CHAPTER 2

Progress, but Problems

This chapter reviews the progress that countries of the Middle East and North Africa (MENA) region have made dealing with their water management challenges. For millennia, societies in the MENA region made innovations to improve water management and deliver water reliably where it was needed. And in modern times, the region is in the vanguard of some of the most advanced water management techniques. These include constructing dams under conditions of high seismic risk (Iran), desalinating brackish and salt water (Saudi Arabia and other Gulf countries), managing complex irrigation and drainage networks (Egypt), successfully privatizing urban water utilities (Morocco), managing efficient public sector water utilities (Tunisia), encouraging farmers to install water-saving irrigation technologies (Tunisia and Jordan), and using flash flood (spate) flows to irrigate crops (Yemen).

Governments have tackled all three levels of scarcity—the physical resource, organizational capacity, and accountability—albeit making most progress on the first, partial progress in the second, and least in the third. Most governments in the region have taken all affordable measures to capture, store, and augment supplies and have invested heavily in bringing water services to their populations. Recognizing the need to manage the resource and related infrastructure carefully, the region has also begun making policy and institutional changes, including policies to promote end-use efficiency. Furthermore, some countries have taken steps toward improving accountability in the sector. Overall, progress in dealing with the scarcity of the physical resource has been substantial, but much remains to be done to solve the underlying water challenges.

Progress Dealing with Scarcity of the Physical Resource

Governments in the region have addressed water scarcity and variability by investing in water storage and augmenting supply with techniques

such as desalination and reuse of treated wastewater. Governments have also made major investments in distributing the water and providing supply and irrigation services.

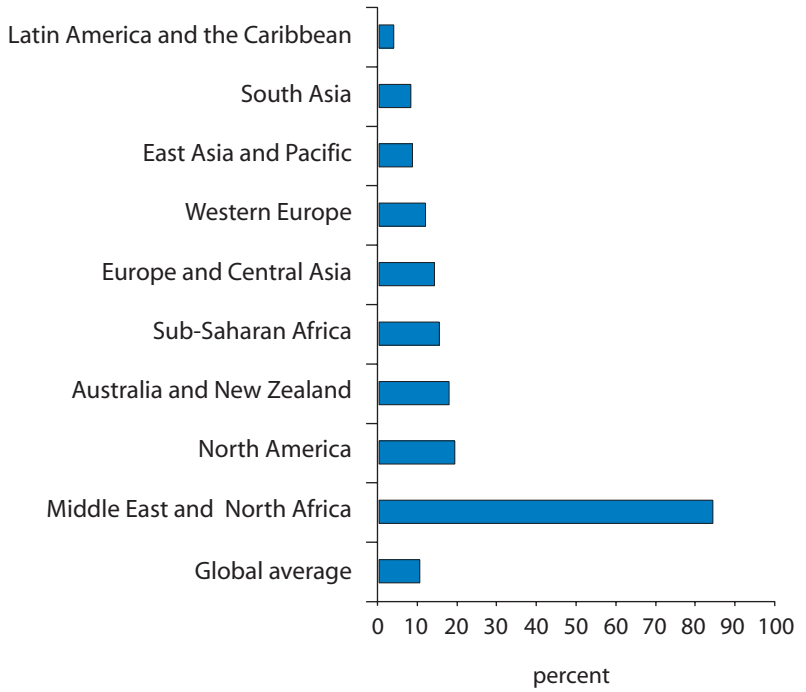
Investing in Securing Supply

The countries of the region have developed major networks of water storage infrastructure, which helps smooth supply between seasons and helps reduce flood risks. Several MENA countries, particularly those with high variability and transboundary waters, have tried to minimize supply risks by investing in water storage. Some hyper-arid areas have constructed dams with the aim of recharging groundwater. The region has built dams on an enormous scale, more than any other region of the world when seen as a share of freshwater resources available (figure 2.1 and table 2.1).

These investments in water storage have brought major benefits. The benefits of the largest in the region, the Aswan High Dam in Egypt, are discussed in box 2.1. Dams have also been associated with important negative effects. Indeed, when it was being planned, this dam was the subject of heated debate in the development community. As will be

FIGURE 2.1

Proportion of Regional Surface Freshwater Resources Stored in Reservoirs



Sources: FAO AQUASTAT; IJHD 2005; ICOLD 2003.

TABLE 2.1

Total Dam Capacity and Share of Freshwater Stored in Reservoirs, by Country

Country	Estimated total dam capacity (km^3)	Share of total freshwater resources stored in reservoirs (%)
Algeria	5.7	51.5
Bahrain	0	0
Djibouti	0	0
Egypt	169.0	289.9
Iran	39.2	28.5
Iraq	50.2	66.6
Jordan	0.1	16.3
Lebanon	0.3	5.7
Libya	0.4	64.5
Morocco	16.1	55.5
Oman	0.1	5.9
Saudi Arabia	0.8	35.0
Syria	15.9	60.4
Tunisia	2.6	55.6
United Arab Emirates	0.1	53.3
West Bank and Gaza	0	0
Yemen	0.2	4.4

Sources: Royaume du Maroc n.d.; World Bank 2005i; Iran Water Management Company 2006; FAO AQUASTAT; IJHD 2005.

Note: The share of freshwater refers to total actual renewable water resources (see figure A1.10 and table A1.10 in appendix 1).

shown later in this chapter, some of its impressive benefits were generated because the Egyptian government was able to develop adaptive institutions that could solve the new hydrological and land quality challenges that arose once dam construction was complete.

Sometimes high fluctuations in rainfall can lead to dams not functioning as intended. This happens, for instance, when lower than expected rainfall reduces the performance of dams constructed on the basis of past rainfall patterns. This has been the case for much of the last two decades in Morocco, as shown in figure 2.2. The result was that many irrigation perimeters had insufficient water to service their customers. The length of the period over which planners examine past hydrological patterns affects the planning process. Water resource planners must take many complex risk factors into account, including the time period. Figure 2.3 shows the probability of two consecutive years of drought in Morocco as the number of years preceding the "base" year increases. The figure shows that the probability falls as the number of years considered increases and that the overall probability appears to have increased in the last few decades.

BOX 2.1

Benefits from the Aswan High Dam

The Aswan High Dam (AHD), completed in 1971, has allowed Egypt to shield itself from natural variations in the Nile's flow. It has also had negative effects, such as the loss of soil fertility through reduced siltation and coastal erosion in the Nile Delta, but, even taking those into account, recent studies suggest that it has had a major positive impact. Economic models estimate that the dam has generated annual benefits, net of the negative impacts, equivalent to at least 2 percent of Egypt's 1997 GDP. These benefits consist of increased agricultural production (including reclaiming approximately 22 percent of Egypt's total irrigated land); energy generation; and improved navigation, which, in turn helped develop Nile-based tourism. The social benefits of the AHD are harder to measure, but studies estimate that stored water from the dam has saved Egypt from the costs of poor harvests in 1972 to 1973 and 1979 to 1987, and protected the Nile valley from major floods in 1964, 1975, and 1988. Furthermore, by reduing uncertainty about water supplies, the dam has acted as insurance for farmers and other consumers. Applying different measures of risk aversion, estimates of this risk premium range from 1.12–4.25 billion Egyptian pounds (US$330–1,250 million [1997 average exchange rate]), or 0.4 to 1.7 percent of 1997 GDP.

