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DEMAND VS. SUPPLY SIDE SOLUTIONS TO YEMEN'S WATER CRISIS



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NOTE FROM THE PRESIDENT

To conclude our analysis on Yemen's water management policies, we present this addendum on supply vs demand side policy solutions to the water crisis. This report breaks down the benefits and shortcomings of each approach in order to better inform policymakers. We envision this analysis of the two primary approaches to natural resource management policies being applied to other countries and resources.

Sincerely,



Yianni Nikolaou
Founder and President



The Center for
Industrial Development

DISCUSSION OF POLICY OPTIONS

Supply-Side Water Management

Like their counterparts throughout the MENA region have attempted, Yemeni authorities could increase water access by seeking out, developing, and operating new sources of water through water management techniques that aim to increase supply. Because natural sources of water are characterized by both scarcity and high price, this approach has become synonymous with technology. Whether that technology means new innovations or more traditional options is to be decided upon by policy-makers. A number of techniques have been implemented in the region to varying degrees of success.

One such technique that has shown promise is sequential water use, in which water that has been exploited for one sector is contained and treated for the purposes of directing it to other uses.¹ Since domestic use requires the cleanest water, the ideal order for sequential water use flows from the household to industry to agriculture as urban wastewater, or “brown water,” is channeled upon treatment in cities to nearby farms as a form of natural fertilizer. This technique has been employed throughout the region,² displaying considerable success in Israel — where the majority of sewage is purified and used for the irrigation of agricultural land — and Tunisia — where wastewater is channeled into irrigation for the city’s citrus and olive orchards, golf courses, and hotel gardens. Although its implementation leaves much to be desired, Jordan’s 1998 Wastewater Policy provides a coherent framework and institutional structure for water reuse. Outside of these successes, though, the rate of wastewater treatment in many MENA countries remains low. Concerns over quality of the treated water continue to dominate debate, and they are not unfounded; the efficiency of the wastewater treatment process is highly variable across plants.³ Many of the obstacles highlighted in Jordanian discussions of its wastewater reuse program will also be concerns for Yemenis: the prevention of effective plant operations due to economic constraints, the difficulty in maintaining an appropriate water quality due to industrial waste additions, the inadequate enforcement of regulations due to institutional weakness, and a limited technical capacity.⁴

Desalination, or the extraction of salt from seawater, is another supply-side technique that has been employed across the region, largely in the oil-rich Gulf States.⁵ Given that just three percent of the world’s water supply is fresh-water, it is easy to explain the appeal of this reliable approach.⁶ Yet, its benefits may be minimal for a country like Yemen with a small amount of coastal areas and an even smaller budget. While Yemeni authorities could implement desalination in the coastal cities of Hodeida and Aden, these areas are in the minority and will not provide much solace for the rest of the water-starved Yemeni population.

¹ Roudi-Fahimi, 4.

² Manzoor Qadir et al., “Wastewater Production, Treatment, and Irrigation in Middle East and North Africa,” *Irrigation Drainage Systems* 24 (2010): 41-48.

³ *Ibid.*, 41-2.

⁴ Gemma Carr and Rob B. Potter, “Towards Effective Water Reuse: Drivers, Challenges and Strategies Shaping the Organisational Management of Reclaimed Water in Jordan,” *The Geographical Journal* 179.1 (2013): 64.

⁵ Roudi-Fahimi, 4.

⁶ *Ibid.*, 1.

Moreover, the high elevations and rough landscapes that characterize the homes of the majority of the Yemeni populace make them a poor target for desalination because the treated seawater will not be able to access them.⁷ Desalination has traditionally been considered too expensive of a technology for a country like Yemen to be able to realize its benefits, but regional cooperation has recently begun to bring down costs and make the technique an increasingly viable option. As experience with the approach has increased, so too have the available technologies which allow countries to input different water types and increase energy efficiencies. Increased unit sizes have produced economies of scales. Investments by Israel and other non-oil-producing countries have decreased production costs. As a result of these shifts, prices have declined from an average of US\$1.0/ m³ in 1999 to US\$0.50/m³ in 2004, according to World Bank data.

