Managing Water Demand

Policies, Practices and Lessons from the Middle East and North Africa Forums

Ellysar Baroudy, Abderrafii Lahlou Abid and Bayoumi Attia




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Foreword

The vast arid and semi-arid regions of the Middle East and North Africa region (MENA) constitute 85% of the region's land area and are home to approximately 60% of the region's population. Limited water resources pose severe constraints on people's economic and social progress, testing their resilience and threatening their livelihoods. Rainfall is not only scarce and unpredictable, but the region is also subject to frequent and severe droughts. Available surface water is declining and the over-pumping of groundwater beyond natural recharge rates is occurring, lowering the water table and causing an increase in groundwater salinity and ecological degradation. Water quality is also declining, as more volumes of untreated effluents are produced and dumped into fresh water bodies or onto land, making their way eventually to groundwater aquifers. All of this has tremendous implications on the health and well being of a large number of women, men and children; especially the marginalized and vulnerable poor. In these dry regions, the poor mostly consist of agro-pastoralists and small farmers whose household food security and livelihood depends, fundamentally, on water. Large farmers who grow cash crops are also affected. Poor water quantity and quality is equally devastating in

poor urban settlements, where access to any type of water, let alone safe water, is diminishing as the population grows.

It is to these challenges that Canada's **International Development Research Centre** (**IDRC**) has sought to position itself. Its mission: *empowerment through knowledge* has made it one of the world's key organizations contributing to the development of indigenous research capacity. Since its establishment, IDRC has provided funding to more than 674 institutions in MENA and has contributed more than 109 million Canadian dollars towards projects in different fields such as natural resource management, health, information and communication technologies and social and economic policy.

The International Development Research Centre (IDRC) is a public corporation created by the Parliament of Canada in 1970 to help developing countries use science and knowledge to find practical, long-term solutions to the social, economic and environmental problems they face. Support is directed toward developing an indigenous research capacity to sustain policies and technologies developing countries need to build healthier, more equitable, and more prosperous societies.

Currently, in the field of environment and natural resource management, IDRC's focus in MENA is on water, with emphasis on research to promote good water governance. In MENA, IDRC's People Land and Water program (PLaW), Cities Feeding People (CFP), and Ecosystem Approaches to Human Health (EcoHealth) have been active on a wide range of topics such as participatory water management, transboundary water issues, social perspectives and water policy, capacity development and tools, wastewater and water reuse, water-health linkages, freshwater fisheries and projects focussing on linking research results to policy.

In the mid-1990s, a specific need was identified by regional water experts for a mechanism to further knowledge on water demand management (WDM). A research network was set up and important contributions to knowledge through applied research were gained. In 1999, the project was redesigned to become a mechanism for the transfer of knowledge, experience and good practices to decision-makers. Following a regional survey, the **Water Demand Management Forum** was developed to further deepen knowledge and exchange on specific and more focused WDM areas, identified in the consultations as priorities, whereby decision-makers act as the vectors of knowledge transfer. Donors were also attracted by the new approach and supported it significantly.

One important product of the Forums is this book. It synthesises the outputs and results from the four events. It is written for the policy community who were active participants by contributing actively in discussions and presented case studies and formulated recommendations. This book provides as comprehensive an account as possible of the tools used to manage demand in

the MENA region, as documented between 2002 and 2003 by the policy community. It looks at what has worked, what hasn't, and what still needs to be done in the areas of wastewater reuse, water valuation, public private partnerships and decentralization and participatory irrigation management.

Though the region still has far to go, the work of the Forums has demonstrated that WDM is increasingly in the consciousness of most water decision-makers and practitioners. Yet while WDM is occurring in the region, it is without the breadth and strength that is needed to mitigate the current water crisis. There is therefore great scope for further analytical work and ways to further promote its adoption in the region. IDRC and its partners are continuing to invest resources on such efforts.

The follow-up project from the Forums is entitled the **Regional Water Demand Initiative**, better known as **WaDI*mena***. Initiated in June 2004, WaDI*mena* promotes effective water governance by enhancing water use efficiency, equity and sustainability in the countries of the MENA region. The objectives of WaDI*mena* are to improve research in WDM and its associated challenges, opportunities and incentives for *practical* application in specific contexts. The project strengthens the skill-sets and capacities of individuals and institutions to positively affect WDM implementation. A network has already been established with the participants from the Forums and is currently being augmented to include the research and policy communities, NGOs, and civil society groups that are key water users. Special attention will be given to those groups representing the rural poor and women. Finally, WaDI*mena* aims to strengthen relationships and collaborative arrangements with national, regional and international water governance programmes to motivate the WDM agenda. Information on WaDI*mena* can be found on www.idrc.ca/waterdemand.

We hope that this book will provide some of the necessary knowledge required to further promote WDM in Algeria, Egypt, Jordan, Lebanon, Morocco, the Palestinian Territories, Syria, Tunisia, Yemen and beyond; while providing insight into the work required for much needed change to improve water governance. It is the result of cooperation and partnerships among our partners and the countries of the region, which we hope will continue.

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1.

Water Demand Management: The Way Forward?

Ellysar Baroudy

Water Demand Management (WDM) is about governance and tools that motivate people and their activities to regulate the amount and manner in which they access, use and dispose of water to alleviate pressure on freshwater supplies. It is also about protecting water quality. The development and promotion of such WDM practices, primarily for governments in the Middle East and North Africa (MENA) region[1], have constituted the core objectives supported by IDRC and its partners through the Water Demand Management Forums.

[1] Participants in the WDM Forums included representatives from the nine active countries in the project: Algeria, Egypt, Jordan, Lebanon, Morocco, the Palestinian Territories, Syria, Tunisia and Yemen.

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The WDM Forums were implemented between 2002 and 2003, to show that water demand management improves the effective use of scarce water resources and complements the traditional supply-orientated technologies, policies and institutions with which freshwater is managed in MENA. The Forums, attended by over 500 decision-makers, organised and facilitated the exchange of information, results and lessons learned among decision-makers of all water sectors in the MENA region in four strategic areas:

- **Wastewater Reuse**, Rabat, Morocco, in March 2002;
- **Water Valuation**, Beirut, Lebanon, in June 2002;
- **Public-Private Partnerships**, Amman, Jordan, in October 2002; and
- **Decentralization and Participatory Irrigation Management**, Cairo, Egypt, in February 2003.

These events brought new perspectives to the management of water shortages. They were undertaken by IDRC with the support of two main donors: the Canadian International Development Agency (CIDA) and the Government of Japan through the United Nations Development Programme's Special Unit for Technical Cooperation among Developing Countries (UNDP-TCDC). Other partners that supported individual forums included: the International Fund for Agricultural Development (IFAD), the German Technical Cooperation (GTZ), the US Agency for International Development (USAID) and the Governments of Lebanon and Jordan.

RATIONALE FOR THE WATER DEMAND MANAGEMENT FORUMS

The MENA region suffers from the least water availability per capita compared with any other region in the world. It has less than 1% of the world's freshwater resources and 5% of the world population (World Bank, 2002). Water problems are exacerbated by pollution from human activities that negatively affects water quality and can further lower water quantities available. These challenges will get worse in the future, as populations increase, overexploitation of current water resources and pollution continues, and the corresponding demand for more freshwater continues to be on the rise. Supply orientated management, usually centralized, generally means that governments make available freshwater at the lowest cost possible to people, farmers and industries, usually exploiting freshwater sources to the fullest. Minimum attention is paid to equity in people's access to water and the sustainability of hydrological systems and water quality. This trend makes apparent the inadequacy of supply-orientated approaches common to MENA freshwater management and highlights the need for alternative or complementary tools. The status quo has to change since water

shortages are a significant threat to development in the MENA region (World Water Council, 2003).

A summary of the MENA water situation can be found in Table 1.1 below. The table shows clearly that six of the nine WDM Forum countries listed already face severe water stress, with levels often well below the redline figure of 1000m^3 per capita per year.

Table 1.1 Basic data on MENA countries in the WDM Forum.

Country	Population (000)	Land area (000 km^2)	GNI per capita ($)	Agriculture as % of GDP	Life expectancy at birth (years)	Freshwater per capita (m^3 per year)	Population with access to improved water services (%)
Algeria	29,950	2,381.7	1,550	11	71	477	94
Egypt	62,655	995.5	1,380	17	67	930	95
Jordan	4,740	88.9	1,630	2	71	148	96
Lebanon	4,271	10.2	3,700	12	70	1,124	100
Morocco	28,238	446.3	1,190	15	67	1,062	82
Syria	15,711	183.8	970	NA	69	2,845	80
Tunisia	9,457	155.4	2,090	13	73	434	NA
West Bank and Gaza	2,839	NA	1,780	17	72	NA	NA
Yemen	17,048	528.0	360	17	56	241	69

Source: Adapted from Grover (2002) and based on the World Bank Atlas (2001). Note: Shaded areas indicate water scarcity at less than 1000m^3 per capita/year. GNI: gross national income; GDP: gross domestic product; NA: not available.

In his well-received opening speech at the Wastewater Reuse forum, Mr Zahir Jamal, UNDP's Chief of the Regional Programme Division, Regional Bureau for Arab States quoted W.H. Auden who once said: "*Millions of people have lived without love. None has lived without water.*" For Mr Jamal, as well as the majority of speakers at the forums, it was widely acknowledged that water management cannot be undertaken sector-by-sector, and that a paradigm shift to a holistic vision is necessary, where WDM is part of that integrated approach. The broad contextual framework for water was outlined in this UNDP speech:

- Water is an important component of a good governance strategy;
- Water is a vector of paramount importance in matters of public health;
- Water must be part of the education curriculum in our schools;
- Water must continue to remain a subject of research and of knowledge transfer;
- Water is an obvious area for action in matters of decentralization, regionalization and local management;
- Water is an unavoidable but fragile ingredient of agricultural or industrial development;
- And, finally, water is an integral part of any environmental strategy and is critical for maintaining an ecological balance and biodiversity.

WHAT IS WATER DEMAND MANAGEMENT?

Water Demand Management (WDM) is a combination of measures to motivate people and their activities to regulate the amount, manner and price in which they access, use and dispose of water, thus alleviating pressure on freshwater supplies and protecting quality. As freshwater supplies dwindle, conservation and efficient use, of both quantity and quality of water, become imperative. Water demand can be managed through a number of wide-ranging measures and practices: non-financial (e.g. awareness, technology) or financial (e.g. incentives, pricing), mandatory (e.g. regulations) or optional (e.g. market systems).

The most recent WDM definition by Brooks (2003) states that WDM may be technical, economic, administrative, financial or social to:

- Improve the efficiency of water used to achieve a specific task;
- Adjust the nature of the task or the way it is accomplished so that it can be achieved with less water or with lower quality water;
- Minimise the loss in quantity or quality of water as it flows from source through use to disposal;
- Continue to provide water at times of drought when water is in short supply.

WDM can be summarized to mean any method that saves water, or at least saves higher quality water.

More holistically, WDM also:

- Improves water savings through maximizing efficiency of use;
- Protects the quality of water, and matching quality of water supplied to use;
- Uses non-conventional sources (e.g. brackish water, wastewater, grey water); and
- Considers the reallocation of water of different quality among sectors.

WDM should have an impact on both water and financial savings, with fewer social and environmental drawbacks, when compared with supply management options. There are numerous attempts for more specific definitions of demand management in the literature (see Grover, 2002) including:

- Any socially beneficial action that reduces or reschedules average or peak water withdrawals or consumption from either surface or groundwater, consistent with the protection or enhancement of water quality (Tate, 1999);
- A practical strategy that improves the equitable, efficient and sustainable use of water (Deverill, 2001);

- The development and implementation of strategies aimed at influencing demand, so as to achieve efficient and sustainable use of a scarce resource (Savenije and van der Zaag, 2002);
- To get the most from the water we have (Brooks, 2002).

WHY INVOLVE DECISION-MAKERS?

A key strategy of the WDM Forum was to engage decision-makers[2] as important *agents for change* in water management in the region. These individuals are responsible for water master plans; are a key influence in rules and regulations for water; and make ultimate investment decisions in water. They are involved in all the day-to-day technical and managerial operations in the water sector. The presence of decision-makers from the same countries but different ministries represented the interests of all sectors and contributed to the sharing of knowledge within, and between, countries.

In each of the Forums, decision-makers documented their experiences in WDM strategies and shared these with their peers. The ultimate aim of this effort was to promote WDM as highly and effectively as possible onto the policy agenda and to influence change in thinking from the traditional supply-driven approach. Involving decision-makers directly facilitated the exchange and transfer of WDM knowledge and experience across the region. This was a ground-breaking approach which achieved getting decision-makers to organize systematically the know-how they have in implementing WDM related efforts.

The decision-makers represented various ministries involved in water management, including ministries of irrigation, water, agriculture, housing and the environment. There were nine core countries involved (Algeria, Egypt, Jordan, Lebanon, Morocco, Palestinian Authority, Syria, Tunisia, Yemen – see Figure 1.1) with additional contributions from other countries during certain forums (e.g. Turkey in the Decentralization and Participatory Irrigation Management Forum).

[2] The term decision-maker is used throughout this book to refer to mainly top to middle management of government representatives that made up the majority of Forum participants.