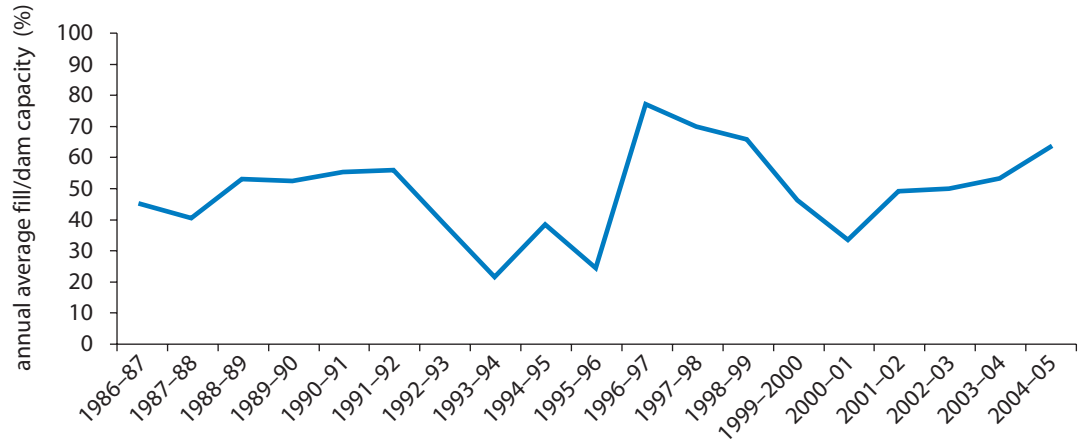
Source: Strzepek et al. 2004.

As a result, if too short a time horizon is considered, resource planners may overinvest in infrastructure for smoothing water cycles. The increasing frequency of drought events does, however, reinforce the case for careful resource planning and optimal use of the existing infrastructure stock.

Distributing water across geographic areas has also required substantial investments, often justified on strategic grounds. Several countries with large populations in areas of water deficit have invested in engineering solutions to transport water from one basin to another. Perhaps the best known of these schemes is Libya's Great Man-Made River, which transfers fossil aquifer water from under the Sahara Desert to population centers in the north of the country for domestic, industrial, and agricultural uses. At a capital cost of US$20 billion, it is one of the largest projects of its kind in the world, with capacity to deliver some 4.5 billion m^3/year when completed (Government of Libya 2005). Similarly, Morocco has developed important schemes to redistribute water resources through 13 interbasin transfer systems, with a cumulative length of more than 1,100 km, capable of delivering a volume of 2.5 billion m^3/year (Royaume du Maroc n.d.). For each of these investments, the state assumed the responsibility for allocating water between the competing

FIGURE 2.2

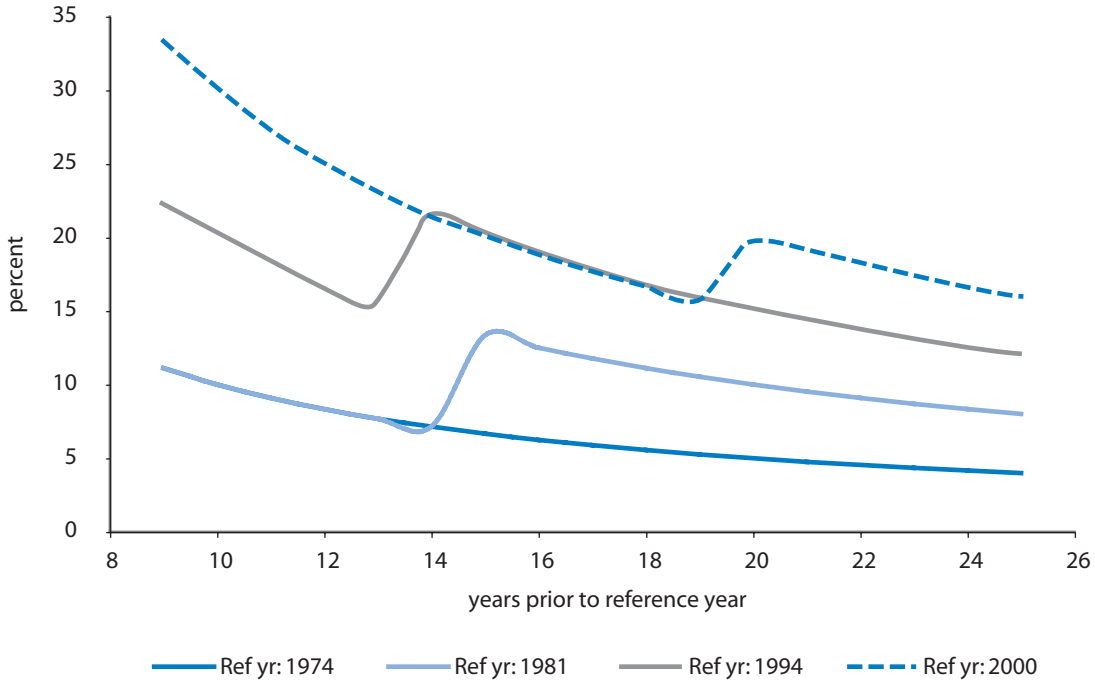
Fill Rate of Dams in Morocco, 1986–2004



Source: Maroc , MATEE, 2004.

FIGURE 2.3

Frequency of Two Consecutive Drought Years in December in Morocco, Based on Four Different Starting Years



Source: Authors' calculation based on the Africa Rainfall and Temperature Evaluation System, developed by the World Bank on the basis of data from the U.S. National Oceanic and Atmospheric Administration.

Note: The figure indicates the frequency of two consecutive years in which December rainfall was less than 30 millimeters, which is the 25th percentile of the rainfall distribution over the period 1948–2001.

needs of water users in the different basins on the basis of strategic considerations. As the resource becomes scarcer, and competition for its use more intense, demands on the state to reallocate water are likely to intensify, as are conflicts between users.

Investing in Technologies to Augment Supply

MENA leads the world in desalination technology investments. MENA countries are increasingly producing water for municipal and industrial use by removing salt from sea or brackish water. The region has 60 percent of the world's capacity and has been using this technology to supply more than half of all municipal water needs since 1990, producing 2,377 million m^3/year (World Bank 2005l). Saudi Arabia is home to 30 percent of the world's desalination capacity; production of desalinated water in Saudi Arabia was 1,070 million m^3/year in 2004 (Ministry of Water and Electricity, Saudi Arabia 2004). Additional investment in this technology is planned in the countries of the Gulf and elsewhere. Several countries outside the Gulf have also invested in this technology and contribute to the technical innovations (table 2.2).

