third edition of the Qatar National Dialogue on Climate Change (QNDCC) addressed the multifaceted dimension of water and food security, and the impact of climate change on these vital resources. Based on the current literature and the insights presented at the forum, this paper offers tailored recommendations for Qatar, encompassing freshwater resources, food production, reliance on imports, population growth, and climate and environmental factors. These recommendations emphasize sustainability, innovation, and resilience as Qatar strives to secure its water and food resources.



Scope and Methodology

The scope of this White Paper covers the topics discussed in the Panel Session "Water & Food Security" on the first day of the QNDCC, in addition to supplementary research to substantiate the session's key findings with in-depth research and produce optimally relevant recommendations. The findings of this White Paper can be utilized to enhance Qatar's national sustainability goals and develop relevant local and regional sustainability initiatives. The methodology followed for data collection

includes preliminary academic research, on-site session note-taking, and post-session supplementary research and benchmarking. Based on the detailed insights, this document offers a set of general and Qatar-specific recommendations to support the implementation of sustainable solutions for water and food security.



Water and Food Security

The effects of climate change pose a grave risk to the water and food systems of the world. Food security, as defined by the United Nations' Committee on World Food Security, refers to the physical, social, and economic access of all people at all times to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life¹ The number of people suffering acute food insecurity increased from 135 million in 2019 to 345 million in 82 countries by June 2022, as war, weather events, and lingering economic effects of the COVID 19 pandemic continue.² Water security, as defined by the UN Water organization, is "the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate

of peace and political stability."³ About 4 billion people, representing nearly two-thirds of the global population, experience severe water scarcity during at least one month of the year.⁴ When a territory withdraws 25% or more of its renewable freshwater resources it is said to be 'water-stressed'. Five out of eleven regions have water stress values above 25%, including two regions with high water stress and one with extreme water stress.⁵ Water is at the core of climate change as the rise of sea levels and melting of ice caps progresses. With the disruption of the water cycle and the rising temperatures around the globe, water is becoming an increasingly competitive and scarce resource. Additionally, water plays a key role in the world's food systems as a source of life for crops and livestock.

¹ (World Food Summit 1996, Rome Declaration on World Food Security)

² World Bank, "What You Need to Know About Food Security and Climate Change," World Bank (October 17, 2022), <https://www.worldbank.org/en/news/feature/2022/10/17/what-you-need-to-know-about-food-security-and-climate-change>.

³ UN-Water, "What is Water Security? - Infographic," UN-Water, <https://www.unwater.org/publications/what-water-security-infographic>.

⁴ Mesfin M. Mekonnen and Arjen Y. Hoekstra, "Four Billion People Facing Severe Water Scarcity," *Science Advances* 2, no. 2 (2016): e1500323, <https://doi.org/10.1126/sciadv.1500323>.

⁵ "Summary Progress Update 2021: SDG 6 — Water and Sanitation for All," UN-Water, accessed November 18, 2023, <https://www.unwater.org/publications/summary-progress-update-2021-sdg-6-water-and-sanitation-all>.

The Relationship Between Water and Food Security and Climate Change



Climate change threatens water and food security in various ways; on the other hand, irresponsible food production and water processing further contributes to environmental degradation. Extreme climate events such as droughts and wildfires worsen soil erosion and reduce the rate with which groundwater resources naturally refill.⁶ Furthermore, these extreme weather events can damage crops and cause food prices to rapidly increase, thereby worsening food security.⁷ Moreover, the cultivation of crops and livestock, particularly those that require higher water usage, contributes to the deterioration of water-dependent carbon sinks like peatlands. Water scarcity further exacerbates the issue of food security as water

plays a vital role in food production.⁸ According to UN Water, 72% of all water withdrawals are used by agriculture, 16% by municipalities for households and services, and 12% by industries.⁹ Water security is also threatened by changes in the cryosphere - the Arctic and Antarctic ice and snow caps systems - as increased melting disrupts the great river systems.¹⁰ In turn, rising sea levels and flooding contaminates water resources with saltwater, feces, or other contaminants.¹¹ As previously mentioned, food and water insecurity also contribute to climate change in a cyclical way. For example, food production and manufacturing damage the environment through the production of high greenhouse gas (GHG) emission levels.¹²

⁶ "Water and Climate Change | UN-Water," accessed November 18, 2023, <https://www.unwater.org/water-facts/water-and-climate-change>.

