

Policy Analysis of National Water Plans in Selected Arab Countries

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Executive Summary

At the 2002 World Summit on Sustainable Development (WSSD) held in Johannesburg, delegates concluded that integrated water resources management and water efficiency planning should be an essential element in all national or regional development strategies by 2005. Over the years it has been shown that an integrated approach to water resources management will be critical for achieving many of the Millennium Development Goals (MDGs), including not only those related to health, but also to poverty and hunger eradication, education, women's empowerment, environmental sustainability and global partnership for development. It is now recognized that inherent in the concept of Integrated Water Resources Management (IWRM) are the principles of water-use efficiency, water demand management, equity of access, a balance of competing uses, the application of appropriate environmentally sound technology, and participatory planning and management to include all sectors of the economy and all segments of society.

The purpose of this paper is to focus on the policy analysis of national water plans, and to examine to what extent and how countries have adopted and implemented the principles of IWRM and thus are progressing towards achieving the MDGs targets. The paper provides an overview of national water plans in selected Arab Countries (Algeria, Egypt, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia and Yemen) conducted through a desk review.

The paper aims at providing a feedback on the taken actions towards developing National Integrated Water Resources Management (IWRM) plans in the selected countries. It describes the major stakeholders involved in water resources planning, and presents the main features of the water policies, strategies and/or plans for the selected countries. In addition the paper portrays some of the policy instruments, and provides a brief analysis of the national water plans describing some of the challenges facing national water planning and whether it is being addressed within a strategic perspective, as some of the challenges facing the implementation of national water plans. The paper produces a set of conclusions and recommendations as to how best to improve national water planning.

This paper builds on the recent assessment conducted in 2004 by the Arab Water Council, the Centre for Environment & Development for Arab Region & Europe (CEDARE), and the United Nations Development Programme (UNDP), to assess the status of the Arab countries in achieving the WSSD Target of developing IWRM plans by year 2005.

The following sections describe the national water strategies, policies, and/or plans in the above mentioned countries.

Algeria

Algeria, with a total area of 2285,263 km², is located in North Africa. It is bordered by the Mediterranean in the North, Morocco and Mauritania in the west, Mali, and Niger in the south, and by Libya and Tunisia in the East.



Main stakeholders of Water Resources

The Ministry of Water Resources (Ministère des Ressources en Eau) MRE governs the water sector in Algeria. The Directorate of Studies and Hydraulic Schemes in the Ministry manages the water resources studies, hydraulic schemes and is responsible for the development of water resources plans. Various departments and authorities are involved in implementing water regulations along with the Ministry of Water Resources. Five organizations have been established:

- National Agency of Dams and Large Transmission Mains (ANBT);
- Algeria Water Company (ADE) for the distribution of drinkable water;
- Office of National Sanitation (ONA);
- Office of National Irrigation and Drainage (ONID); and
- National Agency of Water Resources (ANRH).

In addition to the above mentioned, five watersheds agencies (Agences de Basins Hydrographiques, ABH) were created in August 1996, these agencies translate into practice the principle of joint and integrated management of water resources throughout the watershed.

Main features of Water Strategy and/or Policy

Given the deficit situation in satisfying water needs, and despite the importance of heavy investments in the sector, the water resources sector has undertaken since the early 1995, comprehensive procedures to enhance the system of organization and management of the sector.

A new water policy was initiated and is based on Integrated Water Resources Management principles. The main features of the policy are:

- Scarcity of the resource;
- Integrated management across the river catchment; and
- Applying economic and environmental management.

Policy Goals and Instruments

The broad objectives of this policy can be summarized as follows:

- Systematic mobilization of all exploitable water resources;
- Protection and preservation of existing resources; and
- Rehabilitation and completion of treatment systems.

The current policy depends on the following factors and instruments for the policy achievements:

- With regard to demand management, a major multidimensional outreach program on saving water will be implemented to achieve:
 - Reduction in the drinking and industrial distribution networks losses; and
 - Modernization of irrigation methods and cultivation of low-water requirements crop varieties.
- With regard to integrated water management and protection of the resource:
 - Use of non-conventional water resources to secure water supply for major urban centers, and agriculture through:
 - ✓ seawater desalination ;
 - ✓ Desalting of brackish water; and
 - ✓ Reuse of treated wastewater.

- With regard to development of planning tools and dynamic management, some inconsistency in planning and programming investments have been identified. A review of the study on the "National Water Plan" has been undertaken which was designed to have a clear vision to ensure an interregional balance between "needs" and "resources."
- With regard to institutional and organizational reforms, the following principles will be applied:
 - Water resources are public property;
 - Integrated river basin management;
 - Economic management; and
 - Preservation of environmental quality of the resource.
- With regard to legislative reforms, a new water law was developed in 2005. This law allows for public-private partnership in construction and management of public drinking water, sanitation and irrigation systems.

Analysis and Challenges

Applying the revised National Water Plan and implementing the different policy instruments, it is expected to gradually bring the water resources sector to the implementation of the principles of Integrated Management of Water Resources (IWRM). This shall improve the performance of the water resources system through the involvement of users in decisions and the use of economic incentives, in addition to the implementation of flexible regulatory means.

The improvement of public services in drinking water and sanitation calls for institutional reforms for effective control and water management. The establishment of public institutions of an economic nature is a first response to progress towards sustainable management of the water supply and sanitation sector.