The region has helped bring down the cost of desalinating water. As experience and technology have developed, including through major investments by Israel and other non-oil-producing countries, production costs for desalination have fallen. New technologies, such as reverse osmosis, electrodialysis, and hybrids, can deal with different types of input water or are more energy efficient, or both. Unit sizes have increased, bringing economies of scale. These advances have driven prices down from an average of US\$1.0/ m^3 in 1999 to between US\$0.50/m^3 and US\$0.80/m^3 in 2004 (World Bank and BNWP 2004). Large plants can desalinate seawater for as little as US\$0.44/m^3, although these costs may reflect distortions such as subsidized energy prices, soft loans, and free land (Bushnak 2003).

Desalination has thus become a reasonable option for drinking water for countries with population centers near the coast. The technology is sensitive to energy prices, which is an important consideration for countries that do not have energy reserves. While desalination is still more expensive than most conventional sources when they are readily available, the technology often costs less than exploiting conventional sources when major investments such as interbasin transfers and large dams are required (World Bank and BNWP 2004). The technology has long been an option for the high-income countries of the region, but recent advances mean that it is becoming increasingly viable for poorer countries.

Reuse of treated domestic wastewater also augments supplies.[1] Using domestic wastewater treated to at least secondary level to irrigate crops can

TABLE 2.2

Desalination Capacity in Non-Gulf MENA Countries

Country	Overview of desalination capacity
Algeria	Algeria began investing in desalination plants during the 1960s, primarily to support the oil and steel industry, and more recently to augment water supply in coastal cities. The country has 42 units with a total capacity in 2004 of 59 million m^3/year. The Ministry of Water Resources plans to greatly increase capacity by constructing 28 new large-scale desalination plants, with a combined capacity of about 712 million m^3/year.
Egypt	There are several desalination plants on the coasts of the Red Sea and the Mediterranean, which provide water for seaside resorts and hotels. Most are privately owned. The average production during 1998–2002 was 100 million m^3/year.
Israel	The development of desalination plants began in 1960. The average production in 1990 was 25 million m^3/year. Current capacity is 400 million m^3/year, with plans for capacity to increase to 750 million m^3/year by 2020.
Jordan	In 2002, there were 19 plants with a total capacity of 4 million m^3/year. The country plans to have desalination capacity of 17 million m^3/year by 2010.
Libya	Libya has the largest desalination plant in the world and produces a total of 18 million m^3/year from its 17 plants. A number of new large plants are under construction.
Tunisia	Because of the lack of good quality water in the south of the country, the country has desalination plants to remove salt from brackish groundwater. The 48 plants have a total capacity of 47.5 million m^3/year. A large seawater desalination plant with a capacity of 9 million m^3/year is planned at Djerba to cope with the increasing water demand, mainly from tourism.

Sources: World Bank and BNWPP 2004; Government of Libya 2005; FAO AQUASTAT 2005 Egypt Country Profile.

help reduce pressure on freshwater supplies. With an average cost of US$0.50/$m^3$, this is an expensive source of irrigation water, but can be cheaper than developing new supplies (World Bank 2000). The quality of treated wastewater can be better than that of many freshwater sources used for agriculture and its quantity is reliable, because it is directly related to urban use, which is fairly constant. On average, across the region, 2 percent of water use comes from treated wastewater. Egypt, Kuwait, Jordan, Saudi Arabia, Oman, Syria, Tunisia, and the United Arab Emirates reuse treated domestic wastewater to some extent. The Gulf countries use about 40 percent of the wastewater that is treated to irrigate nonedible crops, for fodder, and for landscaping. (Approximately 50 percent of municipal water, however, is discharged untreated.) Saudi Arabia reuses just 16 percent of its treated wastewater (World Bank 2004e). In Libya, some 40 million m^3 of the 600 million m^3 (6.6 percent) of wastewater generated annually is treated and reused on fodder crops, ornamental trees, and lawns. Israel has long operated large-scale treatment plants for reuse, and plans to provide half of all irrigation water from this source by 2010 (Tal 2006). In Jordan, treated wastewater blended with freshwater irrigates food crops on some 10,600 hectares, and provides about 12 percent of the country's irrigation water (Malkawi 2003). In Tunisia, around 30 percent of treated wastewater is reused in agriculture and other uses.

Public resistance to using treated wastewater is strong but diminishing. The public is beginning to accept the need for reuse because of the

scarcity, especially when used for non-edible crops, gardens, and the like rather than food crops (Faruqui, Biswas, and Bino 2001). A survey in West Bank and Gaza, for example, indicates that 55 percent of respondents from the general public believe that treated wastewater is a useable water source.

These new technologies that provide "produced" water can be a useful element of any water strategy and are likely to gain in importance as scarcity increases. However, they will only achieve their potential in an environment of good water management when water policies are strong and authorities and service providers are accountable to the public. New water sources such as dams, interbasin transfers, desalination, and treated wastewater reuse are mostly being developed at increasing marginal cost. In the current circumstances, in which both nonwater and water polices give users overwhelming incentives to allocate and use water inefficiently, these new sources can at best only relieve the region's water stress temporarily. The new sources provide a way for policy makers to avoid the financially cheaper but politically painful process of generating more benefits from existing investments by allocating water to more efficient uses.

Investing in Water Services: Water Supply and Sanitation

Water supply and sanitation infrastructure is relatively widespread in the region. According to official data, 88 percent of the region's population now has access to improved water sources and three-quarters have access to improved sanitation (World Development Indicators 2005).[2] Coverage varies by country, as shown in table 2.3. Sanitation investments have typically lagged about a decade behind water supply. Furthermore, as in most parts of the world, service in rural communities is lower than in urban areas, with an average 70 percent of the underserved living in rural areas. Eight countries have less than 80 percent coverage of water and/or sanitation in rural areas. These figures suggest that nearly 30 million people in the region lack water services and 69 million do not have access to basic sanitation.

Investments in rural services have recently increased. In Morocco in 1994, for example, only 15 percent of the rural population had access to drinking water, but a decade later, that figure had increased to 56 percent (Royaume du Maroc, MATEE 2004). Other countries such as Tunisia and Egypt have also accelerated their efforts to extend rural services to a larger share of the population.

In September 2000, 189 nations committed themselves to the Millennium Development Goals that aim to combat poverty, hunger, disease, illiteracy, environmental degradation, and discrimination against women.