⁷ "Is There a Global Food Shortage? What's Causing Hunger, Famine and Rising Food Costs Around the World," World Food Program USA (blog), accessed November 18, 2023, <https://www.wfpusa.org/articles/is-there-global-food-shortage-whats-causing-hunger-famine-rising-food-costs-around-world/>.

⁸ World Economic Forum, "Strategic Intelligence | World Economic Forum," Strategic Intelligence, accessed November 18, 2023, <https://intelligence.weforum.org>.

⁹ UN-Water, "What is Water Security? - Infographic," UN-Water, <https://www.unwater.org/publications/what-water-security-infographic>.

¹⁰ "Water and Climate Change | UN-Water," accessed November 18, 2023, <https://www.unwater.org/water-facts/water-and-climate-change>.

¹¹ Ibid

¹² "Climate Explainer: Food Security and Climate Change," World Bank, accessed November 18, 2023, <https://www.worldbank.org/en/news/feature/2022/10/17/what-you-need-to-know-about-food-security-and-climate-change>.



International Agreements for Water and Food Security

There are various international organizations that focus on water and food security such as the UN's World Food Programme, the UN's Food and Agriculture Organization, the UN's Committee on World Food Security, among many others. In 2009, the World Summit on Food Security created an international declaration to combat food insecurity.¹³ This declaration highlights the strategic objectives that countries should adopt in order to achieve food security.¹⁴ As for water security, the UN has created the Water Convention and the Protocol on Water and Health which was opened for countries to sign in 2016.¹⁵ This protocol is multifaceted in its strategy, focusing on issues like sanitation, water supply, and efficient management of water.¹⁶ In March 2023, the UN 2023 Water Conference in New York introduced the different international goals for water security. Listed below are the different goals and their deadlines:¹⁷



Goal	Deadline
Integrated water and climate policy at national and global levels	2030
Operational Global Water Information System to support water, climate, and land management for socioeconomic resilience, ecological sustainability, and social inclusion	2030
Early Warnings for all to help safeguard lives and property	2027

¹³ "UN Milestones - Food Security and Nutrition - A Global Issue - Research Guides at United Nations Dag Hammarskjöld Library," accessed November 18, 2023, <https://research.un.org/en/foodsecurity/un-milestones>.

¹⁴ Dag Hammarskjöld Library, "Research Guides: Food Security and Nutrition - A Global Issue: UN Milestones," accessed November 18, 2023, <https://research.un.org/en/foodsecurity/un-milestones>.

¹⁵ "The Water Convention and the Protocol on Water and Health | UNECE," accessed November 18, 2023, <https://unece.org/environment-policy/water>.

¹⁶ Ibid

¹⁷ "Summary of Proceedings by The President of The General Assembly," In United Nations Conference on the Midterm Comprehensive Review of the Implementation of the Objectives of the International Decade for Action "Water For Sustainable Development", 2018-2028 (New York: UN, 2023), <https://sdgs.un.org/sites/default/files/2023-05/FINAL%20EDITED%20-%20PGA77%20Summary%20for%20Water%20Conference%202023.pdf>

Current Trends, Frameworks, and Solutions

The current solutions for water and food security address the sustainability of existing water resources, sustainable and innovative water management, and agriculture and livestock management. UN Water has offered a comprehensive list of current solutions to tackle water and food insecurity. One of the main goals of these solutions is the safe-keeping of existing water resources. This includes protecting coastal mangroves and wetlands as they play a key role in the prevention of flooding. Another solution for this goal includes limiting the use of groundwater as it is over exploited for agriculture and drinking uses. In order to prevent the over-exploitation of water resources, UN Water suggests harnessing rainwater more efficiently in regions with inconsistent rainfall. This helps countries survive weather shocks. Other solutions concerning climate friendly agricultural methods include switching to less water-intensive crops, using conservation techniques to increase soil moisture retention, and using waste to create biofuels and biogases.¹⁸ Additionally, cooling systems for livestock are vital to maintain their health and increase their efficiency.¹⁹ On this year's