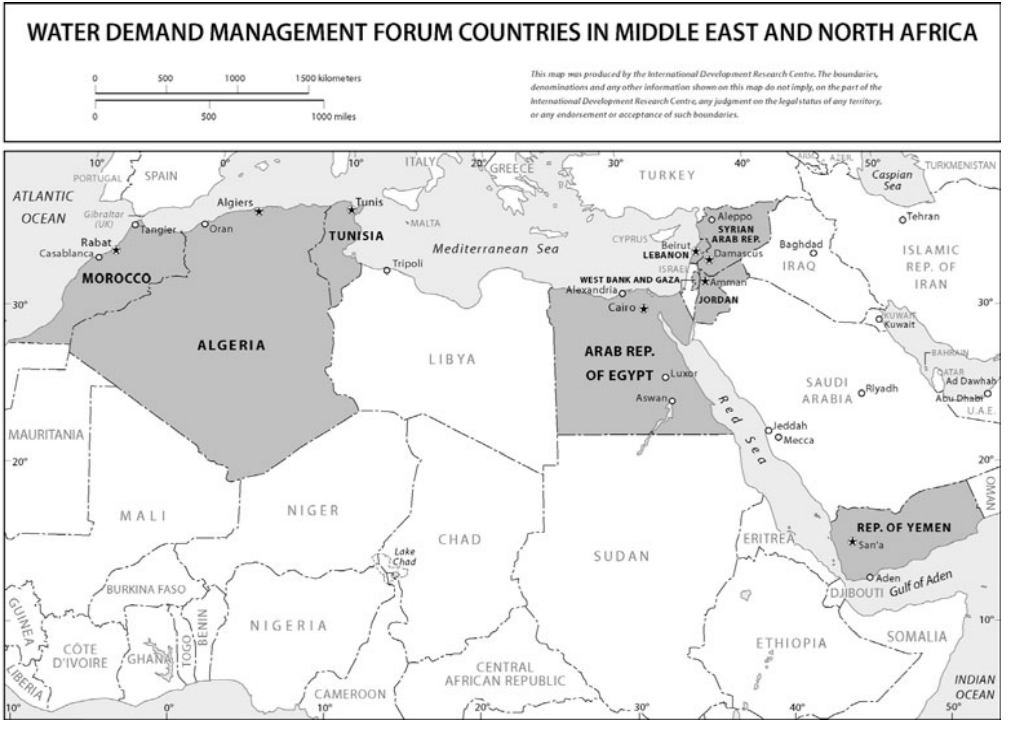

Figure 1.1 Countries that participated in the Water Demand Management Forums

The involvement of decision-makers in the forums and their tangible contribution was reflected on by Mr Mario Renaud, CIDA's former Director General for Middle East and North Africa, in his speech at the Public and Private Partnerships Forum. He paid tribute to the time and effort that participating decision-makers spent in documenting and sharing their experience, "especially since they are not academics and that their priorities lay elsewhere" and which, in Mr Renaud's words, is exactly what gives their message "its value and credibility". He also went on to say that the novelty and quality of the exchanges were pushing forward the frontiers of knowledge and applications in the field. This will contribute to MENA water managers to become world experts in dealing with acute water shortages, and that MENA countries could become international showcases.

THE KNOWLEDGE NETWORK

Although the South-South cooperation among decision-makers was meant to be the main avenue for knowledge sharing, it also contributed to the building of a network both within and between countries. The success of the network is attributed to its timeliness and the common driving factor: the immense water shortage of the region and the challenges faced by all decision-makers. The network generated information that was of value not only to the institution producing it, but also to all other participating institutions. This networking empowered decision-makers and enlightened government officials through the sharing of know-how across the region. The success of the networking is due also to implicating decision-makers at all stages of the Forum process: from choice of topic, to execution of case studies and knowledge sharing.

The sharing of practical experiences provided added value to the more readily available and accessible theoretical and academic work. The frank discussions at the WDM Forums, and the often blunt admission of failure and redundancies in certain water management cases, were valuable lessons learnt for others who are taking similar paths.

HIGHLIGHTS FROM THE FORUMS

The Forums considered water use in all areas, with a focus on the domestic and agricultural sectors, and to a lesser degree the tourist and industrial sectors. This was at the request of decision-makers as the challenges they face are mainly in the allocation of water across these competing areas. Numerous paradoxes were reflected in the forums: the most interesting of which is the documentation of caution over water pricing as it can affect the poor, and yet it is also reflected that the poor are paying more for water. This is partly due to the fact that the poor are not properly served and tend to buy their water from vendors. Another

inconsistency is the reluctance of farmers to use treated wastewater but their willingness to use wastewater *raw* when no other source is available. Below is a brief synopsis of the forum conclusions.

The **Wastewater Reuse Forum** (March 2002) demonstrated that the reuse of treated water varies widely between countries. The advantages for reuse were brought to the fore: easing pressures on conventional resources; protecting human and environmental health; reducing the costs of water treatment when sources are re-abstracted for domestic supply; and for using the nutrient rich water for agriculture. However, the difficulties of reusing wastewater were also evident. These relate primarily to health concerns and the need for awareness and acceptability by the farmers and the public; to environmental impacts (mainly eutrophication, soil salinity and sludge issues); to financing and choosing the appropriate treatment plant size and treatment method in relation to population density and proximity for potential use. Another major issue was the pricing of treated wastewater: how much to charge and how to relate the price of treated wastewater to that of freshwater in order for it to be attractive to farmers. Although the case studies focused mainly on water reuse for agriculture, municipal areas and golf courses, some touched on the relatively novel approach of using treated water to recharge aquifers. It is noted that reuse in the industrial sector in MENA is still rare.

The forum concluded with a call for an integrated management policy that views wastewater management as involving three inseparable stages: collection, treatment and reuse. Attention to treatment quality standards and matching the quality of wastewater to use is critical. The forum participants called for more efficient institutional arrangements, more consolidated legislation, more communication within the diverse ministries dealing with this issue, and above all, drew attention to the fact that the cost of no action is considerably greater than the cost of taking action.

The **Water Valuation Forum** (June 2002) dealt with the issue of valuation of water and wastewater for domestic and agricultural use. Contrary to expectations, there was genuine reflection about this issue, which is frequently assumed to be taboo in the region. Decision-makers recognise that water provision and treatment is expensive and that, in the very least, the costs for operating and maintaining these systems need to be recovered.

It was widely acknowledged that valuation is a tool for WDM. For domestic use, people's willingness to pay depends on receiving a continuous, reliable supply of potable water. In agriculture, the source of water and the costs of abstraction are key to valuation. Consideration of water quality as well as local environmental conditions and traditions are also important. Applying tariffs in agriculture depends on existing economic policies. The valuation of wastewater is dependent on infrastructure, proximity of treated water to areas where it can be used as well as consumer willingness to pay. There is more resistance to

paying for treated wastewater, and as was highlighted earlier, there is little experience on how to cost it.

The **Public-Private Partnerships (PPP) Forum** (October 2002) was appreciated as an arena for discussion as an emerging trend in the region. Bringing in the private sector is driven both by the shortage of water and by governments facing mounting pressures on their financial budgets. Although only two countries (Jordan and Morocco) could offer any substantial experience, most other countries are considering adopting some form of PPP in their management of water resources. For the time being, this is mainly for the domestic and wastewater sectors, but in Morocco for example, there is also some PPP thinking for the agriculture sector. The implications of PPP in the agriculture sector however, are wide ranging and it is not compatible with some existing policies, such as subsidies. Little impact can be expected of PPP in irrigation in the short term.

Implications for the domestic and wastewater sectors have been wide ranging. Although they have adopted different PPP options, both Morocco and Jordan offered frank discussions about the impact this had on many levels. The forum participants called for more in-depth and specialized discussion concerning contract negotiations, operations and regulations on this subject. Although it was recognised that PPP contracts in the region already in operation do not implicitly refer to WDM, some of their goals do contribute to WDM practices (e.g. reducing unaccounted for water).

The way forward

The WDM Forum recognised that a key element for change in the MENA region is *institutional reform*. In his keynote paper for the MENA regional day at the Third World Water Forum in Kyoto, Abdelkader Hamdane (2003) of the Ministry of Agriculture, Environment and Hydraulic Resources in Tunisia, argued for profound institutional reform to shift from supply management strategies to a more balanced strategy to include both supply and demand management. Hamdane identifies the key strategic elements for this reform as: political will; a global strategy of integrated water resource management; legislation and regulation; economic and financial measures; and governance of water services. To achieve this, the following accompanying measures need to be considered: information and user awareness; effective participation of users; appropriateness of training; and monitoring and evaluation. Hamdane argues that this reform can be integrated successfully within the existing political framework and economic and structural adjustment already in place.

The **Decentralization and Participatory Irrigation Management Forum** (February 2003) focused exclusively on the agriculture sector. For the region in general, the main problems with decentralization were the lack of appropriate

legal frameworks and mechanisms for monitoring and evaluation. Some countries clearly demonstrated that their initial embarkation on this route was donor driven and they called attention to the difficulties that occur when the decentralization is imposed without proper regard for local customs and traditions.

The advantages of decentralization were recognised. As the sense of responsibility and cooperation from farmers develops, greater efficiency in water use is achieved through a more flexible and farmer-responsive system. It is still not clear the extent to which water savings occur in a decentralized water management system. However, given the increased availability of water for farmers who were previously not receiving enough, there are important implications of decentralization on equity.

For countries that are achieving decentralization, there is still a mixed record of success rates in the establishment of water user associations. This is due to a variety of reasons, including poor coordination between members and service providers, weak legal frameworks and financial constraints.

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2.

Wastewater Reuse

Abderrafii Abid Lahlou

This chapter reflects the issues discussed at the Wastewater Reuse Forum, which took place in Rabat, Morocco in March 2002. There were 128 participants from eight countries in the Middle East and North Africa. Over 20 representatives attended from donor and international development agencies.

Case studies from three countries were presented: Morocco, Tunisia, and Jordan. Delegates from Algeria, Egypt, Lebanon, the Palestinian Authority and Yemen also contributed short presentations. Three workshops looked into the different aspects of reuse, and a number of recommendations were made. The event brought together decision-makers to promote dialogue and the exchange of ideas in wastewater reuse in the region. The aim of the Forum was to help those countries wishing to advance in this field to meet fellow peers working on the issues and to learn from their experience.

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INTRODUCTION

Wastewater is a potential resource of great importance, with volumes rising and continuously available. The current volume in the MENA region is estimated to be between 2-2.5 billion m_. This amount is expected to double within the next 12 to 15 years due to growing urban populations, the expansion of drinking water and sewer networks, and rising per capita consumption of drinking water in the major cities as standards of living climb (Faruqui, 2000). Wastewater reuse leads to savings in conventional water, which could then be reserved for meeting the demand for higher-quality water such as that for drinking, or for high value-added industrial and agricultural uses. Reuse can also help mitigate the impact of climate variability.

INTEGRATING REUSE INTO WATER RESOURCE MANAGEMENT: A PRESSING NEED

The case studies highlighted the importance of integrating reuse into water resource management strategies and planning, and recognised that this is part of a chain of events that cannot be disassociated: collection-treatment-reuse. In Jordan, where wastewater reuse is considered an essential element of the overall water strategy, an objective is to strengthen wastewater services and management for agricultural use, while protecting the quality of groundwater resources. In this context, the Jordanian government has decided that all new wastewater treatment projects must include reuse feasibility studies. The Tunisian government has shown a clear determination since 1995 through its decision to prepare a strategy for promoting the reuse of wastewater in all economic sectors, as confirmed in the order of 12 October 1999 by the Council of Ministers. At the same time, a rural strategy is being developed on the basis of a sectoral sanitation study. In Morocco, the Supreme Council on Water and the Climate (similar to a "water parliament") devoted a special session to wastewater reuse and confirmed the need to plan for the development of this sector.

ISSUES AND IMPLICATIONS IN THE MIDDLE EAST AND NORTH AFRICA

Standards

There are health and environmental risks associated with wastewater reuse. To limit these risks, standards for the reuse of wastewater have been developed. In 1989, Tunisia supplemented its treated wastewater reuse regulations on the basis of WHO directives so that effluents can be reused without major risk. A ban on using untreated wastewater for irrigation was put into effect. The reuse of

wastewater for agricultural purposes required authorization by the Ministry of Agriculture, upon a prior agreement with the Ministries of Health and of the Environment, setting out the precautions for the protection of farm workers, consumers and the environment. There were to be regular water and crop quality checks. Irrigation of market garden crops susceptible to contamination was prohibited outright, while a specific list of crops for which treated wastewater could be used was drawn up (including fodder, cereals, fruit and fodder orchards, flowers for drying). Impact studies are covered by regulations requiring that they must identify, evaluate and measure the direct and indirect effects of a reuse project, over both the short and long terms, and specify compensatory measures to reduce or eliminate negative environmental effects.

Morocco recently adopted reuse standards consistent with WHO directives. In Jordan, the aim is to reach international water standards and directives issued by the WHO, the FAO, and the US Environmental Protection Agency (USEPA). The standards, however, are often regarded as too strict and based on "worst-case" assumptions or conditions that are not always applicable or even justified in certain local situations.

The stricter the standards are, the more costly they are to enforce. Thus, the heavy investments required in order to reach coliform standards have discouraged many countries from adopting them (Shuval, 1987). Given the scarcity of water, poor farmers still engage in unsupervised, informal irrigation with raw wastewater in peripheral urban areas. The Morocco case study found that, despite the ban, 7,000 ha is irrigated with raw wastewater discharged by towns, using about 70 million m^3 of wastewater every year. Many types of crops are irrigated in this manner (for e.g. fodder, market gardening, field crops and orchards (Jamali and Kefati, 2002)).

