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Morocco has introduced several environmentally focused initiatives as the country approaches absolute water scarcity. Within these initiatives, a significant emphasis is placed on implementing desalination processes to increase water supply. However, policies fail to address the demand aspect of water scarcity, with increased supply leading to increased demand. This article discusses the current prospects within Morocco's water scarcity infrastructure and proposes demand management strategies to expand the country's portfolio of water scarcity solutions.

Introduction

Over the past 20 years, Morocco's annual water withdrawal has risen alarmingly, deepening concerns for water scarcity within the country. The United Nations defines chronic water scarcity as an availability limit of 1000 m^3/capita/year. Currently, Morocco falls within this water scarcity category, with the country's water resources yielding only 650 m^3/capita/year. However, as groundwater reserves become increasingly low and drought more frequent over the next decade, water availability is projected to fall below 500 m^3/capita/year, placing Morocco in the absolute water scarcity category (Conseil Economique..., n.d.).

A growing cause for concern, water scarcity in Morocco is primarily driven by the effects of climate change and expanding consumption among industries and people (Taheripour et al., 2020). Climate change alone is expected to deplete the national water supply by 80% over the course of 25 years (Conseil Economique..., n.d.). As the depletion occurs, the inability to utilize water for various basic activities will have a direct impact on Morocco's citizens. In recent years, water scarcity and its ramifications have led to "Thirsty Protests" in Southern regions, highlighting the water-induced stresses and societal imbalances throughout the country (Hill & Pimentel, 2022). Beyond the anthropological significance of water scarcity, Morocco's economy risks serious negative repercussions. Without the ability to sustain industries' large water consumption, Morocco's GDP, labor market, and economic productivity will suffer.

Acknowledging the increasing severity of the country's water crisis, Morocco has introduced multiple initiatives aimed at addressing the anticipated societal and economic challenges of water scarcity. However, these initiatives are often usurped by the desire to foster growth in the agricultural sector. As a result, early government strategies lacked well-rounded plans that included a diverse set of technological solutions. Instead, resources for water scarcity have been invested primarily in developing Morocco's water desalination technologies. Through desalination processes, Morocco is expected to expand its annual water production by 1B m^3, increasing the country's general production capacity while improving the consistency of water accessibility in more rural regions. However, the benefits of desalination technology can lead to serious environmental and economic costs. Desalination processes have been found to harm nearby ecosystems and are recognized as a high-energy consumption process. To balance the perceived benefits and drawbacks of desalination, Morocco faces a greater challenge of diversifying its solutions to water scarcity. This article explores how Moroccan initiatives could address water scarcity while redefining the relationship between Moroccan experiences and desalination. Solutions beyond technological alternatives are recommended to bolster the future of water availability in Morocco.

The economics of water scarcity

In 2016, economic repercussions of Moroccan water scarcity were evaluated through World Bank computable general equilibrium model analyses comparing permanent decline in precipitation, and consequently water supply, with distinct economic metrics. Such studies analyzed the effects at varying levels of water supply reduction, in which a 15% decrease was identified as a rule of thumb. With a 15% decrease in water supply, Morocco's GDP will experience a permanent devaluation of 3%, equating to $6.14M annually. In conjunction with a baseline 3% decrease, the Moroccan GDP endures additional losses as a function of climate change–induced transitions to new, non-rainfed, crops in the agricultural sector. The added cost from shifts in crops worsens GDP devaluation, inflicting an additional quarter million dollars of annual losses. When large droughts occur, temporary devaluation may also occur when limited production causes price increases and shocks across the economy (Taheripour et al., 2020). Coincident with causing declines in the Moroccan GDP, significant impacts are identified across the country's labor markets. Historically, Morocco has experienced high unemployment levels for multiple decades, maintaining a rate around two times that of the global average (World Bank Open Data, n.d.-a; n.d.-b). Demand decreases for unskilled and skilled labor are expected to intensify as a function of water scarcity challenges. At the 15% water supply reduction rate, it is predicted the country's overall economic demand for unskilled and skilled labor will decrease by 3.4% and 3.0%, respectively. If the transition to non-rainfed crops is considered, the declines in overall labor demand would deepen, lowering by 5.2% in unskilled and 4.7% in skilled markets (Taheripour et al., 2020).