To direct the benefits of its impressive desalination capabilities to the agricultural sector, Israel has combined the technique with drip irrigation. Drip irrigation delivers water drop by drop at the root zone of plants, helping to minimize evaporation and runoff when properly managed. The practice's water efficiency rate of 70 to 80 percent is the highest in agriculture, dwarfing the 40 percent boasted by open agriculture. The success of such efficiency is apparent in Israeli history: the introduction of drip irrigation to Israel's Jordan Rift Valley in the early 1970s resulted in a ten-fold increase in yields and incomes.¹⁰ Despite drip irrigations' acknowledged benefits, Yemenis have exhibited a marked reluctance to adopt the practice in favor of more traditional techniques. This unwillingness is not due to an ignorance of its benefits. One Yemeni farmer was quoted as explaining his disinclination through pride and honor: "Flood irrigation is more honorable ... all [drip irrigation] requires is pumping water up into the tank."¹¹ Even for these farmers firmly entrenched in their old ways, who derive a sense of pride from the exertion of physical labor in agricultural practices, there will likely come a point when thirst surmounts ego. The question for policy-makers then becomes how best to convince the public that this point is now. These measures, which target the water supply rather than address its demand, are thus far from a panacea. Unrestrained in its water use, Yemen's growing populace will reach a level of consumption for which even the most innovative, efficient, and expensive technologies cannot provide. And Yemen is not a country for which technology and funds come easily. Perhaps more dooming for a solely supply-side approach to water management, research suggests that efficiency and consumption do not possess the direct relationship that common thought would necessarily indicate. Greater water use efficiency can actually increase consumption in certain contexts, like in countries, like Yemen, for whom land is not a limited factor.¹² It is clear that governments must take another approach to water management.

⁷ Weiss, 253.

⁸ Julia Bucknell et al., *Making the Most of Scarcity: Accountability for Better Water Management Results in the Middle East and North Africa* (Washington, D.C.: The World Bank Group, 2007): 38.

⁹ Girma Megersa and Jemal Abdulahi, "Irrigation System in Israel: A Review," *International Journal of Water Resources and Environmental Engineering* 7.3 (2015): 32.

¹⁰ Uriel Or, "Technological Development of Micro-Irrigation and Its Applications in Developing Countries," in *6th International Micro-Irrigation Congress, "Micro-irrigation Technology for Developing Agriculture,"* Conference Papers, South Africa, 2000.

¹¹ Heffez.

¹² Zeitoun, 55.

Demand-Side Water Management

Attempting to meet their growing citizenry's demand for water is a noble goal for governments. Yet it is a futile one. In the current politico-economic contexts of many water-starved MENA countries, in which water users are overwhelmingly incentivized to allocate their supplies inefficiently, creating new water sources can only hope to provide a temporary solution. This is not to say that the aforementioned governments were completely erroneous in their great efforts to increase their populace's access to water; the decision to do so was both politically rational and economically rewarding in that it allowed them to respond to pressures from influential agricultural interests in a way that did not eliminate the agricultural water subsidies that so benefit them.¹⁴ Any effort to limit demand rather than meet it could be seen as a direct challenge to these vested interests, resulting in political suicide. Regardless of the clear political dangers, though, the dire projections for the Middle East's water supply necessitate a management policy that reflects an integrated approach of addressing both water supply and water demand in a solution that targets the natural resources abuses from both ends. It is not enough to meet water demand in the short-term, because this demand must be decreased to levels that can be met for a sustainable future. In such, the implementations of policies that manage demand are unavoidable.

According to the International Development Research Centre (IDRC), water demand management constitutes "any practice or policy implemented which results in water being used in a more efficient, equitable and sustainable way." Water demand management is, at least nominally, incorporated into the Yemeni national plan for conservation and use; the country lists the reduction of demand through economic incentives as one of its guiding and social and economic principles of its five-year Water Sector Strategy. In addition to rhetorically endorsing water demand management at a theoretical level, though, the Yemeni government must enact tangible policies to achieve these objectives and supported them through concrete enforcement measures. This can be accomplished through the creation of incentives that decrease the profitability of irrigation water use either by increasing the cost of water or decreasing the price of outputs. Water-use restrictions, pricing policies and impact fees can all motivate industrial and commercial users to reduce their water use.