Legislation and Enforcement

In Tunisia, any violation of the water code is subject to penalties: illegally irrigated crops are destroyed on the spot, by order of the regional authorities. Each region has a wastewater supervision and monitoring commission since 1995. In Morocco, the water law and its regulations form the basis of the legal framework for wastewater reuse. Enforcement will be stepped up with implementation of the watershed agencies, and a major liquid-waste cleanup program.

In Jordan, the law prohibits the use of wastewater, regardless of its quality, in the irrigation of crops that are eaten raw. This prohibition also extends to crops that are eaten cooked, unless the treated wastewater meets the standards described above. Violations of standards mean that crops are destroyed under the supervision of the sanitary authorities and the police, leading to the farmer being prosecuted and fined. The law forbids the discharge of any raw sewage

into the environment, and houses and factories that are not connected to the sewer system, but use septic tanks, must dispatch their wastewater to treatment stations or to a special disposal site. The transportation channels for this type of wastewater are not controlled, and much of it is of unknown origin. With stricter enforcement, the number of violations has declined. Al-Mulqui, Bataineh and Malkawi (2002) note that, as in most countries in the world, there are no restrictions on the quality of irrigation water, except for the effluents of wastewater treatment plants, and that these effluents are often mixed with surface waters and then used unrestrictedly for irrigation.

Institutions

The responsibility for the reuse of wastewater hinges on many governmental institutions. These include the departments responsible for water resources and planning, agriculture, irrigation, the environment, public health, and sanitation.

Tunisia has a specialized, independent sanitation institution (the National Sanitation Office, (*Office National d'Assainissement*, ONAS)) that reports to the Ministry of Environment (now the Ministry of Agriculture, Environment and Water Resources). In Morocco, sanitation is the responsibility of the local authorities (the communes), under the supervision of the Ministry of Interior. These communes do not have specific funds for this activity, and the larger towns have come increasingly to rely on public-private partnerships or specialized agencies (municipal water authorities or the *Office National de l'Eau Potable* (National Drinking Water Office)) to manage and finance sewer networks and treatment plants. The communes themselves have no motivation to process wastewater to the levels required for reuse. This fact provides even more justification for integrating reuse into an overall strategy to be managed by the river basin agencies that are being established. In Jordan, the Ministry of Water and Irrigation oversees both the Water Authority of Jordan (WAJ), which is responsible for water resource management and for the provision of water and sewage services,

Beyond the sanitation aspect, reuse is under the jurisdiction of the agriculture department (as in Morocco, Tunisia) or the water department (in Jordan). The environment ministry and its agencies are generally responsible for preparing legislation and regulations. The health ministry conducts the quality-control program, involving regular inspections of treatment plants and their workers, to monitor and treat waterborne diseases, and to ensure the sanitary quality of treated wastewater. The health ministry is also responsible for health education. Yet the lack of equipment and human resources often means that legal controls are not properly applied. Strengthening the capacities of institutions is essential in order to ensure sound reuse practices.

and the Jordan Valley Authority (JVA), which manages water resources (for irrigation and for domestic and industrial uses) in the valley.

Treatment Options

Treating wastewater can be undertaken through low- or high-tech facilities. One of the most common treatment options is multistage lagooning, which has been shown to reduce the bacterial and helminth load substantially, even when the physico-chemical quality is not improved significantly. This technology has the additional advantages of being relatively easy to operate and offers the best cost/effectiveness ratio. It also is highly appropriate given the availability of land and the sunny climate of the region.

A comparison of technologies is found in the Tunisian case study (Al Atiri, Rezgui and Aniba, 2002), which also notes that the evaporation occasioned by lagooning can augment the salinity of effluents, which affects soil productivity and reduces agricultural yields. Since 1974, priority in water treatment had been focussed on the secondary treatment of effluents, with a view to protecting the environment. However, in some cases Tunisia is undertaking tertiary treatment in order to eliminate nitrates and phosphates to protect the drinking and irrigation water in the Sidi Salem reservoir (600 million m_) and to produce wastewater that can be used without restriction for agriculture.

Stabilization ponds account for 86% of treated wastewater in Jordan, while the rest comes from mechanical plants equipped with polishing ponds. Jordan has a major stabilization pond at the As-Samra station, with a nominal capacity of 68,000 m_ per day, but its effluents are not of good quality primarily because the plant is overloaded. It currently handles three times its design flow, and because average household consumption is low, salinity levels and organic loads are very high. The As-Samra station is slated for expansion with an activated sludge unit that can handle 267,000 m_ a day (Al-Mulqui, Bataineh and Malkawi, 2002). Overloading of existing treatment stations is a common problem in the MENA region. Morocco has four stations that have been specifically designed for reuse. Techniques used are lagooning, aerated lagooning, and filtration-percolation but their nominal capacity is relatively modest.

Financing and Cost Recovery

Implementing reuse requires significant funding to cover initial investment and operating and maintenance costs. Reuse is one link in the wastewater chain: collection, treatment and reuse. Collection costs are mainly a function of the extent of the network and the number of houses served. The cost depends on the type (intensive or extensive) and the level of treatment. The cost of reuse depends on the cost of distribution, pumping and storage, and on the distance

between the treatment plant and the place of use. In the three countries, the cost recovery system is based on the principle of "polluter pays". Progressive tariffs are applied also to the volume of water consumed. In Tunisia, sewerage tariffs are applied to industry according to the pollution level of effluents.

In Morocco, pilot experiments have shown that the cost of appropriate technologies such as lagooning and filtration-percolation varies between US$0.12-0.18 per cubic meter of treated water (Jamali and Kefati, 2002). In Tunisia, investment costs are relatively high, at between US$9,000-13,500 per hectare, compared with an average of US$5,400 per hectare for small and medium-sized fields irrigated with conventional water. Transport and storage costs also increase investment expenses for reuse: they range from US$0.05-US$0.18 (Al Atiri, Rezgui and Aniba, 2002). In Jordan, operating and maintenance costs of treatment are high, varying between US$0.05-0.35 per cubic meter (Al-Mulqui, Bataineh and Malkawi 2002).

Cost recovery for reuse is poor: significant subsidies are required both for investment and operating expenses. The government supports the entire burden of building treated wastewater pumping stations, collection systems and main distribution networks. For farms irrigated with treated wastewater (apart from strictly orchard and tree operations), crop restrictions and the quality of water are such that irrigation is not sufficiently remunerative to provide total recovery of annual operating costs. In Morocco, treated wastewater is generally available to farmers at symbolic prices (US$0.05 per cubic meter). In Tunisia, the prices charged for treated wastewater were set, until 1997, at between 35-95% of the price of conventional water depending on the region (Al Atiri, Rezgui and Aniba, 2002). In 1997, the price for treated wastewater was cut significantly: from US$0.03-0.07 per cubic meter to a standard rate of US$0.02 per cubic meter. Since 2000, Tunisia's aim to provide tertiary treatment in order to produce effluent of better biological quality will require investment estimated at 10-15% of the cost of secondary treatment (Al Atiri, Rezgui and Aniba, 2002).

In Jordan, in areas near treatment stations, farmers currently pay between US$140-280 per hectare per year for treated wastewater. Nevertheless, the volume directly recycled is low in comparison with the amount of treated wastewater dumped into rivers, reservoirs and canals, where it mixes with freshwater. For water of this type, farmers pay up to $0.07 per cubic meter, roughly the same as the price for freshwater. The Jordan Valley Authority plans to raise the freshwater charge and to keep the charge for mixed water at the same level, as a means of compensating farmers for the high salinity of wastewaters (Al-Mulqui, Bataineh and Malkawi, 2002).

In the case study countries, the proceeds of treated wastewater charges go to the irrigation authority, and not to the institution that runs the sanitation system. There is no customer-supplier relationship between the producer of wastewater and the agency responsible for operation and maintenance of the irrigation water

distribution system. Moreover, there is even less of a relationship between producers and users, which would link the demand for wastewater with its qualitative and quantitative components (modalities, level, seasonal variability, etc.) and the willingness of users to pay. The participatory approach involving users' associations, which might facilitate the sharing of operating and even of renewal costs, is still very little used. While in the case of conventional farming there has been more delegation of distribution management to users' associations (GIC, *groupe d'intérêt collectif,* in Tunisia, or water users' associations in Morocco), these groups are reluctant to get involved in wastewater recycling. Nevertheless, Tunisia has recently introduced the participatory approach on a pilot basis (Al Atiri, Rezgui and Aniba, 2002).

Public Acceptance

There are no religious prohibitions on reuse in the region. On the contrary, the Council of Islamic Theologians of Saudi Arabia, the United Arab Emirates and Oman have issued a decree (*fatwa*) from the religious authorities authorizing the reuse of wastewater that has been properly treated (Faruqui, Biswas and Bino, 2001). However, with the exception of regions where water shortages are most severe, users are still resistant to reuse, finding that it compares unfavorably with conventional water sources. In particular, they object to the perceived health risks, the high degree of salinity that reduces crop yields and impacts soil productivity, and the restriction to use on crops that are not sufficiently profitable.

Governments have made significant efforts to promote the reuse of treated wastewater: setting standards, adopting legislation for their enforcement, introducing controls, and providing subsidies. All these measures are meant to reassure users and to reduce their resistance to reuse.

In Tunisia, the agricultural demand for treated wastewater is no more than 50% of perceived needs (Al Atiri, Rezgui and Aniba, 2002). Farmers' resistance has been reduced by an awareness campaign, and the scarcity of other water supplies has led some farmers to begin using wastewater, primarily for tree plantations. In Jordan, many farmers are using mixed water from the King Talal reservoir containing at least 80% treated effluent from the As-Samra treatment plant. These farmers have seen a sharp drop in their yields because of the salinity of the water. Farmers are willing to use treated wastewater when they no longer can get freshwater, or when freshwater costs them more. In Morocco, people are often reluctant to use treated wastewater because they see it as unclean, while at the same time there are farmers who are using raw sewage (Jamali and Kefati, 2002).

In the Agadir region of Morocco, farmers producing for export are reluctant to use treated wastewater for fear of losing their markets. When importers are

aware of such practices, they may refuse to buy the products offered. For example, at one time Saudi Arabia prohibited the import of vegetables from Jordan, citing health concerns over the use of wastewater for crop irrigation (World Bank and SDC, 2001). The adoption and strict enforcement of standards, together with targeted information campaigns, can help overcome consumer scepticism about the quality of produce, and this approach has been recommended for expanding or at least maintaining agricultural exports from the southern to the northern portion of the Mediterranean basin.

Reuse Practices in Countries of the Region

Despite the need for an integrated approach, regional experience shows that collection often takes little account of reuse. Wastewater systems have generally been designed on the basis of local topography with multiple discharge points to simply get rid of wastewater. Wastewater from coastal cities is dumped into the sea, often without treatment (in Morocco and Tunisia, 60% to 80% respectively of wastewater is discharged into the sea). Collection networks frequently do not extend into new districts (which would require coordinating collection with urban planners) nor are they properly maintained, which not only results in the loss of a large portion of the volumes discharged but also exposes groundwater to pollution.

In Jordan, treatment plants serve about 50% of the population. The volume of effluents in 2000 was 72.5 million m_. The volume of wastewater treated amounts to nearly 12% of the water used for irrigation (Al-Mulqui, Bataineh and Malkawi, 2002). In Tunisia, the volume of treated effluents represents 89% of water collected by the ONAS alone, and around 3% of total available water resources. Use of treated wastewater in the region remains low. The portion of recycled wastewater as a contributor to the water supply of countries of the region averages around 2%, ranging from 1% in Morocco to 8% in Jordan (World Bank and SDC, 2001).

In Morocco, the volume of directly recycled wastewater is no more than 0.5% of the water used in agriculture. A particular example is the USAID-supported Drarga project in the Agadir region, an institutional partnership under contract between the Ministry of Environment, the project managers, the Wilaya of Agadir, the commune, and a regional construction firm (Kerby and Choukrallah, 2002). This is a good example of an integrated approach: methane from the anaerobic basins is recovered and converted into energy; wastewater is sold to farmers through a users' association at a price competitive with alternative water sources (US$0.05 per cubic meter, a price that will rise gradually as crop yields increase); sludge is dried and composted with solid wastes from Drarga.

In Jordan, treated wastewater effluents are discharged into open wadis or reservoirs. In this way 1,570 hectares are irrigated using 15.7 million m_ of treated effluent for unrestricted crops (50% for fruit orchards, with the remainder divided between forest plantations and grain and forage crops). Treated wastewater mixed with surface water is used to irrigate 9,100 hectares for unrestricted agriculture, primarily in the central and southern portions of the Jordan Valley (64% of the surface is used for vegetables, 27.5% for fruits, and the remainder for forest plantations, grains and forage; Al-Mulqui, Bataineh and Malkawi, 2002). In Tunisia, more than 6,600 hectares of farmland are irrigated with up to 30% of treated effluent (Al Atiri, Rezgui and Aniba, 2002). Nearly 80% of this farmland is located around the city of Tunis. The main crops involved are trees, forage, industrial crops (e.g. tobacco and sugar beets) and field crops. Attempts to irrigate some industrial crops such as cotton with treated wastewater have proven uneconomic.

ALTERNATIVE USES FOR TREATED WASTEWATER

While irrigation is the preferred mode of use of treated wastewater, other uses are also being tried out in the region.