The National Water Plan aims at achieving development in the different segments of the national economy (industry, agriculture, tourism), based on the maximum mobilization of conventional and unconventional water resources. The implementation of the plan and its associated institutional reforms requires state financial support of about 1.3 billion \$ per year.

One of the challenges facing Algeria is the efficient use of water, and the reduction in water losses from distribution networks. The new water code gives the legal basis for providing a reliable public service of water supply and sanitation, and allows for managing water in an integrated manner at the watershed level through regional agencies and committees.

Egypt

Egypt lies in the northeastern corner of the African continent with a total area of about 1 million km². It is bordered in the north by the Mediterranean Sea, in the east by Palestine and the Red Sea, in the south by Sudan and in the west by Libya. The Egyptian terrain consists of a vast desert plateau interrupted by the Nile Valley and Delta, which occupies about 4% of the total country area. The land surface rises on both sides of the valley reaching about 1,000 m above sea level in the east and about 800 m above sea level in the west. The highest point of the country, at Mount Catherine in Sinai, is 2,629 m above sea level and the lowest point, at Qattara Depression in the northwest, is 133 m below mean sea level.



Main stakeholders of Water Resources

Several ministries are involved in managing the water sector. The Ministry of Water Resources and Irrigation (MWRI) plays a key-role in the planning and management of water resources in Egypt. MWRI is also in charge of the distribution, operation and maintenance of Nile Water through an extensive network of the irrigation system. The Ministry is also responsible for collection and disposal of agricultural drainage water, monitoring and assessment of water quality of the various water sources, and protecting the coastal lakes and the shoreline. The Ministry of Agriculture and Land Reclamation (MALR) is involved in improving agricultural activities and land reclamation, including irrigation management on the farm level. The Ministry of Housing, Utilities and New Communities (MHUNC), is in charge of investment projects for water supply and sanitation services in the municipal and industrial subsectors. The Holding Company for Water Supply & Sanitation (HCWSS) under the auspices of the MHUNC is in charge of O & M of the Water Supply and Sanitation sector. The Ministry of Health and Population (MoHP) is in charge of auditing drinking water quality, the Ministry of State for Environmental Affairs (MoSEA) of auditing potential point sources of pollution to different water bodies.

Main features of Water Resources Management Policy 2000 – 2017

The main features of the water policy of Egypt to the year 2017 can be summarized as follows (MWRI, 2000):

- Developing new water resources through:
 - ✓ Increase Nile River water yield through cooperative projects with Nile riparian countries;
 - ✓ Rainfall and flash flood harvesting is estimated at about 1.0 BCM;
 - ✓ Drainage water reuse can be increased from 4.7 to 9.0 BCM by the year 2017;
 - ✓ Deep groundwater extraction can be increased from 0.57 to 3.50 BCM till the year 2017;
 - ✓ Shallow groundwater extraction in the Valley and the Delta can be increased from 4.80 to 7.50 BCM by the year 2017;
 - ✓ Reuse of treated wastewater can be increased from 0.70 to 2.00 BCM till the year 2017; and
 - ✓ Desalination of sea water can be increased according to needs.
- Improving the efficiency of the present use of water resources through:
 - ✓ Minimization of surface water losses in canals, drains & irrigated areas;
 - ✓ Irrigation Improvement projects (IIP) in 3.50 Million feddans to save about 4.0 BCM by the year 2017;
 - ✓ Achieving better integration between agricultural policies and irrigation policies;
 - ✓ Setup a fair cost sharing system for all related operational and maintenance activities for water infrastructures;
 - ✓ Cropping pattern shifts to save about 3.0 BCM of water; and
 - ✓ Increase of efficiency of Municipal water use.
- Improving water quality management in industrial, domestic and agricultural sectors;
 - ✓ Implementing environmental management systems for the Northern Lakes;
 - ✓ Improving water use ethics;
- Institutional, and legislative, and Financial Improvement
 - ✓ Promoting decentralization within the MWRI;
 - ✓ Conducting institutional reform activities at all levels;

Policy Instruments

The current policy depends on the following instruments for policy achievement:

- Public awareness;

- Capacity building for all levels of stakeholders;
- Continuous monitoring and evaluation;
- Water quality monitoring programs;
- Drainage water quality monitoring programs;
- Groundwater quality monitoring programs; and
- Improvement of water resources management systems through:
 - ✓Users' participation in water management;
 - ✓Institutional strengthening of MWRI;
 - ✓Co-ordination between MWRI and other ministries;
 - ✓Continual revision and of laws and decrees pertaining to the water sector and adoption of effective enforcement mechanisms;
 - ✓Transboundary cooperation through implementation of the Nile Basin Initiative programs; and
 - ✓Use of modern technologies in water resources management.

Main features of National Water Resources Plan (NWRP)

MWRI, as the leading official government entity, took the lead in collaboration with other Ministries to develop a National Water Resources Plan (NWRP) that is in line with its Water Management Policy. In addition, other efforts were also launched by MWRI to provide the enabling environment for the implementation of the NWRP. These efforts include Institutional Reform, Irrigation Improvement, establishing Integrated Water Management Districts, Improvement of Rural Sanitation, and Involvement of Water Users Organizations.