Although many countries in the Middle East and North Africa continue to subsidize their water supply, some have undergone processes to reduce public expenditure on water services while providing incentives to increase the efficiency of services. Most notably, Morocco and Tunisia have introduced strict constraints on their water and sanitation budgets, creating incentives for utilities to operate at a more cost-efficient level and create a predictable financial environment in which to work.¹⁷ Through volumetric pricing, these countries charge farmers for the amount of water they use rather than the traditional method of the amount of land under cultivation. Results have been promising: Tunisia's operations and maintenances costs are almost completely recouped by irrigation charges and Morocco's finances are moving towards the same success with a flourishing of private sector investment.

¹³ Bucknell, 40.

¹⁴ Zeitoun, 54-5.

¹⁵ Thomas Sikor, *The Justices and Injustices of Ecosystem Services* (New York: Routledge, 2013): 112.

¹⁶ Zeitoun et al., 55.

¹⁷ Bucknell, 50.

Yemen's extreme undercharging for its water resources not only fosters a culture of waste and promotes the production of water-intensive crops, but it also deprives its already-strained government agencies and institutions of the funding needed to maintain agricultural and irrigation systems. Correcting this longstanding inefficiency will not be easy. While it may be economically beneficial to require farmers to pay for at least the operation and maintenance of their irrigation systems, there will be some small farmers who simply cannot afford higher prices. Yet, the way that these subsidies are financed suggests that their removal could free up space in the government budget to address the concerns of Yemen's poor: fuel subsidies comprise more than 20 percent of the government's budget, more than expenditure on education, health and social transfers combined.¹⁸ In eliminating fuel subsidies and allowing the price of water to reflect its opportunity cost,¹⁹ then, the Yemeni government must use the released funds to invest in rain-fed farming to provide a livelihood for the rural poor. Prices should be raised incrementally over the course of many years to avoid sudden disruptions and conflicts, and the government should help pay for conservation investments undertaken by their farmers.²⁰ Direct cash transfers may serve as a viable option to ensure that the local people can maintain an income even in the face of restrictive policies. Tunisia provides an example for its regional neighbors on matching water pricing and scarcity; the government charges rates that are sufficient to cover operation and maintenance costs.²¹

Given the inefficiency of Yemen's current crop distribution, any future government seeking to increase water efficiency in the agricultural section should look to the reallocation of water towards the domestic and industrial sectors to satisfy the needs of Yemen's growing urban populations. This approach is complicated, however. While the water wasted on cash crops must be decreased, directing water away from agriculture runs the risk of threatening not only farmers' livelihoods but also countrywide food security.²² A safer — and more politically astute — approach could involve the redirection of water away from traditional cash crops and towards those that are less water-intensive. These crops could then be sold on international markets while the traditional crops are imported to conserve water use. Crucial to the economic gains of such an opening of the qat market is the substitution of a productive alternative use for this saved water.²³ Some analysts claim that qat use has become a major source of inefficiency of Yemeni people, but it is indisputable that it has taken on a central role in both Yemen's economy and culture.²⁴ Efforts on the part of the Yemeni government to curb its production are thus likely to be met with significant obstacles and opposition. As a result, policies implemented in promotion of a shift in crops must be accompanied by short-term policies to guarantee the affected farmers a stable source of livelihood during the transition. Options include subsidies during the length of the transition to encourage the farmers to implement the shift in crops or, in targeting the opposite end of production, taxes levied on high-water crops to create a disincentive to cultivate these crops and instigate a natural shift towards their more water-efficient counterparts.²⁵

¹⁸ Clemens Breisinger, Wilfried Engelke and Olivier Ecker, "Petroleum Subsidies in Yemen: Leveraging Reform for Development," International Food Policy Research Institute Discussion Paper (2011): 3.