Groundwater Recharge

Recharging of groundwater with treated wastewater is still in the pilot phase; yet it has not only helped to increase the potential of aquifers but it also offers a way to protect against the infiltration of seawater. In Jordan, a direct recharge project is in place at Aqaba, where 1.91 million m_ of treated wastewater is recharging the aquifer from a specially designed pond (Al-Mulqui, Bataineh and Malkawi, 2002). There is a major pilot project in the Tunisian region of Nabeul to recharge the water table with treated wastewater. Percolation takes place between November and March, with volumes ranging from 60,000-200,000 m_ depending on the annual program (Al Atiri, Rezgui and Aniba, 2002).

Golf Courses

Tunisia has eight golf courses covering 600 hectares. They are all irrigated with treated wastewater, using about 4 million m_ annually, or 15-20% of treated wastewater reused, and 4% of the potential volume available for reuse. The availability of this source has been a decisive factor in golf course development (Al Atiri, Rezgui and Aniba, 2002). In Morocco, high-quality treated wastewater from the Benslimane plant is used almost entirely for watering golf courses. Any surplus is discharged outside the plant to be used seasonally and sporadically by farmers (Jamali and Kefati, 2002).

Green Spaces

Little use is made of treated wastewater for irrigating hotel gardens, green spaces, and municipal lands due to health concerns. However, a pilot project for irrigating green spaces with treated wastewater was launched in Tunis in 1996. Similarly, treated wastewater is used in some municipal nurseries in Morocco (Jamali and Kefati, 2002).

Industry

Some industries in Jordan are reusing industrial wastewater on a small scale, primarily for cooling systems. Industrial recycling efforts in Tunisia have not made much progress because of the weakness of the institutional and regulatory framework. Nevertheless, some industries are conducting feasibility studies to determine the type of treatment best suited to the specific activity and economics of cooling systems, power plants, the chemical industry, steel, papermaking and oil refineries.

ENVIRONMENTAL AND SOCIAL CONCERNS

Protection of the Environment

Wastewater treatment helps to protect receptacle bodies of water against pollution. If wastewater is not treated, it can cause severe ecological disruption and nuisances such as odours and insects. It affects the equilibrium of the receptacle water bodies into which it is dumped: it reduces dissolved oxygen in the water, kills fish, and poses serious supply problems and health concerns for people downstream from the dumping points. In Morocco, stretches of the Sebou River are considered technically dead, and people have been forced to stop taking drinking water downstream from the city of Fès at times when pollution is high.

> Economic evaluation of the real and significant benefits in terms of environmental protection and public health would suggest that the treatment and reuse of wastewater should be among the top priorities of government (Faruqui, 2000).

Fertilisers

Reuse can reduce the quantities of commercial fertilizers used in agriculture. The Morocco study assessed the economic advantage of reuse, adding to these fertilizer savings and the reduction in energy required for the alternative solution (i.e. the opportunity cost). Savings vary between US$220-530 per hectare per year, and the economic advantage of reuse increases with the rising marginal

cost of developing new conventional sources. The Tunisian study showed that the marginal cost, i.e. the cost of an additional cubic meter of water from a new dam would be US$0.70 per cubic meter, whereas the equivalent figure for a cubic meter of secondary-treatment wastewater is US$0.50 per cubic meter (Al Atiri, Rezgui and Aniba, 2002). However, when treated wastewater is used for irrigation without first being de-nitrated, nitrogen can build up in the soil to levels well beyond the needs of crops, causing the leaching of nitrates into the groundwater. This poses a significant long-term threat to water quality and public health.

Salinity

Another environmental concern with the reuse of treated wastewater is water and soil salinity. Soluble salt concentrations in treated wastewater are generally higher than those in drinking water. This is particularly the case in Tunisia and Jordan, where the salinity and mineral content of wastewater is high. In Jordan, wastewater characteristics differ slightly from those of other countries as average household consumption is low (Al-Mulqui, Bataineh and Malkawi, 2002). This can be further exacerbated by stabilization ponds where water is lost through evaporation. In Tunisia, wastewater effluent quality is conditioned by the proportion of industrial effluents, by the infiltration of brackish water and by the quality of drinking water and thus the salinity varies generally from 1-6 g/l from one station to another (Al Atiri, Rezgui and Aniba, 2002). More studies are needed to determine the long-term impact of this increased salinity on soil productivity.

Health Risks

The consumption of produce irrigated by wastewater or fertilized by treated sludge, direct contact with wastewater and the proximity of wastewater irrigation operations can pose health risks to humans. The Tunisian experience has shown that contact with secondary-treated wastewater can provoke allergies and other serious dermatological or gastrointestinal illnesses. Farmers or workers who handle treated wastewater do not always follow public health officers' recommendations and often neglect to wear boots and gloves. As irrigation takes place in the hot seasons, they find that wearing boots and gloves is inconvenient. However, the Jordanian and Tunisian case studies stress that dermatological or gastrointestinal illnesses associated with treated wastewater reuse cannot be attributed solely to reuse.

Sludge

A large proportion of the operating cost involves handling and disposing the sludge generated by conventional treatment plants. This sludge is rich in organic materials but may also contain heavy metals, which may be toxic. Therefore, it is important to treat the sludge and control the concentration of these elements in the soil. Moreover, the environmental impact of this sludge, including odours, non-biodegradable matter and transportation nuisances, needs to be reduced. There are many processes available for treating sludge such as pasteurization, aerobic thermophilic treatment, thickening with lime, and composting. In Ouarzazate, Morocco, sludge from drying beds was tested on Italian ray grass crops, and produced an increase in dry matter of more than 20% in comparison with the control case, and without the accumulation of heavy metals either in the soil or in the vegetation (Jamali and Kefati, 2002).

CONCLUSION

The forum stressed that an integrated approach to wastewater is needed in the region, covering collection, treatment and reuse. The investment costs of wastewater treatment and reuse is high but the cost of inaction is even higher.

Although a large potential resource, wastewater reuse in MENA is only 2% of water supplied. The main difficulties the region faces is from both ends of the collection-reuse spectrum. Departments responsible for sanitation and reuse must be organized with a clear mandate, they must have well-trained, motivated and experienced human resources, and they must make reuse a strategic theme of their overall policy. Governments must find the financial means to make services and facilities viable and sustainable. Efforts are also needed to win over potential users of treated wastewater, through awareness and information campaigns and to encourage participatory approaches such as the creation and services of water users' associations.

The Forum participants also called for the need for legislative reforms. Wastewater reuse in agriculture requires appropriate legislation to regulate the use of this resource, using quality standards appropriate to local conditions. If standards are too strict, they are both costly and difficult to monitor. But serious consequences related to human health, soil productivity and crop market potential are found if standards are lacking or not properly enforced.

The questions and issues raised by the case studies show that wastewater reuse is still at its early stages. Additional research, training and information are needed. Policymakers in the region have declared their willingness to cooperate in sharing lessons learned, so that successes can be replicated and errors avoided. This is important because, as the Forum demonstrated, countries in the region are not all at the same stage, and reuse has progressed in those countries

with the greatest water shortage. Promoting dialogue and the exchange of experience is beneficial for the region where the use of treated wastewater is bound to increase given the scarcity of water and the steadily rising demand.

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Water Valuation

Abderrafii Abid Lahlou

The second forum was on the economic valuation of water, held in Beirut in June 2002. There were 162 representatives from ministries involved in agriculture, drinking water and wastewater, from eight countries in the Middle East and North Africa. Over 20 participants represented donors and international development agencies.

The principal case studies were from Tunisia, Morocco and Jordan, with additional papers presented from a number of countries (e.g. Lebanon (see Geadah, 2002), Egypt and Yemen). Ten case studies were prepared covering aspects of valuation in drinking water, agriculture and wastewater. A key note address, "*Reflections on Water Pricing and Tariff Design: Key Principles*", was made by the World Bank (Saghir, 2002) and the UN Economic and Social Commission for West Asia contributed a paper on water tariffs (UN–ESCWA, 2002).

The objective of the forum was to encourage decision-makers to recognise the importance of water valuation as a tool in managing water

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demand. The forum showed the extent to which the valuation experience across the region is varied, and promoted the exchange of experience in all three sectors: agriculture, drinking water and wastewater.

INTRODUCTION

Given the scarcity of water in MENA, water valuation is an economic tool that can contribute significantly to managing water demand, and may bridge the gap between supply and demand. The forum highlighted that the concept of "*value* of water" is more complex than financial and/or economic valuation to include several other dimensions, such as the social, cultural, historical and environmental.

Water services include production, distribution, irrigation and the collection, treatment and distribution of treated wastewater. It was also recognised that in spite of people's reservations, steps to recover the investment and operating costs of facilities for providing users with the water they need is valid. It may be noted that the more abundant water is, and the closer it is to places of utilization and the better its quality, the lower will be the investment and operating costs for making it available to users; yet this does not rule out taking the opportunity cost of water into account. Without seeking to diminish the value of this debate, the forum chose to focus more on the examination of water prices or tariffs (the terms that will be used in this paper) and their role in demand management.

> Some consider that the "real value" of water is so significant that it can't be reflected by any price. Others argue that the price should relate to water services and not to water itself.

FUNCTIONS AND OBJECTIVES OF WATER PRICING

Financial and Revenue-generation Aspects

Water pricing is often conceived as an instrument of cost recovery in water utilities and/or irrigation schemes. Weak cost recovery translates into inadequate financial resources to maintain minimum Operation and Maintenance (O&M), not to mention expanding or upgrading the system to accommodate additional users. The quality of services then declines and users resist any price increase, thereby further undermining the financial means for O&M and causing services to deteriorate further. This vicious circle can only be broken by substantial investments in upgrading facilities, reducing leakages and improving services. In an era of structural adjustment programmes and heavy internal and external pressures to cut public expenditures, raising water tariffs provides governments with an option for additional revenues, but it is something that users find hard to accept.

The case studies provide many illustrations of this situation for agriculture, drinking and wastewater services. In Morocco and Tunisia, agricultural water prices were frozen for a long time, which meant there was a significant pricing lag that had to be made up to support system rehabilitation programs (El Yacoubi and Belghiti, 2002; Hamdane, 2002). In Jordan, drinking water prices were far below real costs of O&M and, as a result, the distribution networks were not properly maintained (Taha and Bataineh, 2002). Thus, water was being lost through increasing leakages in a country where it is particularly scarce and households suffer severely from shortages.

In the absence of additional financial resources (from the government budget or from external loans), water utilities would need to substantially increase water tariffs in order to generate the needed revenues to prevent further deterioration in the provision of water services. Additional increases in water tariffs would also be needed to adjust for periodic increases in O&M costs and for inflation in general. In Morocco, the prices for irrigation as well as for drinking water and sanitation services delivered under concession contracts are indexed to inflation rates. In addition to indexing, these contracts typically provide for price hikes at the outset of private sector involvement as an additional incentive. Because of this, users frequently associate the concessioning of services with substantial price increases, whereas it would be more relevant to compare price with levels of service as well as benefits received in the long-term.

Social Aspects

When there is no funding to expand water and sanitation systems, the first to suffer are the poor who live on the outskirts of the cities and in the countryside. Because these communities are often unconnected to the water system, they find themselves obliged to pay high unit prices for trucked water (which can cost up to 50 times the price of tap water), and to make do with lower and insufficient quantities of uncertain quality, or to see their women and children spend their time carrying water, instead of going to school or engaging in more profitable activities. According to some, social concerns should focus on facilitating connections for these disadvantaged groups to the drinking water and sanitation systems, i.e. giving them access to services, rather than in keeping prices artificially low for all consumers (Saghir, 2002). In Morocco, families not connected to the water network pay 7% of their household budget on water, while those that are connected pay only 0.7% (Lahlou and Bahaj, 2002).

In order to improve both rural water services and its system management efficiency, Morocco and Tunisia have introduced programs that are gradually transferring responsibility to the users of water services, so that they contribute to the investment effort and take over operation of the systems for distribution of

drinking water and agricultural water. This approach should lead gradually to full cost recovery from users and would involve the beneficiaries directly.

It is often argued that the price of water for consumers should be based on the concept of "*ability to pay*". For drinking water and sewage services, this ability is often measured by the ratio of the costs of such services relative to the overall household budget (where the ratio should generally not exceed 5%). For producers (manufacturing, tourism and commercial agriculture), the concept of "*value-added*" is often suggested as a more appropriate basis for water pricing, i.e. the price of water should reflect the overall revenues generated by the use of water, as is the case with the prices of other factors of production. Another concept used by producers is the proportion of water consumption in overall charges. In some countries, authorities have maintained lower water tariffs for industry and tourism in an attempt to make them more competitive by artificially lowering their costs, but this is not an economically sound approach, as it may lead to price distortions and excessive water consumption.

Another important concept to be considered in water pricing is "*willingness to pay*". It is often argued that users may be willing to support a price increase if they can expect a parallel tangible improvement in services. Thus, users could be willing to support the increasing cost of services if the framework is transparent, and if there is trust between them and the institutions responsible for water supply. This requires, first, a reasonable level of service. Beyond that, outreach and awareness campaigns are needed to inform users about the efforts that are being made to bring them water, and to help them appreciate the cost of water delivery. The case studies highlight the link that must be established between the service improvements and tariff increases. Tariffs must ensure a social fairness. Users who profit from facilities, set often through subsidies, must share with the community the benefit that they derive from their situation. Access to water often creates an increase in land value, and this is one reason to contribute to the investment, as well as the pumping costs that have to be supported by the beneficiaries.

Environmental Aspects

The polluter pays principle means that the person who uses water, and thereby pollutes it, must pay the cost of releasing it, purified, into the environment.