The main objective of the National Water Resources Plan (NWRP) is to safeguard Egypt's water resources in the future, both with respect to quantity and quality, and to ensure the use these resources in the best way from a socio-economic and environmental point of view. The planning horizon is the year 2017. The vision of the NWRP was based on the IWRM concept.

NWRP has the economic and social development objectives to

- Increase employment;
- Improve equity in water distribution and farmers income;
- Attain some minimum level of food self-sufficiency
- Meeting water needs in all sectors in the future;
- Protecting public health and the environment;
- Recovering of operational and maintenance costs to enable better services.

The NWRP aims to achieve the national objectives through activities that are categorized under the following four strategic measures:

- Developing new water resources;
- Improving the efficiency of the present use;
- Protecting the environment and health; and
- Strengthening the institutional framework.

Analysis and Challenges

The NWRP was developed in a participatory manner involving all relevant stakeholders, and each stakeholder including the relevant ministries, the private sector, the water users' organizations, the non-governmental organizations has a role in implementing the planned activities. Implementing the NWRP plan 'Facing the Challenge', as stated in the NWRP, is expected to improve the performance of the water resources system. More water will be available for the various uses and the water quality will improve significantly. The agricultural area will increase by about 35% as a result of horizontal expansion including the two mega projects in Toshka and North Sinai. New living communities will be created for more than 20% of the population. The implementation of the plan will support the socio-economic

development of the country and provide safe drinking water to its population. The access of the population to safe sanitation facilities will double from the present 30% to 60%. As stated in the objectives, the plan will safeguard the water supply up to the year 2017. However, it should be realized that by implementing all these measures, the renewable water resources system will have reached a critical situation in supporting the country's increasing water demand.

The implementation of the NWRP up till year 2017 requires an investment budget of about 145 billion Egyptian pounds (27 billion USD \$), and a recurrent operation and maintenance budget of about 45 billion Egyptian pounds (8.5 billion USD \$). It is a challenge to make the necessary budget available for the implementation of the NWRP in the presence of other pressing governmental budgetary needs for other socio-economically important sectors. Another challenge that faces the successful implementation of the NWRP is maintaining the interest and involvement of the different stakeholders which had started by forming an inter-ministerial committee for the monitoring and evaluation of the NWRP implementation.

Jordan

Jordan lies to the east of the Jordan River with a total area of about 8,928,720 hectares. Jordan is bordered on the north by Syria, on the north-east by Iraq, on the south-east and south by Saudi Arabia, on the far south-west by the Gulf of Aqaba (northern shores of the Red Sea) and on the west by Palestine.



Main stakeholders of Water Resources

Three institutions take responsibility for water administration in Jordan: Ministry of Water and Irrigation (MWI), Water Authority of Jordan (WAJ), Jordan Valley Authority (JVA). WAJ and JVA are by law responsible for water supply and wastewater services in Jordan.

MWI is the official body responsible for the overall water and wastewater system and the related projects, planning and management, the formulation of national water strategies and policies, research and development, and information systems.

WAJ was established as an autonomous corporate body, with financial and administrative independence linked with the Minister of Water and Irrigation. WAJ became responsible for the public water supply and wastewater services as well as for the overall water resources planning and monitoring, construction, operations and maintenance.

JVA has been established for the social and economic development of the Jordan Rift Valley including the development, utilization, protection and conservation of its water resources. The King Abdallah Canal represents the backbone of the JVA water distribution system in the north of the Dead Sea.

Main features of Water Strategy and/or Policy

The Jordan water strategy and policies document covers five main aspects: 1) water strategy, 2) groundwater management policy, 3) water utilities policy, 4) irrigation water policy, and 5) wastewater management policy. The main features of the water strategy and policies of Jordan can be summarized as follows (MWI, 2002):

- Enhancing water supply and management;
- Securing a supply of water that is reliable in quantity and quality;
- Developing new water resources through:
 - ✓ Investigating the potentiality of deep aquifers. A major additional groundwater resource is foreseen to be developed in Disi;
 - ✓ Using of marginal water including treated wastewater and brackish water. Annual Water reuse is expected to exceed 200 MCM by the year 2020, while the present reuse is in the range 70 MCM;

- ✓ Desalination of seawater and brackish water is foreseen to contribute up to 55 - 60 MCM to Municipal and Industrial supplies.
 - ✓ Ensuring the rightful shares of Jordan's shared water resources; and
 - ✓ Assessing the available and potential resources periodically.
- Conducting institutional restructuring and decentralization;
 - Involving private sector;
 - Improving the efficiency of the present use of water resources through:
 - ✓ Utilizing the full potential of surface water and groundwater based on economic, social and environmental impacts;
 - ✓ Conducting water and wastewater projects, including the scheme for the development of the Jordan Rift Valley;
 - ✓ Combining the use of ground and surface water with different qualities;
 - ✓ Improving the conveyance and distribution systems;
 - ✓ Setup of a fair cost recovery system for all related operation and maintenance activities of the water infrastructures; and
 - ✓ Cropping pattern shifts to less-water consuming crops.
 - Achieving better cooperation with the Ministry of Agriculture MoA and environmental authorities;
 - Improving water quality management in industrial, domestic and agricultural sectors;

Policy Instruments

The current policy depends on the following success factors and instruments for the policy achievements:

- Public awareness;
- Capacity building for all levels of stakeholders;
- Continuous monitoring and evaluation;
- Water quality monitoring programs;
- Marginal water quality monitoring programs;
- Groundwater quality monitoring programs;
- Initiating a comprehensive water related data bank;
- Setting up suitable plans through:
 - ✓ Formulating long-term strategy for the development of the resources;
 - ✓ Developing five-year plan and update it as necessary; and
 - ✓ Setting a parallel investment plan to the development plan.
- Improvement of water resources management systems through:
 - ✓ Users' participation in water management;
 - ✓ Adopting a dual approach of demand and supply management;
 - ✓ Institutional strengthening of MWI;
 - ✓ Co-ordination between MWI and other ministries;
 - ✓ Continual revision and of laws and decrees pertaining to the water sector and adoption of effective enforcement mechanisms;
 - ✓ Transboundary cooperation through establishment of Joint Water committees with neighboring countries; and
 - ✓ Use of modern technologies in water resources management.

Main features of National Water Master Plan

With due consideration of the provisions of the *Water Authority Law*, MWI prepared the National Water Master Plan (NWMP). Within the context of the National Water Master Plan the national management level is important for information availability, coordination, policy development, planning, the legal framework, and human resources development as required for integrated water resources management (ICWE, 1992).

Legal responsibilities with regard to water resources monitoring and planning exist with MWI, WAJ and JVA. The Jordanian Institute of Standards and Metrology is charged with the duty of issuing standard specifications for the water sector in cooperation with representatives of MWI, WAJ, JVA and representatives of the Ministry of Health and the Ministry of Environment.

The NWMP has an overall objective of the sustainable use of the scarce natural water resources, in line with a continuous improvement in living conditions for the country's population. This implies the adherence of the Jordan's water sector to the principles of integrated water resources management through securing the needs of future generations. The NWMP has the economic, social and environmental development objectives of:

- Moving the Jordanian economy from its public sector orientation into one where the private sector plays an important role;
- Applying decentralization as major elements of the reform process;
- Setting up priority criteria for additional water allocation that shall be based on economic, social and environmental considerations. First priority will be given to the basic human needs; as such, first priority is given to allocation of a modest share of 100 litres per capita per day to domestic water supplies;
- Setting and enforcing national health standards, especially in the municipal water supply sector;
- Installing a network of observation wells in each of the groundwater reservoirs; and
- Maintaining properly equipped laboratories for water quality analysis and pollution controls.

The NWMP has created the necessary coordination mechanisms to develop consent on the objectives and implementation of the NWMP between all stakeholders involved.

Analysis and Challenges

Moving Jordan's economy from being public sector oriented into one where the private sector will have its impacts on water service efficiency and affordability which is yet to be witnessed.

The implementation of the NWMP will support the socio-economic development of the country where reuse of wastewater will play a critical role. It will be collected and treated in accordance with WHO and FAO Guidelines which shall allow its reuse in unrestricted agriculture and other non-domestic purposes, including groundwater recharge resulting in augmenting the scarce water resources within the country.

Applying Water Demand Management within the framework of Integrated Water Resources Management will result in an increased water use efficiency and reduction of water consumption and water losses.

Morocco

The area of Morocco is about 71 million hectares (about 710,000 km²). Morocco has approximately 9 million hectares of agricultural land, which equals about 13% of the total area. It is bordered, by the Mediterranean Sea in the north, Algeria in the east, Mauritania in the south and south-east, and the North Atlantic Ocean in the West.



Main stakeholders of Water Resources

Law No. 10-95 on water, which was enacted in 1995, is the legal framework for water management. There are three institutional bodies that govern water management, namely:

- “Conseil Supérieur de l’Eau et du Climat” (CSEC) (Supreme Water and Climate Council), headed by the King of Morocco, develops general guidelines on the national water and climate policy;
- “Agences de bassin hydraulique” (Water Basins Agencies) (ABH) that are the central structures for integrated water resources management, and which are the only entities with prerogatives regulations;
- Provincial water commission that ensures the implementation of the councils’ actions for water saving and protection of water resources against pollution.

Several ministries, structures and stakeholders have different roles in water management:

- (i) Inter-Ministerial Water (CIE), chaired by the Prime Minister, brings together all government ministries involved in the management of the water sector.
- (ii) Ministry of Regional Development, Water and the Environment (MATEE), exercises technical supervision over the National Drinking Water Authority (ONEP).
- (iii) The Ministry of Agriculture, Rural Development and Sea Fishing (MADRPM), through its Agricultural Development Regional Offices (ORMVA), is charged with managing irrigation water.
- (iv) The Ministry of Interior (MI), through the Department of Utilities and Services under Concession, exercises supervisory authority over water distribution and sanitation and conceded management utilities.
- (v) The Ministry of Health (MOH) is responsible for drinking water quality control, health education of the population, and sanitary monitoring of water points.
- (vi) The Ministry of Economic and General Affairs (MAEG) presides over the Inter-Ministerial Tariffs Committee and intervenes in the regulation of drinking water and sanitation tariffs, except for contractual tariffs in case of delegated management.
- (vii) Lastly, the Ministry of Finance and Privatization (MFP) is charged with coordinating the economic and financial planning of the water sector

The management of drinking water and sewerage services is provided by ONEP (80% of drinking water), private enterprises (Société des Eaux d’Oum Er Rbia, LYDEC in Casablanca, REDAL in Rabat-Salé and AMENDIS in Tangier-Tétouan) and by autonomous drinking water, electricity and sewerage utilities.