World Food Day (October 16th), The International Food Policy Research Institute (IFPRI) published an article that provides recommendations to achieve water and food security. One of the pertinent points made in the article was the need for better data, institutions, and investments. Proper data collection for water and food security is non-negotiable in terms of implementation. Proper data collection is essential for water and food security because it enables the development and implementation of effective policies and goals based on accurate information, leading to informed decision-making and improved resource management.²⁰ As for frameworks regarding the ease implementing data-driven solutions, the Integrated Water Resources Management is one of the international frameworks proposed by a team of experts around the world that enables the implementation of these solutions.²¹ This framework incorporates policies that promote the importance of the environment, involves and strengthens the participation of institutions, provides management tools for specific challenges, and offers financial guidance for implementation.²²



¹⁸ "Summary Progress Update 2021: SDG 6 — Water and Sanitation for All," UN-Water, accessed November 18, 2023, <https://www.unwater.org/publications/summary-progress-update-2021-sdg-6-water-and-sanitation-all>.

¹⁹ "Helping Livestock Beat The Heat This Summer," VMBS News, June 16, 2023, <https://vetmed.tamu.edu/news/pet-talk/livestock-summer-heat/>.

²⁰ "World Food Day 2023: Five Actions to Get Us Closer to Water and Food Security for All | IFPRI : International Food Policy Research Institute," accessed November 18, 2023, <https://www.ifpri.org/blog/world-food-day-2023-five-actions-get-us-closer-water-and-food-security-all>.

²¹ "IWRM Explained | IWRM Action Hub," accessed November 18, 2023, <http://www.gwptoolbox.org/about/iwrm-explained>.

²² "IWRM Tools | IWRM Action Hub," accessed November 18, 2023, <http://www.gwptoolbox.org/learn/iwrm-tools>.

Implementing water and food security solutions on a global scale faces several challenges. Key obstacles include inadequate funding, political conflicts, limited access to technology and infrastructure, and differing priorities amongst nations. Additionally, addressing these challenges often requires long-term investments and coordinated efforts across borders, making international cooperation crucial. Balancing the need for increased food and water production with sustainability goals, such as reducing environmental impacts and mitigating climate change, presents further complexities. Overcoming these barriers necessitates commitment from governments, international organizations, and the private sector to prioritize and fund initiatives that promote food and water security, while also addressing the underlying systemic issues that hinder progress.

While there are commonalities between global challenges in water and food security and those faced by Qatar, the specific context and circumstances of Qatar, including its geographical location, demographic composition, economic capacity, and reliance on energy-intensive solutions like desalination, give rise to unique challenges that require tailored approaches and solutions. Here are some of the key challenges:

• Limited Freshwater Resources:

Qatar is located in a hyper-arid desert region with extremely limited natural freshwater resources. Its challenges related to water scarcity are more acute and immediate compared to many other regions. Qatar has limited freshwater resources, and most of its water supply comes from desalination and groundwater extraction. One of the issues faced with desalination plants currently is the environmental consequences of those plants, including the release of brine into the sea and the large amount of energy required for cooling, heating, and vapor compression of seawater in the plants.²³

• Food Production and Agriculture:

Qatar faces significant challenges with its local food production and agriculture primarily due to its arid climate and limited arable land. The extreme heat and minimal rainfall in the region make traditional farming practices difficult to sustain. The scarcity of fertile soil further complicates efforts to grow crops domestically.²⁴

²³ "Desalination Process: How Does It Affect the Environment? | World Economic Forum," accessed November 18, 2023, <https://www.weforum.org/agenda/2022/12/desalination-process-freshwater-negative-environmental-cost/>.