TABLE 2.3

Percentage of Population with Access to Improved Water and Basic Sanitation

Country	Urban water (%)	Rural water (%)	Urban sanitation (%)	Rural sanitation (%)
Algeria	92	80	99	82
Bahrain	100	100	100	100
Djibouti	82	67	55	27
Egypt	100	97	84	56
Iran	98	83	86	78
Iraq	97	50	95	48
Jordan	91	91	94	85
Kuwait	100	100	100	100
Lebanon	100	100	100	87
Libya	72	68	97	96
Morocco	99	56	83	31
Oman	81	72	97	61
Qatar	100	100	100	100
Saudi Arabia	97	97	100	100
Syria	94	64	97	56
Tunisia	94	60	90	62
United Arab Emirates	100	100	100	100
Yemen	74	68	76	14
West Bank and Gaza (urban and rural, 2003)	87	87	26	26

Sources: World Development Indicators 2005; sources for West Bank and Gaza are USAID-PWA 2003, World Bank 2004j, 2005d.

Goal No. 7 includes the target to "halve by 2015 the proportion of people without sustainable access to improved drinking water and basic sanitation." Most MENA countries are projected to meet the Millennium Development Goal targets but, even so, large numbers of people in the region will remain without basic services. Official data indicate that MENA countries and territories, with the exception of Djibouti, West Bank and Gaza, and Yemen, are likely to accomplish these goals (AWC 2006; World Bank 2005h). Nevertheless, even if the target is met, 14 million people across the region will remain underserved with basic water supply, and 40 million will not have access to basic sanitation, three-quarters of them in rural areas.

Most of the infrastructure, however, does not deliver services as designed. Recording how much infrastructure is built is easier than measuring how well it actually functions, but most estimates indicate that service levels are considerably lower than intended. In Iran, the official figure indicates that 83 percent of the 22 million people who live in rural areas have access to improved water supply. However, when Iran's National Water and Wastewater Engineering Company conducted a survey in 2005, the findings suggested that only 58 percent actually receive safe water services. Some 30 percent of the facilities supply less than one-

third of their design capacity and 20 percent are nonoperational because either the source has dried up or because water quality has deteriorated beyond the plant's capacity to treat it. The same survey also indicated that 20 percent of latrines in rural areas were unsanitary (World Bank 2005f). Often, poor performance of most MENA water utilities can be traced to the existing financing arrangements, under which low tariffs result in inadequate cash flow from users. Consequently, these utilities have been largely managed as government departments, rather than as business enterprises that respond to user demand.

Investing in Water Services: Irrigation and Drainage

Irrigation networks, which use 85 percent of the region's water, have expanded across the region over the past two decades. The MENA region has large irrigated areas, as shown in table 2.4 and in map 4 in chapter 1. The total irrigated area in the region is the same as that in the United States. Iran alone has the world's fifth largest expanse of irrigated land, although it has water stored in reservoirs to irrigate a lot more (ICID database). This irrigated area has huge implications for water resource management: 1,000 hectares of gravity irrigation consumes on peak days the equivalent of a city of 1 million people (Tunisia Ministry of Agriculture and Hydraulic Resources 2006).

Several countries in the region are overequipped with irrigation infrastructure, given the amount of water they have available. In many

TABLE 2.4

Area Equipped for Irrigation in MENA, 2000

Country	Area equipped for irrigation (thousand hectares)	Percentage increase in irrigated area since 1970
Algeria	569	101
Egypt	3,422	20
Iran (2005)	8,100	40
Iraq (1990)	3,525	138
Jordan (1995)	73	114
Lebanon (1995)	88	29
Libya	470	169
Morocco	1,443	57
Oman	73	150
Saudi Arabia	1,731	374
Syria	1,267	181
Tunisia	394	338
United Arab Emirates (1995)	67	1,234
Yemen (1995)	482	85

Source: FAO AQUASTAT 2002.

Note: Countries with less than 50,000 hectares total area were omitted.

years in Algeria, Iraq, Jordan, Libya, Morocco, and Yemen, water does not reach the entire area equipped for irrigation. As much as half of the land equipped for irrigation is left without service, though the situation varies from year to year and across different perimeters. This is caused by a number of factors that vary from country to country, but include planning based on average rainfall rather than facilities designed to cope with extremes, and difficulties managing and maintaining the infrastructure (Government of Libya 2005; IDB 2005; Maroc MATEE 2004; World Bank 2006g).

Progress Dealing with Organizational Scarcity

Water organizations take several forms: agencies that manage the quantity and quality of water resources and promote intersectoral planning; those that provide service or regulate service providers; and those that manage the financing of water investments.

Investing in Water Organizations

Several countries have reorganized the institutional structures governing water. Until recently, responsibility for different aspects of water lay with different agencies, which often had unclear or overlapping functions. However, most countries have now rationalized and consolidated these responsibilities, and made one ministry responsible for water planning, legislation, investments, and some water-related services. Water resource management can be the responsibility of ministries of irrigation (Jordan, Egypt, Syria), agriculture (Bahrain, Djibouti, Tunisia,), energy or electricity (Iran, Kuwait, Lebanon, Saudi Arabia), or planning or environment (Morocco, Oman, Yemen). Algeria has a dedicated Ministry of Water. Responsibility for water supply and sanitation tends to lie elsewhere.[3] The ministries responsible for water supply and sanitation are in most cases responsible for both service delivery and regulation of the quality of service, although Jordan, Morocco, and Tunisia have separated operational and regulatory functions. Many countries have also established committees or councils charged with interministerial coordination, although decision-making powers of these committees are often weak.

Many countries have begun to decentralize water decision making. International experience recognizes that water management should take place at the lowest appropriate administrative level, and that the river basin is a good unit for integrated water resource management. Even though the governments of the region are highly centralized relative to

the rest of the world (Arzaghi and Henderson 2002), several have managed to decentralize responsibility for water resource or water service management, or both. Morocco has the longest experience in MENA with basin agencies, established legally by its 1995 water law. One pilot agency began operating in 1996 with six more formed after 2002 (Ecology and Environment, Inc. 2003). Algeria established five river basin agencies in 1996 after an amendment to the 1983 water law (Benblidia 2005a). Tunisia and Lebanon have split responsibility for water management along administrative rather than watershed borders, with 23 financially autonomous public provincial offices in Tunisia, and 22 regional water authorities in Lebanon. Yemen has begun deconcentrating regulatory responsibility to the regional level through branch offices of the National Water Resources Authority.