Although the presence of water scarcity generally affects all sectors of the Moroccan economy, the country's agricultural economy largely dictates water scarcity's magnitude of economic influence. Temporary and permanent water supply reductions restrict farm production capacities and induce price shocks beginning at the base of a supply chain. Constraints on crop production limits accessibility to crops as an input for other goods and services. Thus, when the water supply is reduced by 25%, the Moroccan agricultural economy's contribution to the national GDP is predicted to fall from 13% to 11.75%. This decrease in economic share also translates into concentrated unemployment rate rises for the almost 40% of Morocco's population working in agriculture. While the previously mentioned declines in labor demand for the general Moroccan economy were found to be around 5%, the demand for labor directly related to agricultural activities, primarily in the unskilled market, is predicted to see a deeper decline, of 7.8% (Taheripour et al., 2020).

Implementing policy

Recognizing the problems associated with increasing water scarcity, Morocco has implemented initiatives designed to boost its agricultural economy. During the early 2000s, the government introduced the Green Morocco Plan to increase and diversify agricultural exports, with an eye toward expanding Moroccan influence internationally. The plan called for a transition away from traditional to drip irrigation incentivized by subsidies on water costs (Oxford Business Group, 2020). Despite the seemingly positive goals set in place with the Green Morocco Plan, it ultimately created new challenges due to uneven distribution of investment and missed environmental objectives. To address these, the Moroccan government instituted Generation Green 2020-2030, to prioritize the influence of agricultural solutions on Moroccan quality of life over the benefits of economic expansion. The multifaceted, complex plan comprises two sections intended to resolve both the environmental and the agricultural challenges, yet water scarcity and reform are acknowledged in but a single discussion point, falling secondary to maintaining agricultural economic goals (Ministry of Agriculture…, n.d.).

To expand the agricultural sector, water scarcity must be addressed, given consumption rates (80% of the 11B–15B m^3 consumed annually) (Hill & Pimentel, 2022; Taheripour et al., 2020). In 2020, Morocco supplemented Generation Green 2020-2030 with the National Water Plan and the National Priority Program for Drinking Water and Irrigation to address the lack of water scarcity solutions. Through these programs, the country intends to install a range of infrastructural solutions aimed at progressively increasing water supply, including dams, groundwater location studies, wastewater recycling, rural potable water centers, and interbasin water transfer projects (International Trade Administration, 2022). However, the focal point of the country's water scarcity plans has been constructing seawater desalination plants (Hooper, 2023; Magoum, 2023).

The desalination of water

Processes at desalination plants include pre- and post-treatment steps commonly used for water treatment while introducing an additional, more intensive process to remove dissolved particles found in saltwater and brackish water. Initially, the actual desalination process was completed by applying distillation mechanisms to the overall process, with heating and cooling cycles separating salt particles from water vapor. In recent years, however, technological developments have increased affordability of membrane technology methods, such as reverse osmosis. Such methods pump the saline water through semiporous membranes at extreme pressures that immobilize dissolved salt particles and grit as water molecules continue to flow and eliminate the need to control water phase changes. However, depending on plant location and size, the chosen desalination method may still vary (El-Ghzizel et al., 2021).

Morocco's approach

Desalination processes have been used to treat seawater in Morocco since 1995, with the construction of a plant in Laayoune. That technology, however, was introduced to Morocco in 1975, when a small 75-m^3/day plant was built in Tarfaya to treat brackish groundwater. Within the past decade, Morocco's application of seawater desalination has grown and advanced, driven by reductions in annual dam water supply yields and the membrane technology improvements (El-Ghzizel et al., 2021).

Morocco's investment in desalination solutions to address the country's water scarcity crisis is cultivated under the National Priority Program for Drinking Water and Irrigation that calls for the construction of at least 20 seawater desalination plants across the country by 2030. As of 2023, the country has implemented nine of these desalination plants (Magoum, 2023). The capacity of each plant ranges, with the largest producing 75M m^3 annually in Agadir (Meerganz von Medeazza, 2004). Combined, operating desalination plants supply up to 147M m^3 of treated water annually. Over the course of 2023, an additional three plants broke ground for construction along the coasts of El Jadida, Safi, and the Oriental region to increase annual production volumes by at least another 150M m^3. Ultimately, Morocco aims to add a total of 1B m^3 to the national water supply annually through desalination plants (Magoum, 2023). Such an increase in volume will add around 27 m^3/capita/year to the water supply.