²⁴ Theodora Karanisa, Alexandre Amato, Renee Richer, Sara Abdul Majid, Cynthia Skelhorn, and Sami Sayadi, "Agricultural Production in Qatar's Hot Arid Climate," *Sustainability* 13, no. 7 (2021): 4059, <https://doi.org/10.3390/su13074059>.

²⁵ Tarek Ben Hassen and Hamid El Bilali, "Food Security in the Gulf Cooperation Council Countries: Challenges and Prospects," *Journal of Food Security* 7, no. 5 (2019): 159-169.

²⁶ "Monthly Figures on Total Population," accessed November 18, 2023, <https://www.psa.gov.qa/en/statistics1/StatisticsSite/pages/population.aspx>.

These environmental factors hinder Qatar's ability to produce sufficient food locally, making it essential to explore innovative and sustainable agricultural techniques that can thrive in the challenging desert conditions.

• Reliance on Imports and External Shocks:

GCC countries including Qatar heavily rely on food imports to meet their dietary needs. This dependence on foreign food sources can be vulnerable to supply chain disruptions and price fluctuations in the global market.²⁵ Additionally, Qatar is susceptible to international trade disruptions, which can affect its food supply. For example, the COVID-19 pandemic highlighted vulnerabilities in the food supply chain.

• Population Growth:

Qatar's rapid population growth, primarily driven by immigration, presents a considerable challenge for the implementation of water and food security solutions.²⁶ The influx of people has substantially increased the demand for resources, including freshwater for drinking, agriculture, and industrial use. This places added stress on already limited water and food resources. Furthermore, managing the diverse needs of a rapidly growing and culturally diverse population requires tailored solutions and infrastructure development. Striking a balance between accommodating the needs of the expanding population and ensuring sustainable access to essential resources like water and food is a complex and unique challenge that Qatar must address to maintain the well-being of its residents and future residents.



• Climate and Environmental Factors:

Qatar's low-lying coastal areas are at risk of inundation from rising sea levels, threatening critical infrastructure and potentially contaminating groundwater sources. This climatic vulnerability underscores the urgency of developing sustainable and innovative solutions to ensure a stable food and water supply for Qatar's population while adapting to the challenges posed by a changing climate.²⁷

²⁷ Stanford University, "The Effects of Climate Change on Water Shortages," *Stanford Earth*, March 22, 2019, <https://earth.stanford.edu/news/effects-climate-change-water-shortages>.