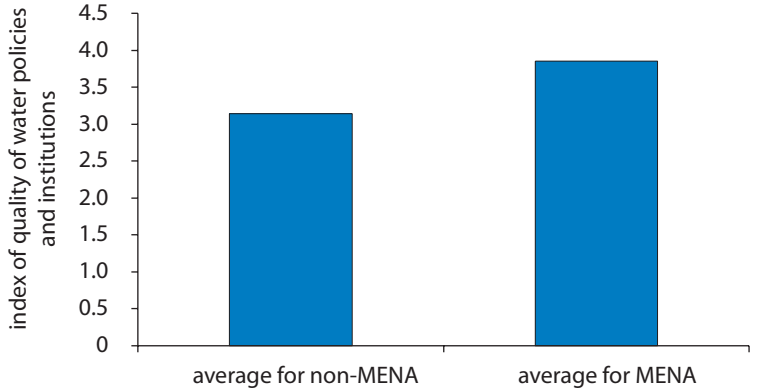
Countries have made progress in passing new water legislation and developing strategies that are consistent with international good practice. Four countries have passed modern water laws: Morocco in 1995, Djibouti in 1996, and both Yemen and West Bank and Gaza in 2002. Other countries have published official water resource management strategies since the late 1990s, including Bahrain, Djibouti, Egypt, Iran, Jordan, Lebanon, Libya, Saudi Arabia, Syria, Tunisia, West Bank and Gaza, and Yemen (CEDARE 2005). The legislative changes usually recognize the need to manage both the water resource and water service delivery aspects.

These organizational changes have brought the region's freshwater resources management institutions ahead of those in other developing countries. An internationally comparable index evaluates countries' policies and institutions for freshwater management. This index covers the adequacy of the policy mix (legislation, property rights, and rationing or allocation mechanisms) as well as instruments and policies to control water pollution (standards, pollution management instruments, involvement of stakeholders). Taking the score for 10 MENA countries and 27 low- and middle-income countries from outside the region, water policies and institutions are better on average in MENA than in other regions, as figure 2.4 shows. This reflects the efforts the region has made to improve water management organizations and policies to manage water.

However, the new policies and organizations are not fully achieving their intended goals in most countries, for three primary reasons. First, the existing regime of subsidies does not encourage growth of organizational capacity. Water organizations are unable to attract and retain staff with the range of skills (particularly finance and commercial operations) required for efficient service delivery. Instead, with unclear accountability structures and resource and performance management systems that provide poor incentives for good outcomes, they are reduced to a status

FIGURE 2.4

Evaluation of Water Policies and Organizations: MENA and Comparator Countries, 2004



Source: World Bank 2004a.

of perpetual dependence on allocations from the public budget (AWC 2006).[4] Second, legislation often lacks the necessary implementing rules and regulations and many of the water laws themselves lack key provisions, such as the definitions of penalties for infraction, to allow new organizations to raise revenues, hire staff, and otherwise fulfill their mandates (Benblidia 2005a; World Bank 2003c, 2004g; UNESCWA 2001). Third, enforcement tends to be weak. Studies of the water sector in the region often mention limited or inconsistent enforcement of legislation, limited sanctions for violations, and the lack of an impartial judiciary as reasons for water management problems and conflicts (CEDARE 2006; World Bank 2003c, 2004b, 2004g, 2005a, 2005e, 2005m, 2006g)

It is becoming increasingly urgent to make the new organizations function as intended. As competition for dwindling resources increases; as customers demand increasingly complex services; as new market opportunities emerge that depend on clean water or clean environments (agricultural exports, tourism); as affordable supplies become more and more scarce, in spite of investments in new technologies; as infrastructure needs to be maintained or replaced; and as the resource becomes increasingly degraded by pollution and overextraction, water management is becoming more and more essential. MENA countries need water organizations to manage supplies, to ensure that reliable services are provided, and to protect the environment.

Yet, transforming water organizations that have traditionally focused on supply enhancement and direct service provision into ones that manage resources and services is challenging. A determination at the highest political level can provide such a transformation. In the absence of that

political driver, the most likely cause of such a transformation is an improvement of public accountability at the national, regional, and local levels (see chapter 4). Communities and organizations need to come to a shared vision of the needs, priorities, and actions and then work to implement that vision. The challenge today is to work out new institutional and financing mechanisms that are able to respond to societies' changing priorities and carry out reforms such as reallocating water from agriculture to municipal, industrial, environmental, and other uses if needed. Under these changing circumstances, a legal, financing, and regulatory framework needs to support an integrated package of instruments—water allocation, rights, cost recovery, regulation—that would structure the relationships among water users so that water is used in an environmentally and financially sustainable fashion.

Water Supply and Sanitation Organizations

Over the past few decades, several countries in the region have focused on improving not only coverage but also the quality of water supply and sanitation services. While the majority of utilities in the region suffer from problems such as unclear lines of responsibility for operations, low tariffs, difficulties retaining qualified personnel, and political interference in staffing policies and other aspects of operations, some countries have improved urban water supply services. Various institutional models have been tested in this process: the examples come from utilities run by the public sector, under management contract, and under concession to the private sector. Box 2.2 summarizes these improvements in Tunisia, Jordan, Morocco, and Egypt.

However, the progress does not hide the fact that most MENA utilities operate with weak incentives for improving organizational performance and therefore deliver relatively poor quality services. Most MENA water utilities are dependent on direct or indirect government support to finance their investments and operations and maintenance. This inability to generate cash flow from the water service business largely results from political reluctance to raise water tariffs. In these situations, water utility managers are not empowered to manage their enterprises on commercial principles, and have few incentives for efficient management. Consumers are equally dissatisfied by the poor levels of service. The bottom line is that utility managers need to spend their energy lobbying for funds from governments, giving them less time to spend on improving service. A recent study in Egypt showed, for example, that if urban water tariffs were raised to cover operations and maintenance costs, enough financial resources could be freed up to finance urgently required investment in sanitation infrastructure (World Bank 2005b).

Irrigation Organizations

Many countries in the region have made considerable progress passing some responsibility for operating and managing irrigation systems to groups of users known as Water User Associations (WUAs). These organizations directly involve users in determining service levels, charges, and water allocations. Members of WUAs typically elect individuals to a governing board. The board then follows established, transparent procedures to decide upon capital expenditure or change in leadership. Members are generally obliged to finance part of the infrastructure and the operations and maintenance costs. Egypt, Iran, Jordan, Libya, Morocco, Oman, Tunisia, and Yemen are among several countries promoting this form of irrigation management (Government of Libya 2005; GTZ 2005; Royaume Maroc MATEE 2004). Egypt has been piloting WUAs that manage local infrastructure as well as larger scale canals (that is, at the tertiary, secondary, and district levels) since 1999. Secondary associations (known as Branch Canal WUAs) involve other water users in decision making and cover environmental issues as well as irrigation and drainage, while tertiary associations deal with day-to-day operation and maintenance issues. The pilots have reduced public financing of the water distribution infrastructure and demonstrated more efficient operations and maintenance, less water pollution, and more efficient water use (AWC 2006). In Yemen, participatory regulatory systems have helped improve irrigation services. Water saving technologies and regulatory systems were designed in consultation with users to ensure that the technologies meet farmers' needs and that regulatory systems are equitable. A high degree of beneficiary ownership and the existing financial arrangements give farmers an incentive to maintain the modern irrigation equipment and replace it after the end of its economic life (World Bank 2005m).