Mostly relevant to wastewater services, tariffs generate investments for collection and treatment before discharging it into the environment or reusing it. Thus, tariffs also have an environmental role, often expressed in the "polluter pays" principle. For Jordan, Morocco and Tunisia, the sanitation charge is generally calculated based on the quantity of drinking water consumed. In Morocco, however, this charge has been replaced by a "council tax" for sanitation when the service is managed directly by the commune (Lahlou and Chigguer, 2002).

Economic Aspects and Efficient Allocation of Resources

Tariffs should send a clear and simple signal to consumers to encourage them to rationalize their demand for water. A low price gives the impression that there is an inexhaustible availability of water and saps the economic justification from efforts to curb consumption. This leads to misallocation and misuse of the resource. At the same time, a price that is too high departs from the Pareto optimum because it unduly limits consumption of an available resource, reduces user satisfaction and penalizes the poor segments of society.

To induce efficiency, the signal must be fair. This means that the tariff applied must reflect actual consumption, measured in a reliable way. Tariffs should also vary according to water quality. In Morocco, prices for agricultural water are reduced as a function of salinity (El Yacoubi and Belghiti, 2002). In Tunisia, a significant price cut (up to 74%) was introduced to encourage the reuse of treated wastewater (Aniba, 2002), and sanitation charges to industries vary according to the degree of pollution of industrial effluents. This pricing structure provides industry with a financial incentive to invest in pre-treatment of effluents.

Water pricing is an important tool for resource allocation because it provides guidance, both to users and to planners, in comparing alternative solutions. For example, in northern and central Tunisia, where use of shallow-lying groundwater (at a depth of less than 50 m) is subject to limited administrative controls, any significant price hike for surface water sparks increasing use of lower-cost groundwater. This leads to overexploitation of this resource and a deterioration of its quality. To avoid this situation, surface water prices in this region could be set at a level slightly below that for groundwater (Hamdane, 2002).

Price distortions can lead to the wrong choice: the consumer may decide to use groundwater if its cost turns out to be lower than that of surface water, and this choice may end up depleting the aquifer and degrading its quality. A tariff structure that is too steep can also lead consumers to seek alternatives that are not necessarily optimal. Similarly, there is a question of how wastewater recycling can be promoted if conventional sources are virtually free. Sound demand management should reserve conventional water sources to water uses that demand the highest quality, while diverting "second-hand" (reused) water to irrigation, or tasks that require lesser quality water. If such an allocation pattern is to be achieved, the tariff structure will have to differentiate according to the quality of water, and will have to include an incentive to steer users towards socially optimal choices. Water pricing must therefore be integrated into overall resource management.

PRICING PRACTICES IN COUNTRIES OF THE MIDDLE EAST AND NORTH AFRICA

Governments in the region charge fees to cover costs based on the abstracted and discharged volumes of water. In Jordan, authorities try to limit the over abstraction of groundwater by collecting fees on the water pumped. In Morocco, recently established fees are usually the main source of revenues for public agencies responsible for watershed management. Public authorities in charge of water services are often in a monopolistic position and governments assume the regulation of tariffs for water to be accessible to all. This social equity concern is present as reflected in progressive tariffication in the pricing structure.

Block Tariffs

In Morocco, Tunisia and Jordan, domestic water and sanitation tariffs are progressive, rising with each "block" of consumption. Starting with the assumption that the level of consumption is a function of household income, this system keeps prices relatively low for small consumers connected to the network (the price for the first “block” is below production costs in Morocco, and is only about 25% of delivery costs in Tunisia). The water agency offsets this shortfall by charging a fairly high price for successive blocks. In Tunisia, the price for the last block, which is set to reflect the long-term marginal cost, is around six times the "social" tariff, and in the case of sanitation it is 20 times higher (Limam, 2002). Thus there is cross-subsidization between consumers. Progressive pricing is also supposed to induce bulk consumers to save water, and to encourage the rational use of water in peak demand seasons.

This policy of progressively higher prices for successive blocks of consumption is also used in agriculture in Jordan (Al Hadidi, 2002). Morocco has adopted it for irrigation, but has found it difficult to implement because of problems in installing and maintaining the costly unit metering and billing systems required to obtain reliable information (El Yacoubi and Belghiti, 2002). In Tunisia, a flat unit rate applies to agriculture, although the case study suggests that a dual pricing system, under which bulk consumers pay lower tariffs, is preferable in some cases because the flat rate encourages heavier consumers to seek alternative sources (Hamdane, 2002).

The block tariff formula has drawbacks (Boland and Whittington, 1997). In some cases, the artificially low price for the first or "social" consumption block may not really benefit the target population. This is the case in low-income neighbourhoods where many families living under the same roof use a single connection and are invoiced on the basis of a single meter. Total consumption for the dwelling will therefore be high, and will be billed at a higher block rate. Moreover, an analysis of subsidy distribution across consumption blocks reveals

that consumers of the first block are not necessarily those who benefit most from the pricing system. The Tunisian case study showed that the consumers in the higher blocks (including tourists) provide 76% of the cross-subsidy whereas the main beneficiaries of the subsides are those in the second and third blocks who benefit the most from the subsidy by 38% and 34%, respectively (Limam, 2002).

Another difficulty with the block-based pricing system is in setting limits for consumption blocks and determining their prices, and consequently the degree of progressiveness. Jordan has been applying a four-block pricing structure for domestic water since 1997; Morocco and Tunisia use five blocks. The limits of the blocks (defined in terms of cubic meters of water consumed over a three-month period) are not the same (Jordan: 0-20, 21-40, 41-150, 150+; Morocco 0-24, 25-60, 61-120, 120+; Tunisia 0-20, 21-40, 41-70, 70-150, 150+). Progressiveness is steepest in Tunisia, where the larger consumers are billed at the marginal rate for their final block, and at the rate for the immediately preceding block for all the rest of their consumption. This produces sharp increases in water bills for consumers who cross the higher block thresholds (40 m_ and 70 m_ especially), and the number of complaints that the authorities have received is an indication that the price signal is distorted. In Jordan, instead of setting a social tariff for the first block of drinking water, a minimum consumption level was set at 20 m_/quarter, with a flat charge of JD 2 (US$2.80) even though small scale consumers did not consume the full 20 m_/quarter (Taha and Bataineh, 2002).

If price increases in the upper blocks lead to consumption cutbacks, this will change the structure of consumption and thus reduce the average selling price. In Tunisia, the over-150m^3 block accounted for 3.3% of customers and 52% of consumption in 1984 whereas by 2000 these figures were only 1.9% and 35% respectively (Limam, 2002). Customers have shifted towards the lower blocks, and consumption has decreased. The goal of saving water was achieved and the investment needed to meet demand was deferred, but the fact remains that the short-term financial return from tariff increases has fallen short of expectations.

Cross-subsidies

In addition to the cross subsidies implicit in the block tariff system, another form of cross-subsidy makes it possible to improve and expand water services in smaller towns that do not enjoy economies of scale through contributions from consumers in the big cities. In order to make water prices reflect the scarcity of water, Morocco applies tariffs that are differentiated by the city or district served; production tariffs are distinguished from distribution tariffs; and there is a surcharge on wholesale prices that is used to improve and expand services in smaller towns and rural areas. The record of this experiment has been very positive: water agencies in charge of services in small towns have been able to

maintain their financial health while providing service to many towns where reduced volumes make unit costs of water and sanitation especially high. In Tunisia, the tariff is equalized at the national level.

Cross-subsidies also occur among different categories of consumers. In Jordan, for example, drinking water and sanitation services to business and industry are billed at almost five times the average price charged to domestic users (Taha and Bataineh, 2002).

As another social feature of water pricing in the region, agencies often allow extended terms for paying the charge for initial connection to the water, sanitation and irrigation networks. For example, Moroccan farmers can take up to 17 years, at 6% interest, to pay their 40% share of hook-up costs. Stretching out payment for "social" hook-ups in Morocco has led to steady growth (averaging 7% a year in the smaller towns) in connections to the drinking water and sanitation networks, although this has not been reflected in a comparable increase in demand: the new customers are for the most part small-scale consumers (Lahlou and Bahaj, 2002). This constitutes a further reason behind shifting consumption patterns and the decline in the average distribution price (in real terms). Tunisia has seen a similar downward trend: the average selling price of water is falling by 0.5% a year in real terms (Limam, 2002).

Metering

Consumption metering is widely used to ensure that these tariffs are fairly applied. According to the case studies, drinking water bills are based on the quantity consumed, as indicated by meters, and wastewater services are also billed on the basis of drinking water consumption. For agriculture, the predominance of gravity-fed irrigation means that water consumption must be measured on the basis of irrigation time and pipe capacity; generally, meters are used for systems under pressure. The Jordanian case study describes the process of widespread installation of meters at private wells so that billing can be introduced to discourage overexploitation of the aquifers (Al Hadidi, 2002). Force of habits established since the government authorized the abstraction of this resource without metering has not facilitated the new system’s implementation.

IMPACT OF PRICING ON WATER SAVING: RESULTS TO DATE

Drinking Water

The long-standing efforts in Tunisia and Morocco have achieved satisfactory levels of service for drinking water. About 85% of urban dwellers are connected to water systems in both countries; in Jordan 95% of households are connected but service is only intermittent. Tunisia and Morocco have also achieved some reductions in unaccounted for water (averaging 32% in Morocco, and around 20% in Tunisia in 2001) as well as assuring continuous service. Because Jordan faces an acute water shortage and much of the water that enters the system is being lost, facilities are being upgraded to prevent leakages.

Bills for drinking water are having relatively little impact on consumers in Morocco and Tunisia: they account for less than 1% of household budgets and business turnover. In Amman, Jordan, the water item in household budgets rises from about 1% in winter to 2.9% in summer, while in rural areas the corresponding figures are 0.7 and 1.4%. Yet the intermittent nature of service leads many customers to rely on pumping and reservoirs: when these factors are taken into account, the water share of household budgets rise to between 2.3 and 4.6% in Amman and 1.5 to 2.3% in the countryside.

Tunisia estimated water savings over the period 1990-2002 in the wake of tariff increases (Limam, 2002) and domestic water demand fell by around 4.5%. That estimate considered only customers who consume more than 150 m_/quarter (estimated elasticity of about -1%), on the grounds that other customers' consumption would be relatively inelastic.

The drinking water agencies in Morocco and Tunisia are financially independent. They no longer receive subsidies, and are now developing the capacity to finance themselves (investments are being self-financed to the order of 40%), in addition to which they can borrow to finance system extensions and renovations. It must be noted, however, that government pays for the construction and upkeep of dams. Producers of drinking water pay nothing for its extraction, although this situation is changing in Morocco with the introduction of the charges mentioned above. The Water Authority of Jordan still receives "balancing" and investment subsidies. Following the tariff revision of 1997, however, the "balancing" subsidy, which represented 42% of operating expenses in 1995, was reduced and in 2000 it covered only 5% (Taha and Bataineh, 2002).

The Tunisia and Morocco case studies show that customers have shifted from the higher to the lower consumption blocks. The Tunisian study estimated that industrial consumption over the same period declined by 3%, while consumption in the tourism sector recorded a drop of 0.7%. These savings not

only conserve water but also allow investments to be deferred, and in this way they improve the allocation of funds in financial terms. The Jordan case study also reports a decline in domestic consumption (of 3%) following a major price hike in 1997, but the intermittent nature of service makes it difficult to assess real demand.

Wastewater

The water price includes a component to cover the costs of wastewater collection and treatment, in accordance with the "polluter pays" principle, in order to protect public health and the environment (including water sources) from pollution and to allow the recycling of wastewater. Differentiating the price of sanitation services as a function of wastewater pollution should encourage industries to undertake pre-treatment so that their effluents will not overburden and reduce the efficiency of treatment plants.

In Tunisia, the sanitation charge is no more than 35% of the overall water bill for 98% of customers; for the remaining 2% of customers, the sanitation charge can be as high as 55%. Revenues cover only a portion of costs, and subsidies are still granted to sanitation services. Facilities are in need of expansion and modernization to improve their performance. Tunisia has adopted a strategy of regular annual tariff revisions that should lead to the progressive withdrawal of the State from this business: the "balancing" subsidy represented 50% of revenues in 1992, but only 25% in 2001 (Aniba, 2002). Morocco has launched an ambitious program of concession for water and electricity distribution, and sanitation services. This is expected to produce major investments and significant improvements in service. Tariff policies applied to concession contracts preclude any subsidies from authorities, and yet there are significant investment programs underway. This may reflect the emergence of synergies, since drinking water and electricity as well as sanitation services are now managed under concessions. According to the Morocco case study, international comparisons would suggest that the charge for sanitation services should be up to 20% greater than that for drinking water, whereas currently the sanitation portion of the overall water bill (water plus sewage services) is barely 30%. This demonstrates the effort that must still be made to raise tariffs, recognizing in particular that the investment program for the next 10 years, as set out in the national sanitation master plan, is enormous (Lahlou and Bahaj, 2002).

The valuation of wastewater itself for reuse is treated in detail in the previous chapter on Wastewater Reuse (see also Al Atiri, Rezgui and Aniba, 2002; Al-Mulqui, Bataineh and Malkawi, 2002; Jamali and Kefati, 2002). In MENA, cost recovery for reuse is poor and significant subsidies are provided for both investment and operating expenses. Where farmers are paying for treated

wastewater, charges tend to go to the irrigation authority and not the institution that runs the sanitation system.

Agriculture

Agriculture policy in the region has long been marked by heavy state intervention, particularly subsidies. This policy was justified on social grounds, to preserve farm income and to prevent adverse effects on a country's development and its food security. More recently, with liberalization of the economy, stepped-up efforts at cost reduction and reliance on market mechanisms for setting prices, water tariffs are playing increasing roles as instruments for managing demand.