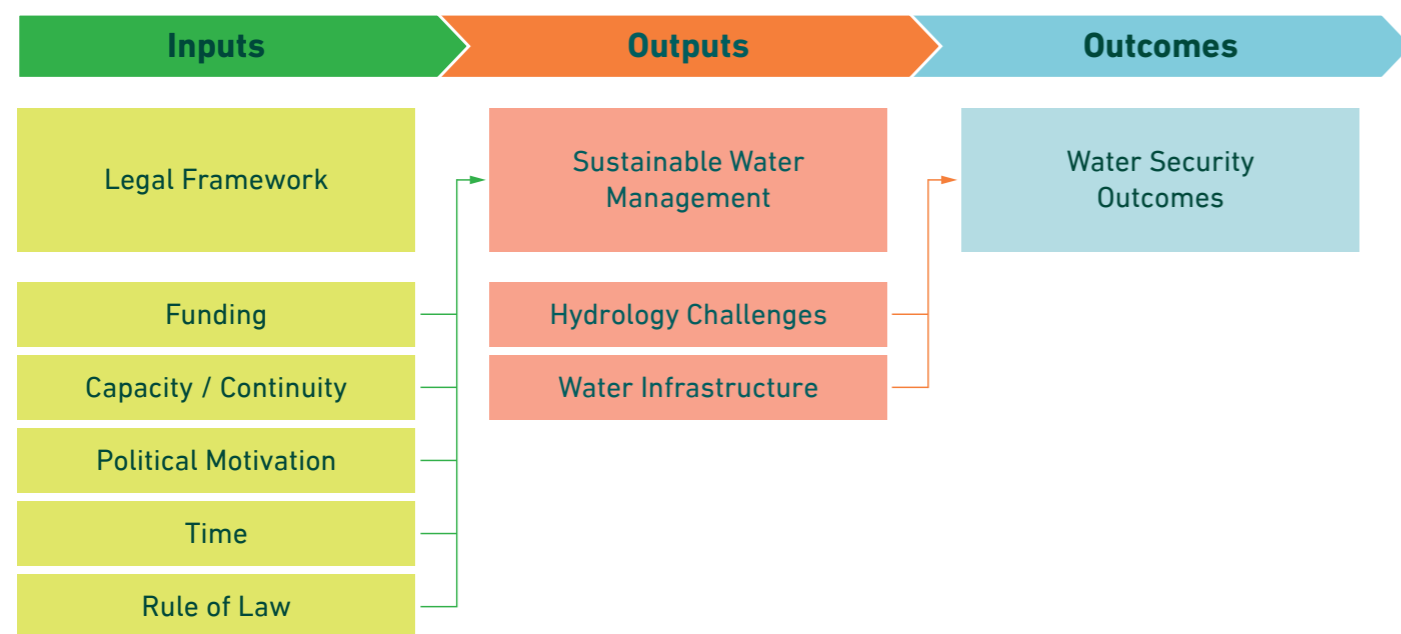
²⁸ "Qatar Treads Water," accessed November 18, 2023, <https://nuq-reports.shorthandstories.com/qatar-treads-water/>.

Recommendations for the Implementation of Water and Food Security Solutions

Global recommendations for the implementation of food and water security solutions emphasize several key principles. These include sustainable resource management, increased investments²⁹ in research and innovation, equitable access to resources, and international cooperation. Prioritizing the reduction of food loss and waste, improving agricultural practices for efficiency and resilience, and adopting technology-driven solutions are also crucial.³⁰ Additionally, addressing the impacts of climate change, promoting fair trade practices, and ensuring political stability and economic resources play significant roles in achieving global food and water security.³¹ Together, these recommendations aim to secure access to safe and sufficient food and clean water for all while safeguarding the environment and enhancing global resilience to future challenges. A general recommendation for all countries is the implementation and enforcement of a legal strategy for water and food security.³² According to a paper published by the World Bank - a study of the relationship between water laws and water security

- water security outcomes are influenced heavily by the legal frameworks in place that promote sustainable water management.³³ These legal frameworks should be derived from the international water frameworks in place. The figure below, given by the World Bank paper, examines this relationship.

While these global recommendations offer a broad framework for addressing water and food security challenges, it's important to tailor strategies to Qatar's unique circumstances. To address its specific challenges, Qatar should consider the following recommendations:



²⁹ Darren Rabenou and Darren Rabenou, "Comment: Why Investing in Food Security Is Investing in the Future," Reuters, September 25, 2023, sec. Sustainable Finance & Reporting, <https://www.reuters.com/sustainability/sustainable-finance-reporting/comment-why-investing-food-security-is-investing-future-2023-09-25/>.

³⁰ "Seven Solutions to Jointly Improve Water Security and Food Systems Outcomes | IFPRI : International Food Policy Research Institute," accessed November 19, 2023, <https://www.ifpri.org/blog/seven-solutions-jointly-improve-water-security-and-food-systems-outcomes>.

³¹ B. James Deaton and Bethany Lipka, "Political instability and food security," *Journal of Food Security* 3, no. 1 (2015): 29-33.

³² Graham Hamley and Samjhana Thapa, "LAW AND WATER SECURITY IN ASIA AND THE PACIFIC," in *The 7th International Water Association ASPIRE Conference* (Kuala Lumpur, Malaysia: EBA Water), accessed November 19, 2023, <https://thedocs.worldbank.org/en/doc/229451534214149850-0050022018/original/EBAWaterLawandWaterSecurityinAsia.pdf>.