Main features of Water Strategy and/or Policy

Morocco’s water needs have been satisfied mainly by increasing supply, centered on water resources development. This approach is nearing its limits, given that over 80% of the potential resources have been mobilized. Faced with this increasing scarcity and in a bid to ensure the sustainability of a sector that is essential for the economic development and welfare of the population, the Moroccan Government has started a sectoral policy based on integrated water resources management, aimed at protecting and saving the resource. It is in this light that Law No. 10-95 was enacted in 1995. It represents the legal basis of a new water policy based on a forward-looking vision which takes into account the trend of resources on the one hand, and real water needs, on the other.

The principles underlying this policy are:

- Water is a public good, whereby all water belongs to the public water domain except for traditional water rights, the ownership of which is legally established or recognized by an appropriate procedure;

- Water is one and the same, and its quantitative and qualitative aspects are indivisible;
- Water is to be managed at basin level, the appropriate geographical setting for integrated water management;
- Recognition of the economic value of water with the application of the principle of “user-pays” and “polluter pays” to ensure water saving through demand management;
- National and regional solidarity, with the creation of basin agencies aimed notably at setting up solidarity mechanisms in the water management process, notably between users, between sectors and between regions; Consultation in water management at all levels (national, regional, and local) between government services, users and elected officials;
- The adoption of a long term strategy for integrated water resources management, where a National Water Plan will be the vehicle for strategy implementation and will serve as the framework for investment programs until the year 2020;
- The development of a new legal and institutional framework to promote decentralized management and increase stakeholder participation;
- Introducing economic incentives in water allocation decisions through rational tariff and cost recovery;
- Capacity building to meet institutional challenges for the management of water resources; and
- Establishing effective monitoring and control of water quality to reduce environmental degradation.

In the irrigation sector, the following features of the national plan have been identified:

- Improving hydraulic performance of irrigation systems through:
 - ✓ Rehabilitation of old systems;
 - ✓ Strengthening ORMVAs water management capacities through introducing modern O&M practices to provide reliable, flexible and equitable water supply to farmers at optimal costs involving as much as possible the private sector;
 - ✓ Improving on-farm water management through the reinforcement of irrigation management extension services and on-farm investments to introduce water saving irrigation technologies;
 - ✓ Developing Water User’s Associations that are able to effectively participate in the management of their irrigation systems.
- Increasing cropping intensities and yields whose effect is increasing farmers’ financial ability through:
 - ✓ Providing appropriate agricultural extension services to farmers;
 - ✓ Strengthening farmers’ capacity to market their products through organizing professional commodity associations and enhancing the role of the private sector;
 - ✓ Optimizing cropping patterns in each irrigation schemes in terms of comparative advantage with regard to maximizing water use efficiency
- Strengthening ORMVAs managerial capacities to make them more client oriented and cost conscious through:
 - ✓ Revising the organizational structure of the ORMVAs and introducing appropriate management information systems (MIS) mainly for better financial control including cost accounting systems;
 - ✓ Reinforcing human resources development programs.

Policy Instruments

The Government, through the Secretariat of State in charge of Water, in coordination with the departments concerned and all the stakeholders at all the levels, identified the following policy instruments for strategy implementation:

- Monitoring and evaluation of water resources in terms of quality and quantity;

- Planned development of resources to ensure constant balance between supply and demand;
- Harnessing of ground and surface waters according to watersheds development plans;
- Rational management of water, and the safeguard and maintenance of water works;
- Protection and restoration of water resources quality;
- Provision of structures for protection against high waters and floods;
- Institutional reform to promote the protection and development of water resources and the constant balance between supply and demand, and
- Promotion of the national company in the fields of studies, engineering and works.

Analysis and Challenges

In Morocco, the consequence of increased industrialization and a rapidly growing population, accentuated by a progressive shift from rural to urban living is the cause of increased pressures on the quantity and quality of water resources. The emphasis in Moroccan development planning has been for the last three decades on maximizing the capture of the country's surface water resources and providing for their optimal use in irrigated agriculture, potable water supplies, industrialization and energy generation. Enormous capital resources have been invested in the essential infrastructure to capture and utilize about two-third of surface water potential. A number of major infrastructure projects are in advanced stages of planning and/or construction to capture most of the remaining potential.

As Morocco nears the end of the infrastructure phase of its national development plan, emphasis is beginning to shift to the more sophisticated and difficult task of ensuring socially and technically efficient allocation of the existing water resources among competing consumer groups on a sustainable basis. Morocco has made modern, large scale irrigation the centerpiece of its irrigated agricultural development and has rapidly built or modernized nearly 500,000 ha out of a potential of 850,000 ha.

Palestine

Palestine with a total area of 26,323 Km², is situated east of the Mediterranean Sea and stretches about 210 km along the coast and about 65 km average inland. It is bordered by Lebanon in the north and by Syria and Jordan in the east and by Egypt in the south west. The existing Palestinian territories - the West Bank and Gaza Strip covers an area of a little more than 6,000 km², (5,690 km² in the West Bank and 365 km² in the Gaza Strip). The total length of the West Bank, is about 150 km, and width between 31-58 Km, which are mostly mountainous area. Gaza is a coastal area with 45 Km in length, and width varies from 6 kilometers in the north to 13 kilometers in the far south.