Beyond the apparent increase in volume of treated water Morocco's growing number of desalination plants will produce, their implementation introduces a steadier supply of water to the country's remote regions. In the southern region of Laayoune, Moroccans have followed centuries-old practices to collect and store infrequent rainwater, one of the limited sources of water in the area. Local homes have underground storage tanks, collect water from inconsistent stream flows, and rely on trucked water to supplement fluctuations. Because these homes are connected to the consistent stream of new desalination plants, the pressure to rely on storage methods has dissipated (Meerganz von Medeazza, 2004).

Foreseen drawbacks

The large-scale implementation of desalination plants presents great promise in addressing Morocco's water scarcity crisis. Alongside that potential lie concerns about resultant challenges. Unfortunately, increasing the supply and consistency of water in Morocco results in deterioration of surrounding marine ecosystems, heightened water prices, and expanded consumption of nonrenewable resources.

In addition to the treated water, desalination processes produce a concentrated stream of salts and contaminants removed during treatment. These streams of waste, referred to as brine, are diluted and discharged into surrounding coastal waters. Brine's high concentration of salt and raised temperature increase the ambient temperature and salinity within a few hundred meters of the discharge point. The alterations in the surrounding ecosystems' ambient conditions have been found to affect the local marine environments and the smaller resident organisms. For example, several monitoring studies determined that seagrass, an important plant in providing habitats, food, and sediment stabilization, undergoes reductions in growth, photosynthetic, and survival rates from salinity-induced osmotic stress. Because brine disturbs the development of smaller organisms, the overall ecosystem will undergo significant changes, resulting in damaged biodiversity, leading to additional challenges (Petersen et al., 2018).

Beyond the negative environmental impacts, desalination solutions have raised concerns regarding their large consumption of energy, hence, economic costs. Membrane technologies are categorized as highly intensive energy processes. The theoretical energy consumption for reverse osmosis treatment is 0.7 kWh/m^3. However, actual consumption is dependent on plant specifications, and the average desalination plant utilizes up to 5 kWh/m^3 (Meerganz von Medeazza, 2004). This level is approximately five times the 2014 determined energy intensity required to carry out public water services in the United States and, upon completion of Morocco's desalination plants, will amount to almost 17% of the country's annual energy consumption (World Data, 2024; Jones & Sowby, 2014). Such high energy usage for desalination processes connects to a broader issue: limiting fossil fuel usage. Thus, Morocco has focused on coupling the desalination plant implementation with renewable energy infrastructure installation. While renewable energy is seemingly a promising solution to reducing fossil fuels and reaping desired environmental benefits, renewable energy options hold lower return-on-energy input values that create unsustainable production costs of up to \$9/m^3 of water (Karagiannis & Soldatos, 2008).

Under more reasonable energy consumption levels, the overall cost of desalination remains a concern. For instance, a large percentage of treated desalination water is for agricultural irrigation. The irrigation of common grain crops, such as wheat, requires between 2550 m^3 and 3400 m^3 of water annually for a single hectare of land (Berdai et al., 2011). Assuming the water for irrigating wheat was produced at the minimum cost for a typical large-scale desalination process, the cost to irrigate a hectare of grain would range from \$1147.50 to \$1530 per hectare annually (El-Ghzizel et al., 2021). However, the grain harvested from that hectare is limited to an average 1.6 metric tons, to be sold at an average price of \$325 (Fardaoussi, 2023). The cost of desalination causes losses of \$627 to \$1010 per hectare annually. If desalination processes continue to incur such economic losses, in addition to other noted consequences, its effectiveness as a solution to water scarcity must be reconsidered. Contemplating the efficiency of desalination implementation then poses a greater question: What other solutions exist to address Morocco's water scarcity?

A technological alternative

The costs of implementing desalination in Morocco inherently raise concerns over the viability of desalination solutions with limited economic benefits. The unease regarding the consequences is not unique to Morocco, as the topic of water desalination solutions has become a worldwide discussion. In response to similar proposals for desalination plants, communities have protested, promoting another alternative: wastewater recycling. Among many ideas to address water scarcity, wastewater recycling is a solution presenting significant advantages worth the country's exploration.

Orange County, California, provides a modern comparison between the two technologies following the recent pushback against a proposed desalination plant. Although state administration and companies point to the apparent benefits of desalination, the Orange County community has referenced the drastic impacts on the environment and cost of implementation while cheaper and more environmentally safe options exist. Specifically, Orange County has cited its historic use of wastewater recycling. Recycled water is generated through an intensified wastewater treatment process followed by retention in aquifers and enhanced by reverse osmosis processes at a final water treatment facility (Reinhart, 2023).