³³ Ibid

Freshwater Resources and Agriculture

In response to the acute water scarcity challenges posed by its hyper-arid desert environment, Qatar has undertaken several initiatives to address its limited freshwater resources. At the QNDCC, Ms. Wafaa ALSaffar, the ESG Director at Balanda, highlighted Baladna's remarkable strides towards self-sufficiency and sustainability. Baladna's five-year strategy plan is centered on reducing their carbon footprint and addressing climate-related hurdles. Veolia, a company specializing in water management, waste management and energy services, was also at the QNDCC to discuss its innovations in sustainable water management. Michael Martin, Director of Process & Innovation at Veolia, explained that Veolia provides support to various Qatari companies like Qatar Cool by building treatment plants for high-quality irrigation water. Balanda has collaborated with Veolia to establish a water treatment plant that has effectively cut water usage by 50%. Furthermore, Hamad Bin Khalifa University (HBKU) has a water research center which focuses on circularity in the water sector, sustainable methods of drinking water provision, laboratories, and research for clean water solutions. These efforts reflect the commitment of Qatar's community to sustainable water management, although ongoing efforts are needed to ensure the long-term resilience of its water supply in the face of growing demand and climate change challenges.

To address the challenges of food production and agriculture posed by Qatar's arid climate and limited arable land, it is vital to invest in innovative farming practices that are less reliant on natural resources and better suited to its desert environment. Qatar has already implemented some of these novel solutions, notably hydroponics and vertical farming³⁴, which have gained traction and are being increasingly adopted to maximize agricultural productivity in controlled environments.³⁵ Furthermore, Qatar has taken steps to promote sustainable water management practices for agriculture, such as efficient irrigation systems and the use of treated wastewater for farming.³⁶ At the QNDCC, Dr. Kira Schipper, a research associate at Qatar University's Centre for Sustainable Development, described the unique potential for biological innovation in Qatar's environment, given the presence of microalgae

and cyanobacteria that thrive in the region's hot and dry climate. These organisms, according to Dr. Schipper, are useful resources for sustainable feed production. Additionally, Qatar should explore saltwater resources, such as the extraction of materials from seawater for industrial use and alternative livestock options like seaweeds and halophytes. Moreover, Dr. Tareq Al Zadjali recommended that Qatar switch to crops that need less water, such as maize. He explained that switching to less water-intensive crops can significantly enhance food security. Firstly, these crops require lesser water to grow, reducing the strain on water supplies in regions facing water scarcity. These crops are also more resistant to volatile weather changes like droughts.

Recognizing the vulnerabilities associated with reliance on food imports and exposure to external shocks, Qatar has taken steps to enhance its food security. In 2020, Qatar published the Qatar National Food Security Strategy 2018 - 2023 which focuses on four key pillars to enhance food security in the country: International Trade and Logistics, Domestic Self-Sufficiency, Strategic Reserves, and Domestic Markets. As part of its food security strategy, the country has been strategically diversifying its sources of imported food, entering into agreements with different nations to ensure a stable supply chain. These measures, coupled with a focus on enhancing supply chain resilience and ensuring the availability of essential food items, reflect Qatar's commitment to bolstering its food security in the face of external challenges and disruptions.³⁷ At the QNDCC, Dr. Tareq Al Ansari, Assistant Professor at the College of Science and Engineering at HBKU, underscored the benefits of adopting a water-food-energy nexus strategy to tackle water and food insecurity. This strategy takes into consideration the different cause and effect relations between water, food, and energy in order to manage demand for all three.³⁸ This strategy ought to be incorporated into future food security strategies in Qatar.

³⁴ Qatar Development Bank, "Qatar's Potential Opportunities on Indoor Vertical Farming at Jahiz 2 Facility," (Doha, Qatar: Published July, 2022), accessed November 19, 2023, https://www.qdb.qa/en/Documents/vertical_farming_july_en.pdf.