At the central government level, Egypt demonstrated how a flexible government organization can help deliver real improvements to the population and help achieve the full benefits of a public investment because the government was able to adapt to environmental problems that arose after constructing the Aswan High Dam (AHD). The AHD changed the hydrology of the basin. Traditional Egyptian agriculture, practiced over five millennia, grew one crop per year, which was sustainable because it did not degrade land quality. After construction, the AHD made water available for perennial irrigation and increased crop intensity to 200 percent. This increased application of water led to land salinization and waterlogging that could have undermined Egypt's productivity gains. Addressing these problems required installation of drainage infrastructure, which was not popular with farmers, because these traditional open field drains used up 10 percent of the land area. The government managed to

BOX 2.2

Progress Providing Water Supply

In **Tunisia,** publicly owned and operated urban water supply and sanitation services perform reasonably well. Tunisia has a publicly owned operator, the *Société Nationale d'Exploitation et de Distribution des Eaux* (SONEDE), which is responsible for domestic and industrial water supply in all of the country's urban areas. SONEDE, regulated by the Ministry of Agriculture, Environment, and Water Resources, has financial independence, a predictable series of tariff increases, and a clear set of performance standards. Coverage is universal, water is available 24 hours a day, and losses are relatively low (World Bank 2000; 2005g).

In **Jordan,** a management contract with a private firm is increasing system efficiency within severe contractual constraints. The Ministry of Water and Irrigation manages the country's water resources and regulates services provided by the Water Authority of Jordan (WAJ). The country has several models for promoting efficiency: (a) a Build-Operate-Transfer contract in force for the Asamra wastewater treatment plant near Zarqa; (b) a commercially run public utility in Aqaba on the Red Sea; and (c) a management contract for the city of Amman that began in 1999. In each case, the ministry is the regulator and the WAJ is the executing agency, although in practice, lines of responsibility are often unclear (Rygg 2005). In Amman, under the terms of the contract, the private company (LEMA) is responsible for providing water, for customer service, for dealing with complaints, and for maintaining the tertiary network (pipes within 500 meters of housing). LEMA does not set prices, but is empowered to discontinue service to nonpaying customers. The company can reduce staff—by moving them to the Ministry of Water and Irrigation. LEMA has delivered positive results. It now covers 125 percent of its operations and maintenance costs, in contrast with utilities in other cities, which cover a far lower share. Service has improved, with hours of service up from 32 hours per week before the contract to 40–45 hours per week in 2003. LEMA has reduced unaccounted for water from 55 percent in 1999 to 43 percent in 2004, although improvement has been slower than expected. Customer satisfaction has increased.

In **Morocco,** concession of water supply and sanitation services to the private sector in four large cities has provided incentives for improved performance. The government regulates the concessions through the Delegating Authority, which determines tariff caps, service standards, priority projects, and investment obligations. The contracts stipulate investments of almost US$4 billion over a 30-year period. The Delegating Authority has required the concessionaire to extend the water network to low-income

innovate and develop subsurface drains, which it installed on more than 2 million hectares, at a total cost of US$1 billion. Although in general, Egypt has a large centralized bureaucracy, unresponsive to clients and with a history of low cost recovery in the water sector, in this case the

households using a "work fund," which is financed by the cities' network access fees and 0.5 percent of tariff revenues. Private operators are aware that popular opposition to their concessions may harm their chances of continuing their contracts, and have adopted a consumer-responsive approach. Rules and guidelines for adjusting tariffs are flexible: in Rabat, Tangiers, and Tetouan, a price cap requires that any tariff increase of more than 3 percent be made in agreement with the government. Inflation adjustments to tariffs are allowed only if the concessionaires have met all investment obligations. The government also retains the ability to make unilateral changes to tariffs, for "reasons of public interest," as long as it compensates the private operators for any losses. These rules on tariff adjustment, coupled with the fact that the contracts allow private operators to keep a large share of their profits, provide incentives for the private operators to control costs and improve efficiency, to the benefit of the customers. The investments as well as operational improvements have improved service. Water is now available 24 hours a day in these four cities and water supply connections have increased by almost one-third since the concession began. Private investments in sanitation alone amounted to €97 million (US$94 million [average 1997–2001 exchange rate]) between 1997 and 2001. A combination of tariffs that increased three-fold, introduction of a sanitation charge, and reduced leakage have reduced demand by approximately 3 percent per year. As a result, demand projections are lower than previously estimated, reducing the need for dam construction and saving the government some US$450 million (Bouhamidi 2005).

Egypt has improved water supply services in the public sector by strengthening accountability mechanisms. The government separated service provision from regulation by creating a Holding Company for Water and Wastewater in 2004 to manage water services in 14 cities. It then held the Holding Company accountable for achieving progress against a series of performance indicators monitored monthly. The indicators include quality of drinking water, response to public complaints, and improvements in revenue collection. The company has set up performance incentives for staff responsible for bill collection. It has also helped improve consumer trust in the accuracy of the water bills by overhauling domestic water meters. Most of the affiliated companies are now recovering 90 percent of operations and maintenance costs, with 150 percent cost recovery in Alexandria (Khalifa).

government was able to make a series of organizational, technical, and financial innovations. Institutionally, it created the Egyptian Public Authority for Drainage Projects within the Ministry of Water Resources and Irrigation. This organization was able to act flexibly and rapidly to

address the drainage problems. Financially, it implemented a policy of full cost recovery for field level drainage investments. Technically, it adapted the leading international experience to develop tile drains that would perform efficiently without taking up valuable agricultural land. A recent international review concluded that Egypt is "one of the few countries worldwide that has developed institutions with capacities to address drainage needs" (Friesen and Scheumann 2001). This example illustrates the importance of actions to address the second level of scarcity if countries are to benefit from investments that tackle the first level of scarcity.

Organizations to Rebalance the Financing Burdens

Several countries have taken steps to reduce public expenditure on water services and to provide incentives to increase service efficiency. Although most MENA countries continue to subsidize water supply, sanitation, and irrigation services, Morocco and Tunisia have introduced hard budget constraints on water supply and sanitation operators. This gives utilities a predictable financial environment and an incentive to make their operations more cost efficient. The same countries introduced volumetric pricing for public irrigation, charging farmers by the amount of water they use, rather than the hectares they have under cultivation. Irrigation charges almost completely cover operations and maintenance in Tunisia and are moving toward that goal in Morocco. As mentioned in box 2.2, concessions to private operators in four cities in Morocco have led to private sector investment in water and wastewater networks.