In Tunisia and Morocco efforts are being made to bring tariffs into line, to the point where the proceeds of water bills now cover overall operating costs, excluding depreciation. There remain some regional discrepancies with disadvantaged areas still benefiting from State support. Generally speaking, governments continue to support investment and to fill the gap left by payment arrears. In Morocco, not all invoices are paid for several reasons (in particular the effects of drought). This demonstrates that the pricing system cannot be approached in isolation from other aspects, especially institutional. It must be recognized that, regardless of the pricing structure and price levels, it is unlikely to achieve the desired financial balance, improve services, reduce delivery costs, and recover invoices without effective institutions endowed with competent and motivated employees who are given adequate basic and continuing training to do their job. Institutions that charge adequate tariffs and are therefore financially autonomous generally achieve the best results.

The case studies of Morocco and Tunisia on agricultural water deal specifically with the prices charged to large-scale farm users: here, the cost recovery approach is fully justified by the heavy public investments that have been made, and the high crop yields that have been recorded. Irrigated agriculture holds an important place in the economy of these countries: although it represents a relatively modest portion of the total farmed area (7% in Tunisia and 13% in Morocco), it makes a significant contribution to the value of agricultural output (35% in Tunisia, and 45% in Morocco, a figure that can reach 70% in dry years) as well as to agricultural employment (27% in Tunisia and 33% in Morocco). Irrigated agriculture also accounts for a significant portion of the two countries' exports (20% of Tunisia's exports (Hamdane, 2002) and 75% of Morocco's agricultural exports (El Yacoubi and Belghiti, 2002)).

El Yacoubi and Belghiti (2002) describe the difficulties in establishing a direct cause-and-effect link between water pricing and the efficient use of water in irrigated agriculture as a whole in Morocco, because water meters are not installed at most farms. There have been some experiments, however,

confirming that water tariffs and introducing meters induce and encourage changes in the way farmers use irrigation water. In some cases, it was shown that a 21% increase in tariffs led to a 5% drop in water consumption and a 38% increase in crop intensification. This amounts to a 32% saving in water, achieved largely through greater crop intensification and, consequently, greater efficiency. In some cases, the scarcity of water combined with a hike in water tariffs led farmers to employ water-saving irrigation techniques, particularly localized drip irrigation. In Tunisia, the price elasticity of demand for agricultural water is relatively low, but it varies by region (Hamdane, 2002).

CONCLUSIONS

Water pricing can be an effective instrument for managing water service in general, and water demand in particular. Water charges can generate revenues to cover operating costs (including maintenance) and to finance the eventual replacement of equipment, guaranteeing the sustainability of water service and facilities. Water prices must be equitable and fair, and they must therefore be applied to quantities actually consumed. A reliable metering system not only brings transparency into the relationship between the service provider and the user, but also provides information on the level of consumption, as a basis both for achieving savings and for planning future needs.

Pricing can produce an incentive to save water. Analyzing and calculating elasticity so as to establish a cause-and-effect relationship between higher prices and lower consumption can be difficult to perform (because of lack of reliable metering data or interference from other factors that influence demand), yet the case studies presented at this forum have provided concrete examples where higher prices together with metering and/or public awareness and information campaigns have produced substantial water savings and the greater use of water-saving irrigation techniques.

The price must reflect the scarcity of water, discourage wasteful use and promote water-saving behaviour. At the same time, it must include mechanisms for assuring water supply to disadvantaged populations in sufficient quantities and at fair costs to meet their basic needs. If water pricing is to be an effective demand management tool, institutions must be capable of delivering their services efficiently and at the lowest cost, of adopting suitable technologies, of collecting on their service bills and of performing well in both technical and financial terms, while maintaining constant communication with users through awareness, education and information campaigns.

The general theme emerging from the forum is that water pricing is a broad and multifaceted topic. Pricing is one among many tools for the comprehensive planning and management of water resources. It is an important parameter in the economic evaluation of water projects, the study of design variants and the comparison of alternative solutions. It is an indispensable element in economic policymaking and it has an important impact on the development of water services. It constitutes a powerful and effective tool for managing water demand.

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4.

Public-Private Partnerships

Bayoumi Attia

This chapter presents the topic of the third Forum "Public-Private Partnerships (PPP)" held in Amman, Jordan in October 2002. There were 135 participants from ten countries present. In addition to the nine active Forum countries, the United Arab Emirates sent a representative. Thirty-one participants represented international partner agencies.

The objectives of the Forum were to

1) Promote knowledge and experience exchange among decision-makers on issues surrounding PPP and strengthen personal networks between sector professionals concerned with PPP and WDM in the MENA region;
2) Present case studies from MENA countries where there are examples of PPP;
3) Stimulate discussion around merits, demerits, difficulties and risks associated with PPP.

 Managing Water Demand: Policies, Practices and Lessons from the Middle East and North Africa edited by Ellysar Baroudy, Abderrafii Abid Lahlou and Bayoumi Attia. ISBN: 184339104X. Published by IWA Publishing, London, UK.

Jordan and Morocco presented the most comprehensive case studies of the region (Abu Shams, 2002; Nouha *et al*., 2002). These countries are the most advanced, compared with other MENA countries, in their progress of applying PPP in some form. Other countries such as Egypt, Syria and Lebanon presented their status in PPP. Special presentations were also made, including a general overview of PPP, papers presenting the views of the private sector (Cliche, 2002) and privatization and the poor (Franceys, 2002).

INTRODUCTION

Public agencies have been entrusted to supply water to the public, either for free or at minimum costs. This process has often gone unregulated with minimal accountability (Cosgrove and Rijsberman, 2000), which has been the case in MENA. The lack of resources and know-how have contributed to deteriorating public water delivery services and resulted in heavy water losses. Free or under-priced services make it difficult for governments to allocate enough resources for overhauling old systems, which are often characterized by high water leakage and poor efficiency.

Most PPP contracts in the water sector are associated with domestic water supply and much less with agricultural irrigation (Grover, 2002a, b).

Including the private sector in the delivery of water raises many questions: can the private sector run more efficient and viable water supply systems? Would the private sector allocate enough resources to hoist old systems out? Are price hikes inevitable and would they promote water savings? Is it possible to include the private sector without sacrificing the environment and the needs of the poor? Are PPP effective management tools?

Public-Private Partnerships (PPP) refer to a public entity entering into a contractual agreement with the private sector to take over some or all of its activities to provide services for the general public. The degree of private sector assumption of responsibility for the services varies according to the level of ownership conceded by the public entity, and is along a continuum line. PPP ranges from simple service contract, management contract, lease of the system and concession to divestiture, each with different levels of ownership and operational responsibilities (see Table 4.1, adapted from Brook Cohen (1999) and Abu Shams (2002) for a summary of advantages and disadvantages of different forms of PPP). PPP does not affect the ownership and management of the basic water resources, which usually remain under public sector control (Grover, 2002a).

Table 4.1 Different forms of PPP.

Option	Asset ownership	Operation and maintenance	Capital investment	Commercial risk	Duration (years)
Service contract	Public	Public and private	Public	Public	1–2
Management contract	Public	Private	Public	Public	3–5
Lease (“Affermage”)	Public	Private	Public	Shared	8–15
Build-operate-transfer	Private (bulk services)	Private	Private	Private	20–30
Concession	Public	Private	Private	Private	25–30
Divestiture	Private	Private	Private	Private	Indefinite

PUBLIC-PRIVATE PARTNERSHIPS IN COUNTRIES OF THE MIDDLE EAST AND NORTH AFRICA

PPP experience is modest at this time in MENA (Grover, 2002a). Of the 158 global water sector contracts in the middle and low-income countries signed with the private sector between 1989 and 1999, only three percent were in the MENA region, the lowest in all other regions of the world. In MENA, Morocco and Jordan are most advanced compared with other countries in the region, although each has adopted a different form of partnership with the private sector. Most PPP efforts in the region concern domestic water supplies. There have been only a few efforts to promote PPP in irrigation, as this sector is still learning about incorporating PPP as a strategy (for more information see Grover, 2002b). In the Egyptian case study, it was shown that water user associations and boards are the primary applicators of PPP in the irrigation sector.

Below are highlights from the case studies for Jordan (Abu Shams, 2002) and Morocco (Nouha *et al*., 2002). These are also summarised by Grover (2002a) in his overview paper. Table 4.2 lists recent and current PPP contracts in the MENA region.

Table 4.2. PPP contracts and some examples from MENA countries.

Country	Location/ sector	Type of contract	Public entity	Private partner	Contract period	Value ($M)	Population served (M)
Algeria	Oran/WSD	Management	EPEOR	SAUR/France	1999–2004	15.7	0.9
	Algiers Ouest/WSD	Management	EPEAL	SEM/France	2000–2004	19.0	0.4
Egypt	Toshka/I	BO/MC	NA	Kadco/Saudi Arabia	From 2002	NA	NA
	Cairo/WWT	O&M	Wastewater Authority	NA	NA	NA	NA
	Port Said	BOT	NA	NA	NA	NA	NA
	Oxyr	BOT	NA	NA	2001–NA	25	NA
	El Sharkia	Management	Sharkia Economic Public Authority	N/A	NA	NA	NA
Jordan	Amman/WSD	Management	Water Authority	LEMA Consortium	1999–2004	8.8	2.0
	As-Samra/WWT	BOT	Water Authority	Consortium	2002–2027	150	2.2
Lebanon	Beirut/WSD	BOT	CDR/BMLWA	N/A	2003–2006	200	1.8
	Chekka/WWT	DBO	CDR/NLWA	Ondeo	2003–2008	12	0.12
	Batroun/WWT	DBO	CDR/NLWA	Ondeo	2003–2008	7.6	0.1
	Jbeil/ WWT	DBO	CDR/BMLWA	Ondeo	2003–2008	9.5	0.15
	Nabatieh/ WWT	DBO	CDR/SLWA	Vivendi	2003–2008	9	0.25
	Chouf/ WWT	DBO	CDR/BMLWA	Vivendi	2003–2008	14.5	0.3
	Tripoli/ WWT	DBO	CDR/NLWA	NA	2003–2006	60	0.5
	Tripoli/WSD	BO/MC	CDR/NLWA	NA	2003–2005	7	0.4
	Baalbeck/ WSD	BO/MC	CDR/BWA	NA	2003–2006	5.6	0.25
	Baalbeck/ WWT	O&M	CDR/BWA	NA	4 years	1.6	0.25

Country	Location/ sector	Type of contract	Public entity	Private partner	Contract period	Value ($M)	Population served (M)
Morocco	Casablanca	Concession	Municipality	LYDEC (Ondeo)	1997–2027	2,884	4.0
	Rabat	Concession	Municipality	REDAL (Urbaser)	1999–2029	1,322	1.7
	Tangier	Concession	Municipality	AMENDIS (Vivendi)	2002–2027	356	0.8
	Tetouan	Concession	Municipality	AMENDIS (Vivendi)	2002–2027	375	0.7
Palestine	Gaza I	Management	Water Authority	LEKA (Ondeo)	1996–2002	NA	1.0
	Gaza II	Operating	Water Authority	NA	2003–2007	NA	1.0
	Southern West Bank	Management	Water Authority	GEKA (Vivendi)	1999–2003	NA	NA
Tunisia	Tunis South/WWC	Service	ONAS	SRA/SAVAC/SOMEN	2001–2005	2.6	NA
	Tunis North/WWC	Service	ONAS	SOMEDEN	2002–2006	2.1	NA
	Ariana Governorate/ WWC	Service	ONAS	SOMEDEN	2002–2006	1.6	NA
	Tataouine City/WWC	Service	ONAS	SRA/SAVAC/SOMEM	2002–2006	1.0	NA

Source: Grover (2002a), who cited National Governments; World Bank; Water PPP Database, June 2002. Unpublished, Richard Franceys, Cranfield University.

Note: Sectors: I: irrigation; WSD: water supply distribution; WWC: wastewater collection; WT: water treatment; WWT: wastewater treatment. Types of contracts: BOOT: build, own, operate, transfer; BOT: build, operate, transfer; DBO: design, build, operate; O&M: operation and maintenance; BO/MC: build and operate under management contract.

THE CASE OF AMMAN, JORDAN

Jordan's water scarcity places it among the most highly stressed countries in the world. Intermittent water supplies are the norm in most urban and rural areas, with poor people suffering most from the prolonged water shortages, which is particularly stressful during the hot summers. Jordan's recent experience in the water sector began with major policy reforms in 1997 that explicitly endorsed both the use of demand management strategies and public private partnerships. Jordan chose to begin the PPP process with management contracts. It started in Amman, the capital and largest city, through a public bidding process to select the private sector partner, who started operations in 1999. This initial management contract was awarded for 4 years. Jordan has recently awarded a second PPP contract to build, operate and transfer a wastewater treatment plant serving Amman and the second largest city in Jordan, Zarqa. In addition, plans are underway for PPP contracts in other parts of the country.

Jordan's PPP contract clearly defines the technical targets for the private company. For example, they required the increase of accounted for water in the service area by a total of 25 % by the end of the fourth year. Despite a lack of explicit focus on WDM in the Amman management contract, obvious gains are being realised, such as the more efficient operations and reduced losses. The first three years of PPP experience in Amman resulted in significant improvements in water supply services, including:

- Extensive staff training;
- Better wages for active and efficient employees;
- Reductions in unaccounted-for water;
- Higher water revenues and lower operating costs;
- Improved network repairs;
- Extensive use of computerized techniques for mapping (GIS) and information technology.