Main stakeholders of Water Resources

The organization of the Palestinian water sector theoretically envisages a clear separation between policy formulation, regulation and service delivery functions. The National Water Council (NWC), which was established by By-Law No.2 (1996), is theoretically the policy making body while the Palestinian Water Authority (PWA) only acts as a regulator body. PWA is interacting with most of the Palestinian ministries. These ministries are:

1. Ministry of Planning and International Cooperation (MOPIC)
2. Ministry of Justice (MOJ)

3. Ministry of Finance (MOF)
4. Ministry of Industry (MOI)
5. Ministry of Health (MOH)
6. Ministry of Local Government (MOLG)
7. Ministry of Agriculture (MOA)

In the Oslo II Agreement, Israel and the Palestinian Authority have agreed that managing their water resources should be equally shared by both parties during an interim period. Following this agreement the Joint Water Committee (JWC), subcommittees and related Joint Supervision and Enforcement Teams (JSET) have been established:

1. Joint Water Technical Subcommittee
2. Joint Sewage Committee
3. Joint Drilling Committee
4. Joint Price Committee
5. Joint Science Committee

The committees meet on an ad hoc basis to discuss projects of their field of responsibility and competence. Finally, the projects need to be approved by the JWC. The JWC is responsible for the comprehensive custodianship of the West Bank's water resources and sanitation system. Formally the JWC is to function as a coordinating body and it comprises of an equal number of Israeli and Palestinian representatives where decisions are to be made by consensus.

Main features of Water Strategy and/or Policy

The objectives of the Palestinian water strategy are to:

- Secure Palestinian Water Rights;
- Strengthen National Policies and Regulations;
- Build Institutional Capacity and Develop Human Resources;
- Improve Information Services and Assessment of Water Resources;
- Regulate and Co-ordinate Integrated Water and Wastewater Investments and Operations;
- Enforce Water Pollution Control and Development of Water Resources;
- Build Public Awareness and Participation; and
- Promote Regional and International Co-operation.

The increasing unavailability of water resources to the Palestinians, combined with the associated political complexity related to this valuable resource, have urged the Palestinian Authority to formulate the national water policy which lay down the basis for efficient and equitable water management in Palestine. The main features of the policy are as follow:

- All sources of water should be public property;
- Water has a unique value for human survival and health;
- All citizens have a right to water of good quality for personal consumption at costs they can afford;
- Water supply for domestic, industrial and agricultural development must be compatible with the available water resources and based on sustainable development;
- Water has social environmental and economic values;
- Public participation in water sector management should be ensured;
- Water management at all levels should integrate water quality and quantity;
- Water supply and wastewater management should be integrated at all administrative levels;
- Protection and pollution control of water resources should be ensured; and
- Conservation and optimum utilization of water resources should be promoted and enhanced.

On the other hand, the Palestinian Water Strategic Plan outlines the direction in which the Palestinian water sector should be developed to the year 2025 and proposes the actions to be

taken to achieve the water sector goals. The plan for the water sector will be implemented by the PWA in close collaboration and coordination with all Palestinian stakeholders and international donors. It is intended as a dynamic tool to identify, define, and describe an implementation process for the integrated management and development of Palestinian water resources. PWA has created the Investment Plan Outline till 2025, based on priority selection criteria for all demand centers in Palestine. The estimated total investment for the proposed future investment plan is approximately \$3.5 billion over the planning period (2003 to 2025). Of this, \$1.3 billion is capital investment and \$2.2 billion is investment in O&M. General categories of investment are:

- Institutional and Administrative Building category that shall include:
 - ✓ Planning and management;
 - ✓ Legislative policy and standards;
 - ✓ Quality and environmental;
 - ✓ Financial and economic; and
 - ✓ Institution building actions.
- Groundwater Supply
- Water Conveyance and Distribution category that shall include a National Water Carrier with a conveyance line to transport desalinated water from the Mediterranean Sea and new distribution networks.
- Surface Water Supply to achieve the targets of 40 MCM/yr. of surface water resources, in addition to existing supplies, must be developed by 2025.
- Demand Management category that shall include:
 - ✓ Leak detection and repairs;
 - ✓ Consumer actions;
 - ✓ Irrigation technology upgrades; and
 - ✓ Farm subsidies to manage agricultural growth.
- Wastewater Management and Reuse category that shall include the capital cost of constructing the necessary treatment capacity and reuse facilities as well as associated O&M costs.

Policy Instruments

The current policy depends on the following instruments for the policy achievement:

- Public awareness;
- Applying polluter pays principle;
- Adopting affordable tariff structure;
- Capacity building for all levels of stakeholders;
- Reducing water leakage;
- Monitoring and evaluation of groundwater quality;
- Initiating a comprehensive water related data bank;
- Strengthening the cooperation with international development donors through:
 - ✓ Established direct donor reporting mechanisms.
 - ✓ Identified categories for preferred donor intervention.
 - ✓ Implementation of an investment projects database, and
 - ✓ Instituted structured approach for donor awareness and coordination.
- Improving water resources management systems through:
 - ✓ Adopting a water demand management approach;
 - ✓ Encouraging users' participation in water management;
 - ✓ Coordinating the Palestinian water resources on the national level, and appropriate local level;
 - ✓ Separating the institutional responsibility for policy and regulatory functions from the service delivery functions;
 - ✓ Continuing the effort to obtain the right of water resources shared by other countries;

- ✓ Institutional strengthening of the different water related entities; and
- ✓ Co-ordination between PWA and other ministries.