The potential for private financing for water services is now being realized in some countries. To overcome problems of groundwater depletion in the Guerdane perimeter near Agadir in Morocco, the government is planning a US$150 million water transfer scheme. The government will finance 42 percent of the capital costs and an irrigation network to distribute the water. Attracted by the relatively high and reliable incomes of the farmers, a private operator has agreed to cover the remainder of the investment costs, and will manage the operation (World Bank 2006c). A similar project is under preparation in the West Delta of Egypt. In both examples, farmers are growing high-value crops for export and are willing to pay tariffs at full cost recovery levels for reliable, good-quality water services. These tariffs, in turn, enable private operators to recover investment costs through cash flow. Similar models are possible for urban water supply only when existing tariff and regulatory policies are reexamined for losses and gains to society.

Organizations to Improve End-User Efficiency and Equity

Several countries in the Middle East and North Africa region have subsidized programs to encourage more efficient use of water in agriculture.[5] Given the dominance of agriculture in water allocations and the low value-added of much of the region's irrigated agriculture, irrigation efficiency is a key part of any water management strategy and could be used to reduce pressure on water resources, to reallocate water to meet the demands of urban growth and/or to release water to support basic environmental services.

Water saving investments have increased "dollars per drop" and farm profits, but have often not released water from the agriculture sector. Water that was previously "wasted" was often used by others downstream. Tunisia's water saving program, the PNEE, has equipped 305,000 hectares, or 76 percent of all irrigated area, with water saving technology (Tunisie MAERH 2005). This increased water use efficiency from 50 percent in 1990 to 75 percent today (Tunisie MAERH 2005). Although it was not the explicit goal of the country's water saving program, it is worth noting that water consumption has stayed relatively constant because farmers had used the water they had saved to expand irrigated areas, or had switched to higher-value but more water-intensive crips and/or increased cropping intensity.

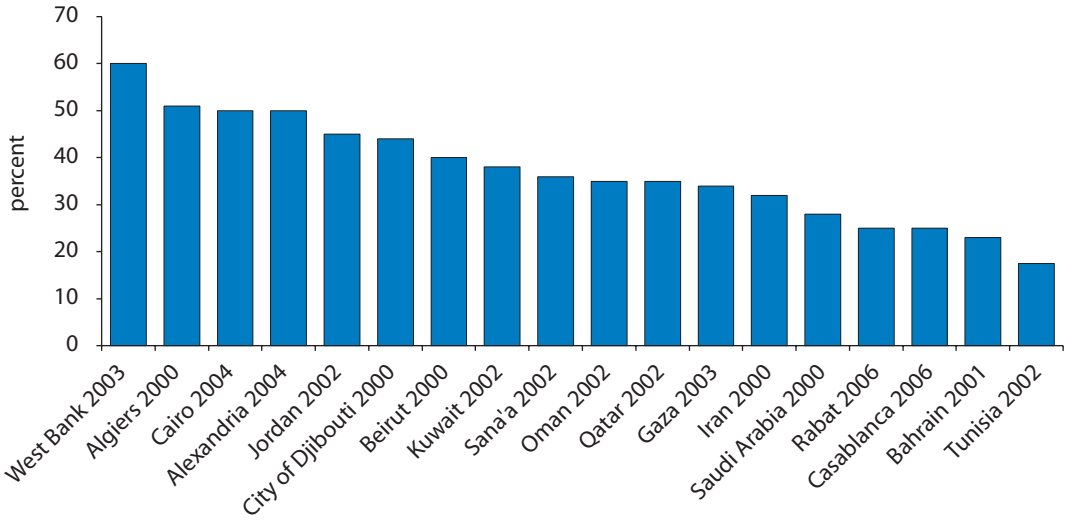
Increasing efficiency in the region's urban water supply and sanitation is important, primarily for financial reasons. In general, public sector utilities do not have incentives to conserve water, and most utilities in most MENA cities have water losses of over 30 percent (see figure 2.5). From a resource point of view, these losses are not significant because the urban water sector consumes only 10 to 15 percent of the region's water, but these add up to substantial financial losses from public investments. The best performing utilities in the MENA region operate with clear incentives to improve their financial performance. In pursuing that objective, they have implemented water loss reduction programs with some effect. However, even in these cases, water losses in the region remain considerably higher than the levels considered to be the international best practice (losses of less than 10 percent), though comparable with average water loss rates in the countries of Western Europe and the United States.

Progress Dealing with Scarcity of Accountability

Mechanisms that promote accountability for sustainable outcomes affect water management decisions at every level. Accountability mechanisms help determine how the rules are made, what they contain, and how they

FIGURE 2.5

Nonrevenue Water Ratio for Utilities in Select Countries and Major Cities



Source: Refer to appendix 3 country tables.

Note: Nonrevenue water is water purified and pumped into the distribution system, for which either customers are not billed or the bills collected. Where national data were not available, the capital city or cities with a population over 1 million were used.

are implemented. They include measures to promote transparency and inclusiveness. Within the water sector, accountability mechanisms ensure that policy makers and service providers face consequences for good and bad performance. Outside the water sector, mechanisms to promote accountability within the government, such as government watchdogs, parliamentary inquiries, and the judicial system, all work to create an environment of transparency and participation necessary for making difficult decisions with broad social impacts such as allocations of scarce water resources and public financing for water services. These decision-making processes require a broader engagement of stakeholders over a long time frame and concern both water allocation among sectors, including the environmental needs, and ensuring effective delivery of water services.

All too often in MENA, the stalemate continues because of insufficient accountability to the public. Governments have retained the roles of financiers, regulators, and service providers in tightly controlled public sector entities. Powerful lobby groups, such as farmers, have protected their water allocations, leaving insufficient water for the environment and forcing policy makers to look for new sources to meet urban water needs. Consumers are provided inadequate services, albeit at sub-

sidized prices, and government finances are too stretched to invest adequately in wastewater collection and treatment.

However, several countries in the region have begun involving stakeholders in public debates about water policy and those of related sectors that affect water management. Decentralized structures such as river basin agencies can, in principle, improve participation and transparency and hence, accountability in water resource management decisions. Some countries have made strides at the central level. For example, community organizations and nongovernmental organizations (NGOs) are becoming more involved in planning processes.[6] Egypt, Jordan, Morocco, Tunisia, and West Bank and Gaza have developed water policies and strategies based on stakeholder consultations including government officials, politicians, water user associations, local communities, and the private sector (AWC 2006). Reflecting the results of consultations in the planning process and, if necessary, revising investment programs will strengthen accountability in water management.

Involving farmers in managing irrigation infrastructure increases their voice in the planning process. Farmers form water user associations, which provide formal mechanisms through which farmers can present their needs and report service problems to irrigation officials. Farmers involved in these groups frequently report that these associations help reduce tension with officials and improve services. "[W]e used to block the road between Cairo and Alexandria whenever our water did not come. Once, someone even pulled a gun on the agricultural agent. Now, we know who to talk to and we know that they listen to us."[7] The farmers also manage the allocations of water among themselves, which in many cases leads to a more transparent and self-regulating process and reduces disputes between farmers. This empowerment function is not without its problems, of course. Empowered irrigators are better able to resist reduced water allocations and increased service charges. Their empowerment can in some cases also weaken attempts to strengthen the functions of local governments.