Controversially, there were some layoffs as a result of PPP, following agreement with the public sector. Such layoffs were possible only after implementing training programs that raised labour skills and system operation efficiency.

Grover (2002a), states that throughout Jordan, total costs for water supply and wastewater services totalled US$169.4 million in 2001. Total revenues from these sectors were only US$76.8 million, requiring the government to subsidise these services by US$92.6 million, some 120% of all revenues, during that year. Management contracts can obviously reduce such financial losses through improved operating efficiencies. But financial losses will continue if the Water Authority of Jordan does not raise domestic water charges. The responsibility

for setting service charges lies outside the scope of any management contracts, and remains the responsibility of the government.

According to the case study, revenues increased and expenditures decreased in the first three years of PPP as a result of various system improvements. This apparently resulted in a change of net income, from a slight loss in the first year to a positive sum equivalent to 16% of operating expenses in the third year (when revenues were US$47.7 million and expenses were US$41.0 million 27.3m).

THE CASE OF MOROCCO

Morocco has adopted *concession* as its form of PPP. Each concession has durations of 25 or 30 years and covers three municipal services (water supply distribution, wastewater collection and electricity distribution) in a single contract. The first concession was awarded for the largest city, Casablanca, in 1997, by means of a negotiated contract. The second concession, for the capital Rabat, was awarded to a different firm in 1999, also by direct negotiation. However, with time the process evolved to become more transparent, involving public tendering. This procedure resulted in concessions being awarded to another private organisation for two other major cities (Tangiers and Tetouan) in 2002. Casablanca now has five years of PPP experience, with results including:

- Major investments by the concessionaire;
- More people served but significantly less water required;
- Extensive staff training, reductions in staff numbers and higher wages;
- Tariff increases of some 20% for water and 47% for wastewater.

Concessions transfer all activities to the hands of the private sector. Concessions however are complex and require effective regulations and oversight to control the long term created monopoly. Grover (2002a) states that the experience with PPP contracts in Morocco indicates that long-term concessions are a better type of contract to release the government from the need to provide constant subsidies. The private concessionaire needs to generate the necessary revenues, through higher tariffs. Thus, consumers pay more realistic charges for these services and are induced to conserve water accordingly. Unlike Jordan, there were no lay offs due to PPP in the four cities of Morocco (Casablanca, Rabat, Tanger, Tetouan). The contract obliged the concessionaries to keep all employees and their benefits.

ISSUES AND IMPLICATIONS FOR THE REGION

Public-private partnerships are used mostly in the domestic water supply and wastewater sector. But the available experience is still quite limited. The Jordan

and Morocco case studies confirmed that these countries are learning important lessons from this experience, with newer contracts being improved accordingly. These countries can be expected to continue to lead MENA efforts to use PPP contracts to help achieve better WDM. Certainly at this forum, there was a call for greater work to be done in this regard.

Some of the important points raised during the Forum included:

Pricing and the Poor: In MENA, as in other parts of the world, many of the poor already have no access to clean water and end up paying more money for water and labour than the richer parts of society who receive subsidised water services (Franceys, 2002). Instituting measures to balance the equation, by which the poor will pay less than those who are well off in societies, will allow PPP to reach its potential. One has to realise that prices of services have to be increased to provide an equitable and reliable service (Faruqui, 2002).

Public-Private Partnerships and Public Health: It is unsubstantiated that privatization will lead to deterioration of water quality and public health. Government regulations and law enforcement are required for either private or publicly run water systems.

Impact of Privatization on Labour: One of the most critical social consequences of PPP, the case studies have shown that layoffs do not have to occur as a result of privatization.

Partnerships, Corruption and Lack of Transparency: Selecting a PPP partner should be transparent, with clear objectives and targets, controls to protect the poor and measures to attain equity, sustainability and reliability. Only complete transparency will ensure the public about the validity of their public official decisions regarding water contracts and contract monitoring. Morocco provides an excellent example of the evolutionary process it undertook in PPP contract negotiation.

Lack of Incentive to Pursue Conservation Strategies: Faruqui (2002) states that privatized utilities will cut leakage rates to increase profits, yet there are few examples where leakage was a top priority for the private company as once they sold water, companies had no incentive to promote conservation. Naturally water conservation is more of a goal for the community than it is a direct goal of the private sector. Therefore building the appropriate measures and incentives in the contractual agreements is vital.

Efficient regulation: Regulations should be wide ranging (technical, social, financial, environmental, etc.) and should protect the interest of all stakeholders. Should the entity of the regulator be the Ministry or a third party? There was a big debate at the PPP Forum, and two schools of thought emerged: one agrees with third party regulation but the second opts for differentiating between control (to be done by authority/government) and regulation by government (for sector). Effective regulation is a vital factor for successful PPP.

CONCLUSIONS

> It is important to note that PPP is not a target in itself; it is only good as far as it improves service equity, reliability and enhances efficiency.

Public and Private Partnerships are driven both by a shortage of water and by governments facing mounting pressures on their financial budgets. Only two MENA countries, Jordan and Morocco, offer substantial experience, but most other countries are considering adopting some form of PPP in their water management. Both Morocco and Jordan offered frank discussions about the impact their PPP options have had on many levels. Because of the difficulties they are facing, forum participants called for more in-depth and specialized discussions concerning contract negotiations and operational regulations on this subject. They also asked for more information exchange among MENA countries regarding the private sector companies serving at the regional level and better public awareness and media campaigns to promote the PPP concept in the MENA region.

MENA countries should reflect carefully in their choice of private partners and in the institutional and legal reforms required to facilitate PPP. Regulations should be clear in all aspects, and should take into account the prevailing national laws and by-laws. Regulations should protect the interests of all parties (public, private and consumers). There are social risks involved in PPP such as acceptance of the concepts, equity among users and employee downsizing.

Although it was recognised that PPP contracts in the region already in operation do not implicitly refer to WDM, some of their goals do contribute to WDM practices (e.g. reducing unaccounted for water in Amman). PPPs in water management have the significant benefit in that they require that water has to be addressed as an economic good as well as a social good. There must be a balance in the necessity to establish contracts that deliver returns to shareholders as well as the necessary economic and environmental regulation of private monopoly providers. This requires that governments address the value of water and the appropriate level of prices and subsidies as well as the economic level of leakage. This is the real value of PPPs to the WDM approach and water specialists, from the public or private sectors, must ensure that the WDM philosophy is incorporated in all future PPP contracts.

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5.

Decentralization and Participatory Irrigation Management

Bayoumi Attia

The fourth WDM Forum was held in Cairo, Egypt in February 2003 with the theme of decentralization and participatory irrigation management (PIM). The forum gathered 211 participants from the Forum's nine countries, as well as representatives from Turkey and Crimea, each with their own experiences in this topic. There were four core presentations by Egypt, Tunisia, Turkey and Yemen (Abdel-Aziz, 2003; Al Atiri, Braham and Mnajja, 2003; Özlü *et al*. 2003; Abdul-Malik and Attas, 2003). Partners promoting participatory management approaches and the involvement of water users in irrigation management gave other presentations. These agencies included the World Water Council (WWC) and the International Fund for Agricultural Development (IFAD). Contributions were also welcomed from Jordan, the Palestinian Territories, Morocco and Syria. The Research Institute for Humanity and Nature in Kyoto, Japan presented the Japanese experience related to irrigation management transfer.

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The objective of the Forum was to inform decision-makers on achievements of decentralization of water management and to bring together a large number or interest users such as members of Water User Associations (WUA), Water Boards (WB), other NGOs, representatives of donor countries, and other water practitioners. Most of the participants were decision-makers from ministries of irrigation, water resources, agriculture and environment.

INTRODUCTION

Decentralization of water management, including participatory irrigation management (PIM), has been identified as a key WDM tool for better and more efficient water management, especially in water scarce regions. It requires the involvement and decision-making of millions of users and user groups in the design, implementation, operation and maintenance of water services.

PIM also provides a basis for fair allocation of water through the collective effort of a group with a common interest, operating on the basis of mutually agreed and binding rules.

Decentralization aims to lift the high burden of government involvement in operation, management, maintenance and rehabilitation of irrigation systems. At all levels, multi-stakeholder involvement is, or should be, concerned with water policy formulation, planning, equitable allocation, water conservation and sustainability and pollution control. Participation must aim for efficient and equitable water use and the promotion of environmental awareness.

PIM promotes the economic use of water and the associated increase in productivity. It gives farmers the opportunity to appropriate, directly, true scarcity and the cost of delivering water to the farm gate, while developing a sense of ownership and responsibility over the irrigation system that supplies this scarce resource. It is expected that system sustainability be promoted by enabling water users to adapt the system operation and maintenance practices to the requirements of their cropping patterns.

There is growing interest by governments worldwide to decentralize water management to exercise WDM and to reduce costs. Typically, government agencies have assumed investment responsibility for installing and implementing large irrigation projects such as dams and canals. The costs for operation, maintenance and rehabilitation of such systems are extremely high and pose a heavy burden on governments, especially those with limited financial and institutional capabilities to install, operate and maintain these water systems.

Under decentralization, cost recovery may consist of contributions (fees) from users/farmers or government agencies (subsidies). Collection of user fees can cover part of the total costs. It is unlikely that full cost recovery will be

reached without formal and effective participation of all users in the management of irrigation projects. This may be done through individual farmer families, user associations, small NGOs and large-scale corporations.

Efforts elsewhere have been made to involve communities and user associations in water supply and small-scale irrigation schemes. Community participation is oriented towards developing and enhancing the sense of ownership and responsibility for individuals and resources within the community. Experiences indicate that public participation provides the basis for better health care and mass education programs have contributed to proper water use and storage practices and in the areas of management, personal hygiene, and human waste disposal. Ultimately though, meaningful participation cannot be achieved unless there is greater and/or real transfer of responsibility, authority and resources to as many users as possible.

There are several benefits gained from users' participation in water management. These include:

- Implementation of rehabilitation and improvement works as farmers' preference;
- Control of quality of service rendered;
- Control of operation and maintenance costs;
- Control of financial resources;
- Less conflict regarding water distribution.

KEY ISSUES FACING THE REGION

Centralized water management at the national level and their close relationship with agricultural agencies characterizes most water management agencies in MENA. This is mainly because of the large financial and administrative resources required to undertake management activities. Therefore and specifically in developing countries, decentralizing responsibilities needs to occur. Local and private capabilities would exist where appropriate regulatory systems are established. Key issues of concern in the decentralization process, expressed by the Forum participants, include:

Institutional Reform

At the Forum, institutional aspects of decentralization focused on the expectations of farmers and governments on the adoption of the decentralization approach of irrigation water management. Farmers expect a reduction in the operation and maintenance costs, cohesion among users within the group, better resolution of conflicts concerning water distribution, better productivity and higher income. In comparison, government officials expect reduction of governmental expenditure on maintenance and operation, improved irrigation

systems, valuation of irrigation water and raised awareness and reduction of responsibilities towards water management.

Most participants agreed on the need to have institutional and legal frameworks to define the responsibilities of the users groups and regulate water management activities. However, some were concerned about the level of constraints these frameworks would have on the performance of the group with respect to specific activities. Also, most participants rejected the idea of having the existing agricultural cooperatives in many countries assume water management tasks and responsibilities as water management groups. This is mainly due to the presence of other types of users -- besides farmers -- within the groups, and the fact that water users groups are non-profit organisations with different objectives than agricultural cooperatives.

Creating an Enabling Environment

Participants discussed the level at which users associations should resume responsibility. They supported having water users associations within the formal water management structure to be regulated technically and administratively by government at higher levels. The participants also backed the principle of delegating authority at the tertiary canal level (*mesqa*) to the water users association and control the association budget and assume operation and maintenance tasks of the irrigation system at that level.

Participants also responded to the fundamental elements of a legal and institutional framework by listing these elements as: legal identity, financial independence, regular meetings, board selection/election, awareness and training of board members, with a clear cut relationship with the government. The participants suggested a number of ways to provide the necessary technical and information capacity to members of the users groups including formal training, on the job training, exchange visits, demonstration meetings, awareness campaigns and building up a communication strategy.

Financial Management

> The user groups' role is to define criteria for selection of members, ensure good financial and technical management, guarantee commitment to perform activities and raise funds, ensure maximum participation, and show interest in carrying out designated tasks.

Participants discussed sustainability requirements both from users associations and from government bodies. Several suggestions concerning government's role were presented including the development of policies and strategies to define roles of water users groups, coordination between government agencies and users associations, provision of the

infrastructure by government, provision of technical support whenever and wherever needed, provision of temporary financial support and incentives to encourage users associations to assume their duties.

The participants agreed on having other groups to be presented in the board of the association. They argued about the potential ways to raise funds to ensure the sustainability of the operation and maintenance tasks to be performed by the association and suggested several approaches such as member subscription according to holding size, flat rates, long-term loans, fees on violations and environmental pollution. They also agreed that full autonomy is required to raise funds, and that the government should remain as an observer to the process. It was also agreed that financial agreements related to water transfers should be clearly drawn.

Monitoring and Evaluation

Discussions on monitoring and evaluation of the performance of users associations addressed the importance of developing and implementing monitoring and evaluation procedures. They suggested several methods to carry out these activities either by the users themselves or by an external government body. They identified a variety of factors to be monitored and measured including the total water consumed, duration and cost of repair and rehabilitation works, regularity of board meetings, implementation of board decisions, expenditure recovery, pursuing budget plans and water quality parameters. Indicators were then identified that would assist in evaluating users group performance.