Analysis and Challenges

Implementing the National policy is expected to improve the performance of the water resources system. Some of the outcomes are:

- Domestic water supply has increased through drilling wells of about 14 MCM/year;
- The national water distribution grid is underway through implementing conveyance pipelines and regional pump stations and regional reservoirs with different capacities (10,000 – 25,000 m³)
- Improved Accessibility to piped water for domestic use for about 120,000 capita in different communities
- Demand management actions saved scarce water supplies through:
 - ✓ Rehabilitation/replacement of local water network
 - ✓ reduced water losses to less than 30 % in specific areas
 - ✓ 75 communities (total of 650,000 people) have been served with rehabilitated water networks.
 - ✓ Rehabilitation of wells and springs resulted in improvement of water quality of 62 springs and 62 wells used for domestic purposes.
 - ✓ Metering and leak detection reduced Unaccounted-For Water (UFW).
- Quantification of available supply has been completed through groundwater modeling in:
 - ✓ Eastern Basin;
 - ✓ Western Basin;
 - ✓ Northeastern Basin; and
 - ✓ Coastal Basin.
- The Mountain Aquifer will be sustained through monitoring and management through:
 - ✓ Drilling 14 monitoring wells in West Bank, and 13 in Gaza;
 - ✓ Palestinian Hydrometric (monitoring) program; and
 - ✓ Aquifer management program is underway.
- Improvement in wastewater collection, treatment and reuse is in progress through:
 - ✓ Both a wastewater collection system and a wastewater treatment plant service exist in three areas (Al-Bireh Ramallah, and Jenin); and
 - ✓ Numerous other wastewater collection and treatment projects are in various stages of planning; and implementation, most notably in Salfit, Hebron, and Tulkarm.
- Surface water supply is being increased wherever, and whenever possible through:
 - ✓ Flood gauges in main wadis; and
 - ✓ Increased usage of rainwater harvesting, 132 cisterns built in Jenin Governorate and Storm water drainage in Khan Yunis.
- Building desalination projects for the middle and northern Gaza.

The implementation of the policy shall support the socio-economic development of the country and provide safe drinking water to its population. However the critical existing political issues and the lack of funding for the investment projects represent significant challenge for the development of these activities in the future.

Syria

The Syrian Arab Republic lies on the eastern coasts of the Mediterranean Sea between Turkey and Lebanon. The total area of the Syrian Arab Republic is 18.5 million hectares, one third of which is arable land or forest and the remaining part is desert and rocky areas. Syria is bordered by Turkey from the north and Iraq



from the east, Jordan and Palestine from the south, Lebanon and Mediterranean Sea from the west.

Main stakeholders of Water Resources

The Ministry of Irrigation (MOI) is in charge of irrigation, dams, planning, research, operation and maintenance and pollution control. The Directorate of Irrigation is involved in water resources studies and surveys, water legislation and shared international waters. Three departments under the responsibility of the Ministry of Irrigation include the Euphrates Basin Development Authority, the Euphrates Basin Land Reclamation Authority and the General Company of Major Water Resources Studies. The Ministry of Irrigation is in charge of groundwater monitoring and the issuing of licenses for groundwater well drilling. There are 5 other organizations involved in the water sector in Syria including:

- Ministry of Agriculture and Agrarian Reform (MAAR), with directorates in all basins, has an advisory role on cropping patterns, on-farm water use, and basic extension and research services to farmers;
- Ministry of Housing and Public Services (MHPS), which in addition to urban planning, mapping, and housing, has primary responsibility for domestic water supply and sewerage. Currently, the MHPS is involved in the design of major drinking water supply projects including one to transfer water from the Coastal Basin to supply water for Damascus. From the point of view of overall water resources management, it would seem that MOI would be the more appropriate lead agency;
- State Planning Commission Section (SPCS);
- State Environmental Affairs Commission Section (SEACS); and
- Mohafazats & Farmers Union; the primary role of the Mohafazats is to control the illegal drilling of wells and construction of canals. According to MOI officials, well closures can also be enforced by the police. The Farmers' Union digs wells and canals and constructs small dams for irrigation and livestock.

Main features of Water Strategy and/or Policy

The following summarizes the main features of the policies related to irrigation water in Syria. Some of these strategies are extracted from the Syrian Environmental Strategy and others represent the official Government policy (Presidency of the Ministers Council, 2001).

The Syrian Environmental Strategy composed of a sequence of actions that can be taken to accomplish strategic objectives of sustainable development including the following:

- Prevent misuse of land and water resources through:
 - i. Developing policies to encourage development in areas with appropriate natural resources;
 - ii. Combating desertification and halt conversion of agricultural land to other uses;
 - iii. Stopping over-exploitation of water resources and maintain sustainable use levels;
 - iv. Accrediting modern sustainable irrigation systems;
 - v. Adopting non-conventional water resources systems
 - vi. Combating deterioration of water resources and protecting against chemical and microbiological contamination; and
 - vii. Integrating water resources management.
- Reduce effects of pollution on human health through:
 - Reducing contamination from sewage of water resources;
 - Ensuring quality and quantity of potable water supply in urban and rural areas;
 - Reducing risk to health from contamination with sewage;
 - Reducing risk to health from industrial discharges;
 - Reducing use of synthetic fertilizers and human exposure to pesticides; and
 - Improving occupational health conditions.