NGOs active in environmental protection are growing in number and influence. NGOs are important advocates for increased attention to environmental issues in decision making, and they balance the more direct or immediate economic interests of other groups. In MENA, these organizations have become more active, although the extent varies from country to country. Environmental NGOs are most engaged in Morocco and least in the Gulf countries. Table 2.5 summarizes the relative strength of environmental NGOs in the region. In Tunisia, despite government funding of their operations, which may limit their activities to some extent, NGOs have helped generate environmental information and promote public awareness for environmental issues. For some spe-

TABLE 2.5

Strength of Environmental NGOs in the MENA Region

Status of NGO strength	Countries
Relatively strong	Morocco, Tunisia, Algeria (although smaller numbers of organizations), Egypt, Jordan, West Bank and Gaza, Iran
Less strong	Bahrain, United Arab Emirates, Kuwait, Qatar, Syria (NGO sector just starting up), Oman, Saudi Arabia, Libya, Yemen (low capacity), Iraq (organizations reemerging).

Source: Emad Adly, Director of RAED, personal communication, April, 2006.

cific issues, such as fauna and flora, they are the country's primary source of information. The Ministry of Agriculture, Environment, and Hydraulic Resources carried out a survey in 2004, which found that these groups had played an important role in defining the country's sustainable development goals and implementing some of the resulting action programs. The ministry found NGOs to be effective at reaching the relevant populations, especially because the ministry's local presence is limited (World Bank 2004i). Egypt has more than 270 environmental NGOs, but very few have sufficient grass-root linkages to influence the public they serve, nor, according to a recent study, are they yet able to influence the central government policy process. They have, however, been active in public debate and in enforcement of environmental laws—even taking violators to court and winning their cases (World Bank 2005a). In the hyper-arid countries, where excess extraction of very slowly renewable groundwater has major intergenerational implications, NGOs are not strong, limiting the extent of public debate about current practices.

To increase transparency, some countries have begun releasing some information to the public. The government of Egypt, for example, has developed the Egyptian Environmental Information System, which produces status reports on the state of the environment, but the information is not in the public domain. Nevertheless, the public has become more active on environmental issues, at least in part as a result of increased media coverage. All major newspapers carry weekly reports about environmental activities, and bring to the public's attention major violations of environmental legislation by state or private entities. Since 2000, the government has begun an environmental outreach program to journalists and has implemented public awareness campaigns. However, these efforts are not enough. Although it has increased, public involvement is not yet influencing the policy process significantly (World Bank 2005a). Transparency in water billing has increased collections in Amman, Jordan. Publishing the basis on which tariffs are set has been one factor in

the dramatically increased rates of cost recovery since the management contract became effective in 1999. Transparency has motivated even those high-ranking officials who were previously delinquent with their bill payments (Rygg 2005). Morocco has joined the voluntary "Blue Flag" program that sets standards for beach cleanliness and safety and requires that these be made available to the public.[8]

These steps toward increased decentralization of responsibility, increased transparency, and involvement of civil society actors, even if limited in scope, are impressive given the context. The MENA region is highly centralized. The region has the largest public sector and the largest share of central government budget in overall public funds of any region of the world. Overall, in comparison with other parts of the world, the public has relatively little real input into decision making. However, in the water and environment spheres it might be possible to tackle accountability issues that might be more contentious in other areas of the economy. The big new challenge is to develop accountability mechanisms that improve the efficiency of public finance and sustain the regenerative capacity of the water, both as instream flows in rivers and recharge of aquifers.

Conclusion

MENA countries have made considerable advances dealing with their water problems. They have addressed all three levels of scarcity, but advanced most in tackling the scarcity of the physical resource and scarcity of organizational capacity. Further progress is needed to improve accountability in the sector to help form a bridge between citizens and governments or service providers, bringing them information, voice, and access to justice.

However, despite this progress within the water sector, countries have not confronted the most important issues. Because some basic economic reforms remain to be implemented, users, particularly irrigated farmers, still have incentives to use water inefficiently. Economic rigidities still give overwhelming incentives for most users to remain with the status quo. Agricultural and trade policies combined with lack of alternative employment opportunities force farmers to remain on their plots and to grow low-risk, low-return crops. Lack of public scrutiny allows public spending to continue to be inefficient. Lack of independence for utilities combined with limited involvement of users in decision making leads to continued poor levels of urban water supply services. Countries have avoided some of the most challenging yet important issues that would lead to more efficient water management and more efficient use of pub-

lic funds spent on water. These include reducing the overall quantity of water withdrawn to protect the environment, and making water allocation more equitable and efficient, both of which have proved politically impossible until now.

There are signs that the factors that drive water management are changing. These could provide political space for reforms that have not been possible. The changes will only lead to positive outcomes, however, if external accountability mechanisms are strong. Without accountability, there is a risk that a few well-connected groups will be able to capture the benefits of the change. This is the topic of the next chapter.

Endnotes

1. This is different from the reuse of agricultural drainage water that is practiced in Egypt, Syria, and Iraq.
2. Access to improved water sources is defined as percentage of population with reasonable access to an adequate amount of water from an improved source such as household connection, public standpipe, borehole, protected well or spring, or rainwater collection. Unimproved water sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 liters/person/day from a source within 1 km of the dwelling. Access to improved sanitation is defined as percentage of the population with at least adequate access to excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection. To be effective, facilities must be correctly constructed and properly maintained.
3. For example, Egypt: Ministry of Housing, Utilities and Urban Communities; Tunisia: Ministry of Agriculture and Water Resources for water supply, Ministry of Environment and Sustainable Development for sanitation; Djibouti: overlapping between Ministries of Agriculture, Interior, and Housing; Morocco: Ministry of Planning, Water and Environment and Ministry of Interior; Bahrain: Ministry of Works and Housing for sanitation and Ministry of Electricity and Water for potable water; Kuwait: Ministry of Energy and Water for water supply and Ministry of Public Works for sanitation; Libya: Water Authority responsible directly to the Council of Ministers.
4. For example, the sector in Lebanon suffers institutional problems including "dearth of technical staff; very low procurement limits...many employees near retirement; ...lack of maps showing water supply networks; low collection rates..." World Bank 2003c, p. 32.
5. Tunisia: National Program for Water Saving in Agriculture; Morocco: National Agricultural Fund; Syria: tax-free low-interest loans through the Cooperative Agricultural Bank; Iran: investing in efficient irrigation systems on almost one-third of its irrigated land; Yemen: multiple projects including the Sana'a Basin Water Management Project, the Irrigation Improvement Project, and the Groundwater and Soil Conservation Project.

6. For example, the Arab NGO Network for Development.
7. Member of the Al-Bustan District Water Board, Egypt. June 2004. Personal communication.
8. http://www.blueflag.org/BlueFlagHistory.