ANALYSIS AND DISCUSSION OF THE CASE STUDIES

Analysis of the four case studies from Egypt, Tunisia, Turkey and Yemen was undertaken (Abdel-Aziz, 2003; Al Atiri, Braham and Mnajja, 2003; Özlü *et al*., 2003; Abdul-Malik and Attas, 2003). These are summarised in Attia (2003). The case studies illustrated the forms of user participation, types of user organisations and the various implications for the different countries. There were extensive discussions on these case studies with emphasis on the different aspects related to the participatory approach of water management. Other less detailed studies were briefly introduced to show other forms of PIM and their impacts.

The IFAD paper discussed lessons learned from experience in the region (IFAD, 2003). It showed that PIM projects not only reduced financial and institutional burdens of the government in relation to operation and maintenance of irrigation systems, but economic use of water was promoted and they provided a basis for fair access to water and resulted in sustainability.

The WWC presentation discussed the major issues of decentralization and participation including the transfer of authority to lower level government, users groups and involvement of payments for service provision by farmers. The example of Indonesia was presented to share the decentralization policy adopted. It presented the approach followed to transfer authority to federal water users associations and discussed the service agreements and the cost sharing. It concluded that political will was the driving force for the success of the management transfer policy (van Hofwegen, 2003).

There are many challenges affecting water resources management in the MENA countries, including:

- Scarcity of water;
- High population growth rates;
- Increased agricultural and industrial activities;
- Inefficiency in government service provision;
- Lack of government funds allocated for operation, maintenance and rehabilitation activities;
- Weakness of enforcement of laws and regulations governing water use; and
- Lack of public participation in water resources system planning, design, operation and maintenance.

The Jordan study described irrigation management in the Jordan Valley through water user's participation in three pilot areas, where in 2001, the private sector participated in water distribution activities (Adwan, 2003). In Morocco, water users associations gained progressive transfer of irrigation management responsibilities in a contractual framework with full responsibility of operation and maintenance according to the law issued in 1990 (El-Haouari, 2003).

The analysis of the four country case studies showed that decentralization has been implemented at different levels and in different forms in the four countries. The assessment of water balance, between available resources and requirements of these countries, led to the realisation of several challenges facing the countries, which hinder the improvement of irrigation system management, and result in lower water use efficiency and loss of precious water as well as increasing conflicts among water users. These, in turn, lend support to the idea of decentralization and transfer of irrigation water management to water users. However, irrigation management transfer means relocation of responsibilities, authority and funding from the government to the water users groups at different levels and for different activities.

All stakeholders would need to identify the functions to be performed to achieve the expected goals and objectives of decentralization and management transfer. It is also required/recommended that the users groups, local authorities and NGOs establish necessary links with central government agencies in charge of irrigation and agriculture. Another function that should be performed by the

users groups and NGOs is to develop financial resources and raise funds to carry out all water management activities.

IMPACTS AND IMPLICATIONS OF DECENTRALIZATION

There are several impacts and implications resulting from decentralization and transfer of water management. These implications are associated with the form of user participation and the level of involvement in planning, implementation, monitoring and evaluation of the irrigation management process. It is also dependent of the method of financing of users groups and their institutional and legal structure. An essential but usually overlooked implication is the new role government has to play and the processes leading to the effective implementation of this new role. Hence, there will *still* be a role for government.

Technical Implications

There are several technical implications of users' participation in water management. However, the country papers did not provide enough information about the details of the technical assessment related to users' participation in irrigation system management. The technical assessment mainly focused on irrigation system operation and maintenance activities. It described the size of the area served by water users associations, which ranged from 10 ha to 1,500 ha. It also described the hydraulic works needed and the energy consumed to perform the water distribution activities. The case studies concluded that in general the availability of water to all users improved as well as the equity in distribution. The irrigation water use efficiency was raised by 30-50%. A major activity carried out by water users groups was the maintenance activity for the system under their control.

Economic Impacts

In some countries like Egypt, the irrigation improvement and the users' participation in the operation and maintenance of irrigation canals resulted in more agricultural production and more income to the farmers (Abdel-Aziz, 2003). It also resulted in reduced costs of irrigation operation as well as reduced costs for the government of the maintenance of the shared private canals. In Tunisia, the prices paid by farmers were incomparable to the costs by the government. Decentralization and transfer of water management to local agencies helped in adjusting the costs according to the irrigation network conditions (Al Atiri, Braham and Mnajja, 2003).

Water tariffs were established in Turkey according to the type of facility constructed and managed. For government run facilities, farmers paid for the

recovery of the operation and maintenance costs for water transmission from the source to the field. For facilities run by water users, water tariffs throughout the year were set based on expected expenditures for the next year. There are also economic incentives for early payment and substantial penalties for late payment (Özlü *et al*., 2003).

In Yemen farmers paid 30% to 50% of the costs of the improved irrigation systems. Farmers in user associations were allowed to accept the options of water management and agree on the percentage of their contribution into the irrigation improvement project (Abdul-Malek and Attas, 2003).

Social and Political Impacts

The main social impact of user participation in irrigation management is the sense of responsibility that was generated among the water users (mainly farmers in all systems). This sense of responsibility led to more efficient operation of the system, equity in water allocation and distribution among farmers. Cooperation and coordination among farmers within the users groups helped to minimise the operation and maintenance costs at the user group level.

In most of the systems presented, members of the users group or association elect a senior member to lead the group and to be in charge of setting the rules for the operation and maintenance activities within the association. Another member may be elected to administer the user's group funds for the various activities. The group leader is also responsible for resolving conflicts among group members such as determining of time for irrigation and rent of equipment for maintenance activities. Regular meetings of the users group helped to identify water shortages and distribution problems earlier. These meetings also helped in the early detection of financial problems. It should be noted that in all four country cases users participation resulted in good cooperation among farmers and positive social impacts. However, most of these impacts could not be quantified.

Environmental Impacts

One of the main environmental impacts of users participation in irrigation management is water saving and conservation in addition to protection against pollution. In Egypt, however, the management of irrigation water at the local level did not reflect any water saving at both the local and national levels (Abdel-Aziz, 2003). This is because in the traditional irrigation system, farmers located at the tail-end of the canal used to cultivate crops that were tolerant to water shortages. However, with the improved irrigation system, these farmers received more reliable water resulting in changes of the cropping pattern to more water consuming crops. Thus, the overall impact is increased productivity and equity but no water savings as such.

In Tunisia, the government subsidised the farmers to invest in water saving by equipping their irrigated areas with water saving systems. In return, such farmers received high incentives from the government to participate in WUAs (Al Atiri, Braham and Mnajja, 2003). In Yemen, and according to the law, local councils are responsible for implementing measures for preventing water pollution and degradation of natural resources (Abdul-Malek and Attas, 2003).

Institutional Implications

There have been several approaches adopted in each country to formally institutionalize and describe the responsibilities of water users groups. Institutional aspects deal with the structure of the users group, the relationship between the governmental agencies in charge of water management at higher levels and these new users groups. In all users groups, members were farmers on a common canal or within a certain area served by shared water resources. All farmers may be members of the users group or in some cases; only a limited number is elected among all users. They are given special assignments and privileges according to the type of the water users group and the level of involvement. They may be involved in water policy formulation, planning, implementation, operation and/or maintenance. They may also be charged with fund raising and monitoring and evaluation tasks.

In the four case studies presented, users groups were responsible for providing opinions and decision-making, as well as analysing and implementing all activities related to operation and maintenance of the irrigation system components. However, only in Tunisia were users involved in water policy formulation, planning and implementation of irrigation improvement projects. Similar structures and formation of associations was presented in the case of Japan (Watanabe, 2003), where users groups are formed at the branch canal level, and are managed by an elected board and a staff of engineers, technicians and clerks.

Legal Implications

Laws and regulations are not available in all countries for legalizing water users groups and this is a fundamental problem facing many countries. Laws are required to formalise the involvement of farmers in the operation and maintenance of the irrigation system at different levels, and define their roles, responsibilities and rights. In Egypt, a law issued in 1994 recognised water users associations as legal organisations at the private canal level in irrigation improvement areas in old lands. The law also defined the water users unions in new lands. Another decree was issued in 1995 to detail the rights and the duties of the associations and the unions. In Tunisia, collective interest associations were established; water users organisations were also established in Turkey, and

water users groups in Yemen. However, the overall conclusion of workshop participants is that better legal frameworks are imperative if decentralization is to be fully realised.

KNOWLEDGE GAPS

Several gaps were identified from the case studies and workshop discussions. One was the lack of effective user's participation and inadequate coordination between them and decision-makers at different levels. This resulted in a tremendous waste of water and poor economic valuation of resources. In addition, the lack of accurate data and information available to users groups concerning water distribution services, and operation and maintenance activities resulted in limited evaluation of the performance of water users associations with respect to water management. The lack of proper information about the actual costs for operation, maintenance and rehabilitation of the irrigation and water delivery systems hindered the assessment of the economic impacts of adopting PIM. In some cases, the lack of a legal framework to organise the establishment and operation of water users associations hindered acceptable performance of the users groups. In all cases, it was found that there is no regular monitoring and evaluation procedure being followed. Importantly, no indicators had been defined to measure effectiveness of management.

> Countries need to actively seek opportunities to implement a refined institutional and legal framework to allow real partnership between government agencies and water users in the effective management of irrigation systems. Such a framework should comprise all regulations and rules to be followed in the establishment of water users groups. It should also include procedures to be followed in carrying out operation and maintenance activities of the irrigation system. A clear allocation of responsibility and accountability between water users associations and government agencies involved should be defined. Rules and regulations for enforcing the terms of the partnership between water users associations and government agencies should be set. Governmental agencies should be able to adapt to decentralized water management by initiating and implementing the necessary institutional reforms. Specific indicators have to be defined for each country to allow appropriate monitoring and evaluation of the irrigation system performance under the coordinated operation between governmental bodies and various water users.

CONCLUSIONS

Decentralization of water management and the participation of farmers and other stakeholders in decision-making activities, as well as operation and

maintenance of irrigation systems have been implemented in some countries of the region. The significance and advantage of decentralized mechanisms and stakeholder participation in water management is recognised and demonstrated. In many cases, there is evidence that decentralized management has resulted in economic, social and environmental benefits: water savings, water distribution efficiency, conflict resolution, financial savings and higher agricultural productivity.

Currently, decentralization of water management in irrigation is one of the core issues for the water vision in many MENA countries to induce efficient use of water and save government costs. However, for decentralized management to be effective, it is necessary to have the supportive legal, institutional and regulatory frameworks as well as a system of water charges to endow water entities with operational and financial autonomy for efficient and sustainable delivery of services. Effective monitoring and evaluation are key to this process. Some countries clearly demonstrated that their initial embarkation on this route was donor driven and they called attention to the difficulties that occur when the decentralization is imposed without proper regard for local customs and traditions.

The advantages of decentralization were recognised. As the sense of responsibility and cooperation from farmers develops, greater efficiency in water use is achieved through a more flexible and farmer-responsive system. It is still not clear the extent to which water savings occur in a decentralized water management system. However, given the increased availability of water for farmers who were previously not receiving enough, there are important implications on decentralization on equity.

In the MENA region, there is a general consensus on the importance of irrigation management decentralization and transfer to users. Stakeholders' involvement in water management is now an acceptable policy goal in many MENA countries. Several forms of decentralization and users associations have been presented with different levels of success. The form of participation differs from one country to another according to each country's capacity and circumstances. All countries must learn from the experiences of the other countries taking into consideration the drawbacks encountered.

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6.

Conclusions

Ellysar Baroudy

Some progress is being made in managing water demand in MENA. Even in countries with leading experiences that were documented as case studies, it is evident that there is still a way to go to attain better efficiency and equity of water use. The Forum participants note that a fundamental change is required at the institutional and policy levels to facilitate the adoption of WDM practices.

The four issues covered in this book were identified by decision-makers as water demand management priorities in their countries. The Forums represented the first time that that decision-makers were able to document and discuss their experiences. The process reflected their commitment to implement change.

Countries are looking at their organisational set ups to deal with **wastewater reuse**, although funding remains a fundamental concern. This water resource is vastly underutilized, but countries are attempting to make more of lesser quality water available, as seen with the increasing number of hectares being irrigated with treated wastewater. However, unless a more integrated approach is adopted to envelop the whole spectrum of collection, treatment and reuse, further progress is hindered.

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The case studies show an evolution in the **water valuation** process that reflects that positive steps are being made; particularly in the domestic sector. Operation and maintenance costs at minimum need to be recovered, and a balance struck between the value allocated to freshwater and recycled water. Another key issue is to balance surface water supply costs versus the groundwater supply costs in order that consumers do not rely on their own alternative extraction methods with negative consequences on resources.

The countries have limited experience in **public-private partnerships**, but the attempts made show positive changes in service delivery efficiency, including reducing unaccounted for water. The region is still learning, but continues to plan for different types of contracts with the private sector. MENA will have to build into their contract negotiations further elements to enable water demand management and to get the private sector on board with the element of conservation.

Decentralization in agricultural water use shows that this is a more equitable system of management, although the current institutional and regulatory frameworks limit advances. Providing a greater responsibility to the user needs a certain level of buy-in. Although not all studies showed direct water saving, in some cases incentives for water saving technologies have been provided to the users. While the role of government is changing with an increased participation of the users, its financial burdens are often reduced.

Further details on the Forums including all the references listed in this book, can be found in English, French and Arabic on the Regional Water Demand Initiative (WaDI*mena*) Web site: www.idrc.ca/waterdemand.