³⁵ Fatemeh Salari, "Qatar Steps towards Sustainability in Food Security with Vertical Farming," *Doha News | Qatar*, August 15, 2022, <https://dohanews.co/qatar-steps-towards-sustainability-in-food-security-with-vertical-farming/>.

³⁶ "Suez Degremont® Water Handbook," "Wastewater Treatment Plant Doha West (Qatar)," accessed November 19, 2023, <https://www.suezwaterhandbook.com/case-studies/wastewater-treatment/Doha-West-wastewater-treatment-plant-Qatar>.

³⁷ Qatar National Food Security Strategy 2018-2023, published by Qatar Food Security Department (January 2020), URL: <https://www.mme.gov.qa/pdocs/cview?siteID=2&docID=19772&year=2020>.

³⁸ "Water, Food and Energy," UN-Water, accessed November 19, 2023, <https://www.unwater.org/water-facts/water-food-and-energy>.

Economic Capacity and Investments

To sustain its investments in infrastructure and technologies that support its goals in water and food security, the country has implemented several strategies. Qatar has established sovereign wealth funds and investment vehicles to allocate resources for long-term infrastructure and technology maintenance. Additionally, the nation has been proactive in seeking public-private partnerships to secure financial support and expertise for critical projects. Qatar's commitment to diversifying its economy has also involved investments in various sectors to ensure a stable source of revenue. While these steps have contributed to addressing funding gaps, continuous monitoring and adaptation of financial strategies are crucial to safeguarding the country's long-term investments in desalination technology, infrastructure, and food security measures.



Conclusion

In conclusion, this white paper has shed light on the critical issues of food and water security in the context of Qatar and the broader global challenges posed by climate change. As we have seen, these challenges are complex and multifaceted, with unique considerations for Qatar's specific circumstances. The recommendations outlined in this paper underscore the importance of tailored solutions, sustainable resource management, technological innovation, and international cooperation.

Qatar has already taken significant steps towards addressing its water and food security challenges, from investing in advanced desalination technologies to promoting innovative farming practices and diversifying its sources of food imports. These efforts reflect Qatar's commitment to ensuring the well-being of its population and adapting to its arid climate and geographical constraints.

However, the road ahead remains challenging, with ongoing issues such as rapid population growth and the need to balance water desalination and food production with sustainability. The commitment to renewable energy sources, efficiency measures, and global climate agreements demonstrates Qatar's dedication to addressing environmental concerns and contributing to global sustainability efforts.

In the face of these challenges, a holistic and adaptive approach is essential. Qatar's ability to secure its water and food resources sustainably will depend on continuous investments, innovation, and collaboration, both domestically and internationally. By implementing the recommendations outlined in this paper and remaining committed to its long-term goals, Qatar can make significant strides towards a more secure and resilient future for its people and the global community.

Acknowledgement

The Ministry of Environment and Climate Change and Earthna would like to thank the French Embassy in Doha and the French Business Council in Qatar for their partnership to help bring the 2023 QNDCC to fruition. A special thanks to Qatar National Bank (QNB) for their excellent strategic partnership and support. Finally, Earthna would like to thank the event organizers, volunteers, interns, and moderators who contributed to the success of this year's conference.

We also owe a lot of gratitude to our speakers who enriched the discourse and provided a forum abundant with novel ideas, collaboration, and innovation. These speakers are H.E. Dr. Tariq Al Zadjali, Former Director General, Arab Organization for Agricultural Development, Ms. Wafaa AlSaffar, Environment, Social & Governance Director at Baladna, Mr. Michael Martin, Director of Process & Innovation at Veolia, Dr. Tareq Al Ansari, Assistant Professor, College of Science and Engineering at HBKU, and Dr. Kira Schipper, Research Associate at Qatar University.

Contributors

Earthna would like to thank the following team from Strategy Hub for their contributions to the development of this report: Masah Barakat, Amna Al Thani, and Haajerah Khan. Earthna would also like to thank interns Umaima Ahmed and Naeema Halim for their assistance in the development of the report.



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