¹⁹ Ward, 297.

²⁰ Postel, 171.

²¹ Qadir, 44.

²² Roudi-Fahimi, 5.

²³ Hellegers, 100.

²⁴ Weiss, 258.

²⁵ Elaine Denny et al. (2008) *Sustainable Water Strategies for Jordan*, International Economic Development Program, Ann Arbor, Gerald R. Ford School of Public Policy, University of Michigan: 12.

These policies can theoretically create incentives to discourage industrial and agricultural efficiencies, but in practice, they are often difficult to implement and enforce. Additional strategies must thus be introduced to address issues that are systematically ingrained in the unique Yemeni context. The Yemeni government must implement institutional and legal reforms to ensure that these policies have the opportunity to function. In doing so, the Yemeni government would do well to remember its past, as debilitated as it may be. The Republic of Yemen has a rich history of rules and regulations, of adaptation and evolution, and of regimes and governance regarding the exploitation of groundwater and conflict management of water usage. Prior to the 1970s and the waning of traditional norms, the Yemeni state displayed a remarkable capacity for self-correction. That the Yemeni state has since failed to provide an alternative to local customary arrangements well established among citizens. This has led many to the belief that, at least in the short term, Yemen's groundwater scarcity cannot be solved without the transfer of responsibility to local communities.²⁶ Such recognition is not unique to Yemenis; it is a widely held belief that the involvement of communities in adopting new strategies for water management can dramatically increase their acceptance.²⁷ By enacting such new water systems, communities and their leaders can be instrumental in evaluating the various options available and can later be taught how to manage and operate the chosen system.

Many countries throughout the region have had success devolving some level of responsibility for the operation and management of irrigation systems to groups of users, including Egypt, Iran, Jordan, Libya, Morocco, Oman and Tunisia.²⁸ Often referred to as Water User Associations (WUAs), these organizations involve water users to determine service levels, charges and water allocations, giving farmers an incentive to maintain the modern systems and equipment through a high degree of beneficial ownership. In Tunisia, for example, nearly 2,500 associations operate the country's' new systems for drinking and irrigation water.²⁹ Unsurprisingly, such community-reliant water conservation measures are much more effective when the state includes a provision of income for the community on which it relies. Jordan's Business and Professional Women's Organization, for example, trains poor women to sell water conservation devices, thus improving distribution efficiencies while simultaneously providing these women with a livelihood. In the past, the Yemeni populace has revealed itself to be extremely receptive to such community-driven endeavors. In contrast to the extreme resistance displayed towards the government's efforts to regulate qat production (exemplified by the qat mafia's threats to down any plane bringing in cheaper qat from abroad), little opposition has formed against taxes exerted by local authorities on the consumption of qat.³⁰ While this cooperation can largely be attributed to the funneling of these revenues into local development projects and thus into local circulation, it also reveals the strong interest and engagement many Yemenis have in maintaining not only local economic development but also a high level of fiscal autonomy from the central state.

²⁶ Alderwish, 16.

²⁷ Roudi-Fahimi, 6.

²⁸ Bucknell, 47.

²⁹ Roudi-Fahimi, 6.

³⁰ Weiss, 258..

As Yemeni institutions grow in their capability and capacity, user rights must be similarly strengthened. Current water markets are active in the sense that they ensure the reallocation of water from lower to higher-value users: Well-owners sell their water both to neighbors and to tankers, who in turn provide transportation to those in distant need.³¹ This is economically desirable to an extent, but where sustainable water rights are poorly defined and weakly enforced, these markets serve as a means to exert an even higher level of demand on Yemen's already drained resources. In Yemen's current state, a definition of water rights must come before the idea of trading can come into play. The need to define water rights is precipitated by its current state: a loose definition conglomerated based on historic use in times that have dramatically changed. Such outdated entitlements must be converted formally into quantitative rights, which must in turn be enforced by a strong application of the rule of law.

³¹ Hellegers, 100.

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