By implementing this process, Orange County has been able to not only avoid harm to marine life and high price increases but also achieve a range of other benefits. Because wastewater recycling begins with waste from industries, agriculture, or public disposal, there is a certain "yuck factor" associated with allowing the final effluent to be redistributed for use. To combat such concerns, the quality of the wastewater recycling process is heightened, producing water almost as clean as distilled water, thereby helping to remove the public's concerns. For Morocco, the ability of societal perceptions to incentivize greater water standards would address the quality concerns in implementing supply solutions. Beyond solving multiple water distribution issues with a single, lower-cost process, recycling wastewater also presents an opportunity to mitigate saltwater intrusion, a growing concern in coastal countries like Morocco. Saltwater intrusion, an issue characterized by the contamination of groundwater aquifers with seawater, occurs as a result of overconsumption and depletion of an aquifer. Because wastewater recycling makes use of and refills the depleted aquifers, the potential for saltwater intrusion would be mitigated (Reinhart, 2023).

A demand management issue

By implementing either desalination plants or proposed water recycling processes, Morocco ultimately can address its water scarcity crisis at the physical level. However, looking forward, Morocco must also balance technological solutions with sustainable programs and policies that focus on reducing water demand. Such management efforts need to counter perceptions that increased supply negates the need to conserve, a trend often characterized as the rebound effect (Taheripour et al., 2020). Serious consideration must also be given to current water subsidy programs that expand, rather than conserve, consumption levels. One mechanism for inducing wider acceptance of the necessity of water conservation efforts is expanded public education initiatives.

The rebound effect

Morocco currently intends to substantially expand the country's desalination processes, an "increased supply" approach. Traditionally, communities experiencing elevated water stress have long practiced methods of rationing that limit water consumption. For example, in Saharan regions such as Laayoune, native groups restricted potable water use to ingestion-related purposes. While conserving potable water, the native groups opted for using higher-salinity, untreated water for other household duties and religious practices. Through recent application of the increased supply approach, however, access to water for such native groups has been reframed. Where water was once viewed as a precious and finite resource, the construction of nearby desalination plants and installation of distribution network connections has misconstrued water supplies as now infinite. The changed perception of the availability of water subsequently affects Moroccans' willingness to limit water consumption, rebounding to utilize clean water sources for superfluous purposes (Meerganz von Medeazza, 2004).

Studies on water scarcity in the Moroccan economy also highlighted the rebound effect and water availability. In the agricultural sector, rebound effects can be observed by connecting the introduction of water-efficient technologies to the transitions to more water-intensive agricultural products. When minimal water-efficient technologies (5% improvement rate) are implemented in conjunction with water-intensive crop choices, the ideal results should yield an equivalent (5%) decrease in water demand. However, Morocco is instead projected to experience a 4.1% increase in demand for water and then a 9.1% rebound effect. That is, rather than reducing demand for water, the investment in efficient technologies actually induced additional demand and stress on the water supply. If the improvement rate of water-efficient technologies is expanded to a maximum of 20%, a reduction in the demand for water can be observed. However, such a reduction in demand is so limited that the rebound effect remains present, highlighting a likely negative return on investment. Similar trends are also seen in cases where the transition to water-intensive crops has not yet occurred: a rebound effect is still present despite some reduction in water demand (Taheripour et al., 2020). Given such projections, the implementation of water-efficient agricultural or increased supply management technologies will not resolve concerns of water scarcity on their own. To effectively address all segments of water scarcity, the range of solutions must also integrate demand management programs to reach the desired return on investment.

Implementing technological solutions in response to water scarcity alone is not economical in the long run. While desalination technologies or other alternatives boast an opportunity to increase supply, those same technologies lack the ability to address the subsequent demand and consumption dilemmas they create. An expected economic benefit of an expanded water supply is stimulated growth in the agricultural sector focused on increased profit from higher-value, water-intensive crops or greater volumes of standard crops. With the high costs of desalination raising the cost of water as an input, coupled with the continued decline in total water availability, any predicted profit aimed at supporting a growing Moroccan economy cannot be sustained. Instead, to ensure a sustained growth in the agriculture sector, policymakers must work to institute a strong demand management plan to balance the existing supply-based, technological approach to water availability.

The influence of water subsidies

Looking forward, a demand management plan in Morocco should aim to incentivize continued conservation of the available water supply. Unfortunately, the increased access to water has led native groups to abandon the use of nonpotable water for religious rituals, eliminate their underground rain collection tanks, and return to using clean water for routine domestic purposes. Meanwhile, the agricultural sector has increased its consumption of water with the motivation to grow the Moroccan economy. Many of these instances of increased water consumption have been spurred by the ease in financially accessing water resources. Government-sponsored water subsidies enable substantially low water prices that do not deter individual Moroccans and businesses from overconsumption.

Noting the high influence Moroccan water subsidies seemingly has on deepening the country's water stress, a 2014 International Congress of the European Association of Agricultural Economists presentation (Thabet et al., 2014) discussed the removal of such subsidies and the Moroccan economy. The authors' findings were based on generated values for computable general equilibrium scenarios, assessing the economic cost of a 50% decrease in subsidies, a 50% increase in investment of water supply expansion strategies, or a combination of the two. They determined the weight the agricultural sector holds within the entire Moroccan economy limits the country's flexibility in shifting financial investments to create such demand management scenarios. The report recognized that a drastic removal of subsidies may not be within the government's current scope for managing ongoing water demand concerns or modify agricultural water usage tendencies to the desired extent. However, the report also implied that the situation might change when "a very high water price is reached" (p. 11). When the price of water increases to such a level, its percentage contribution of the total cost of production may incentivize farmers, and other producers, to reduce their usage. When accounting for the increased costs to produce water through desalination, in comparison to the amount currently needed to irrigate a common crop field, Morocco must reassess the influence of water subsidies on managing water demand. In doing so, high consideration should be given to reducing or removing present-day subsidies.

There are current indications of progress that can suggest recommended subsidy policy changes. On September 28, 2022, the Moroccan Ministry of Agriculture, along with the Ministry of Economy and Finance, announced that water subsidies would no longer be provided to irrigate avocado trees, new citrus trees, and red watermelons. By removing existing water subsidies on these crops, Morocco has positioned itself to introduce additional effective demand strategies beyond the country's more water-intensive crops. Morocco has thus established a framework to target crops with a more moderate water demand but must act on this potential (Zouiten, 2022).

Pairing education with policy

Successful implementation of financial policy that addresses water demand management concerns must be accompanied by educational programs and initiatives. In doing so, systematic changes to water consumption management will be better received, thereby encouraging individuals, businesses, and government entities to incorporate conservation strategies. As an example, Singapore introduced a collection of initiatives aimed at increasing awareness through public campaigns and challenges designed to encourage water conservation. Households were urged to install more efficient water systems with smart devices that quantify water usage with connotated feedback like "very good" or "too much," while companies were pressured to adopt better strategies to meet public demand for water-efficient products through mandates to submit water-efficient plans, to complete water efficiency training courses, and to disclose company water efficiency rates to public consumers (Sanlath & Masila, 2020).

Ultimately, short-term campaigns and incentives should be part of larger initiatives to shift the culture of water consumption. Rather than framing water as an expendable economic good, the goal is to portray water as a valuable resource, sensitizing people to their consumption practices (Gómez Fuentes, 2012). These initiatives must take shape through activating community-level campaigns while instituting government oversight for top-down, industrial usage strategies. With water accessibility continuing to increase in communities like Laayoune, Morocco must institute local campaigns that promote water's status as a precious resource. Beyond community campaigns, Morocco can look toward implementing regulations on industry usage of water. Agricultural products sold could be required to disclose their water efficiency rates, while larger farming companies could be mandated to provide efficiency plans in order to receive support to continue operations.

Moving toward a portfolio of solutions on the global stage

With its National Water Plan, Morocco is in a good position to adopt appropriate water demand management programs to combat water scarcity. If it does so successfully, Morocco can serve as a model for other water-scarce nations. To develop a comprehensive water scarcity resiliency plan, it is crucial to find "a combination [of solutions] that responds well over a range of conditions" (Daigger, 2023). In other words, Morocco must establish a portfolio of solutions in which each approach contributes to the broadly impactful issue of water scarcity. Ideally, the various elements should be implemented concurrently. While desalination shows promise in production volume and consistency, there are environmental and economic costs associated with the technology. Although wastewater recycling addresses many of the cost concerns of desalination, acquiring societal buy-in requires time and resources. Despite the need to alter water usage practices through demand management, technology is still necessary to counteract climate change–induced water stresses. Establishing an inclusive program where each existing solution provides its own benefits to supplement the drawbacks of others, Morocco will ensure a combination that creates an effective framework overall, one that may also serve as a model for other nations.

Providing Morocco continues to expand its national water strategies with a focus on demand management while implementing technologies, the country's progress toward reducing water scarcity can serve as a case study for the extreme water scarcity across the Middle East and North Africa (MENA) region. Twelve of the region's countries are included among the world's 17 countries (home to a quarter of the global population) experiencing "extremely high" baseline water stress. Many of these MENA countries lack the necessary framework to combat water scarcity. Challenges like unstable government structures and economic factors limit such countries' ability to implement successful strategies like those Morocco has begun to lay out. With this understanding, the United States Institute of Peace has identified Morocco as a "valuable baseline" for evaluating the future of water scarcity in the African region due to its perceived political stability and foresight in addressing water scarcity (Hill & Pimentel, 2022). Referencing Morocco's range of existing water stress policies, experience in implementing technological water supply solutions, and potential for enacting crucial demand management strategies, other MENA countries can derive a comprehensive guide to resolving national water stresses. However, Morocco's value as a standard for water scarcity solutions must not be limited to the MENA region.

In addition to the extreme water scarcity in African regions, levels of water stress are rising across the globe. The *UN World Water Development Report 2023* draws attention to other regions experiencing high levels of baseline water stress, including Mexico, Southwestern United States, India, Northeastern Asia, and Southern Europe. In addition to baseline water stress, the report acknowledges concerns for areas, such as Eastern Europe and South America, where heightened seasonal variability is having negative implications for water stress. Further statistical studies have identified that around 4B people, about 50% of the world's current population, face severe water scarcity for at least one month each year, indicating that water scarcity is not limited to developing countries (United Nations, 2023).

Because water scarcity is having a direct impact on almost all areas of the world, it has become increasingly critical that all countries work to address their national water scarcity issues. While all countries may not currently be under the extreme stress of countries within the MENA region, climate change and increasing demands will intensify stress in the moderately affected regions in coming decades. Therefore, a global proactive approach will be crucial in mitigating increased water stresses in all regions. Morocco can not only provide sound guidelines to developing MENA region countries but also serve as a valuable case study for more developed countries. Morocco has exhibited noteworthy efforts in implementing extensive water strategies on a national scale and adapting such plans as necessary to address the rapid decline in water availability. For those nations that are more developed or have had moderate impact, the successes, failures, and prospects associated with Morocco's steps are lessons, both in proactive (mitigate water scarcity present day) and reactive (implementing technology and policy in future years as stresses intensify) senses. Although such countries may have the resources to currently implement similar strategies, the takeaways gained from studying the costs of technologies, such as desalination, that Morocco has already realized are crucial in the future selection of technologies globally. In the same sense, Morocco's potential for improvements in demand management, through educational and financial initiatives, can introduce crucial conversation in studying the most effective management strategies.

Conclusion

The severity of water scarcity in Morocco continues to increase as the country approaches absolute water scarcity. To prevent the onset of predicted economic adversities, Morocco has introduced several governmental initiatives facilitating expansion of water supply infrastructure. Within the guidelines outlined within these initiatives, a strong emphasis has been placed on implementing Morocco's desalination technology capabilities, yet a review of existing literature yields a list of concerning drawbacks associated with such technologies. Despite offering a promising solution to the volume and consistency of growing water supply needs, desalination would harm surrounding environments, negating other green policies and increasing Morocco's energy consumption. Ultimately, the emphasis on desalination in Morocco will inflict significant environmental and economic costs.

To adequately address water scarcity concerns, Morocco must look to widen its scope. Technological alternatives, such as wastewater recycling, supplemented with demand management strategies, like eliminating subsidies or instituting educational programs, offer a multifaceted approach. Such a well-rounded approach builds a stable portfolio of solutions that prepares Morocco for a range of conditions, establishing infrastructural resilience against water scarcity. Reflecting on the existing initiatives and policies in place, Morocco holds great potential to implement more versatile strategies beyond the foundation of initiatives that already are set into motion. As Morocco takes those steps to establish water scarcity resilience, the lessons learned from Morocco's missteps and successes will serve as a valuable reference for the MENA region and the world, moving forward.

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