The official Government policy also includes:

- Conservation of water resources through:
 - Sustainable use of groundwater aquifers;
 - Cost recovery in public irrigation schemes;
 - Irrigation rehabilitation and modernization; and
 - Adoption of modern irrigation technologies at farm level
- Food security to meet food production targets through:
 - Coordinating Agricultural Plan with irrigation water availability; and
 - Development of new irrigation areas.

Policy Instruments

- Prohibiting well drilling in the cretassic layer;
- Allowing only public Ministries to drill wells for domestic water use;
- Forbidding cultivation of summer crops in the steppe areas to preserve non-renewable groundwater reserves;
- Obligation to license all unlicensed wells and banning well drilling license;
- Preventing pumping system installation unless renewable water is available;
- Installing flow meters in wells;
- Grant irrigation license to farmers who invested in the installation of flow meters;
- Collecting O&M costs at SP 3500/ha for spring irrigation and SP 600/ha for winter irrigation;
- Recovering Capital costs for land reclamation at SP 2000 - 7000/ha;
- Adopting the use of pressurized pipe irrigation systems through a national study by Committee of Ministries;
- Rehabilitation of public irrigation schemes within a specific schedule;
- Financing modern irrigation networks;
- Rehabilitation of Al Manajeer irrigation projects in the Tigris and Al Khabour basins;
- Quality control of equipment;
- Public participation; and
- Establishment of crop rotations and cropping patterns of strategic crops.

Analysis and Challenges

Implementing the 5-year plans is expected to improve the performance of the water resources system. Groundwater levels and qualities will be enhanced through the different policy instruments. The agricultural area will increase as a result of horizontal expansion. New living communities will be created for nomad and others as a result of the new irrigation projects.

The implementation of the plan in addition to other action plans from other stakeholder institutions will support the socio-economic development of the country. The living quality in urban areas shall be improved and the effects of pollution on human health shall be reduced. In addition, safer drinking water shall be provided. The access of the population to safe sanitation facilities will increase.

Several challenging issues are facing the water sector in Syria:

- To mobilize additional 2.163 km³ a year from the Euphrates;
- To mobilize additional fair and reasonable shares (5 km³ a year) from the Tigris and from the Yarmouk/Jordan and its branches;
- To transfer the water surplus in littoral basin to the upper part of the Orontes (0.5 km³ a year) in a fair share to Turkey;
- To regulate the shares in Koueik River; and
- To share the water of the Big South River.

Tunisia

Tunisia, with a total area of 162,155 km², is located in North Africa, bordered by the Mediterranean on the North. It is bordered by Algeria in the west and Libya in the west and south.

Main stakeholders of Water Resources

The Ministry of Agriculture and Water Resources (previously the Ministry of Agriculture, Environment and Water Resources (MAERH, Ministère de l'Agriculture de l'Environnement et des Ressources Hydrauliques)) is the main responsible ministry for water management in Tunisia.

The Ministry of Agriculture and Water Resources (MAWR) is responsible for the mobilization of all available natural resources and the realization of basic infrastructure for the preservation of agricultural land development.

In addition to the organizations supervised by MAWR, NGOs (Collective Interest Associations/Groupement d'Intérêt Collectif, GIC), which are professional and users associations, MAWR collaborate with other ministries such as:

- Ministry of the Environment and Sustainable Development
- Ministry of Interior and Local Development
- Ministry of Justice and Human Rights
- Ministry of National Defense
- Ministry of Finance
- Ministry of Development and International Cooperation
- Ministry of Equipment, Housing and Physical Planning
- Ministry of Public Health



Main features of Water Strategy and/or Policy

Faced with a water deficit with respect to the mobilized resources, the strategic choice was to move from increasing water production to demand management by financial means, new techniques, legal and institutional mechanisms. The Tunisian national strategy is centered around three major points including:

- Water demand management through:
 - ✓ Preserving water resource;
 - ✓ Ensuring economic efficiency; and
 - ✓ Preserving social equity by a good water distribution.
- Integrated water resources management through:
 - ✓ Using of groundwater during periods of drought;
 - ✓ Recharging of groundwater to reduce overdraft and degradation; and
 - ✓ Using of treated waste water and brackish water.
- Resource and environmental protection through:
 - ✓ Quantitative conservation through reinforcement and improvement of water capture and storage; and
 - ✓ Qualitative conservation of water resources and ecosystems through pollution reduction, monitoring, and cost evaluation.

Policy Instruments

The current policy depends on the following policy instruments:

1. With regard to demand management, some reduction targets were set as objectives for the year 2010:
 - 30% water savings in agriculture by improving irrigation systems, replacing some of the hydraulic structures and modernization of the distribution network;
 - 20% water savings in industry by recycling, improving the production processes and the introduction of clean technologies; and
 - 27% water savings in drinking water by the use of modern equipment.
2. With regard to integrated water management and protection of the resource, the goals were as follows:
 - Make use of reclaimed water in the agriculture and industrial sectors;
 - Evaluate groundwater recharge potential;
 - Desalinate brackish groundwater for domestic use;
 - Promote the use of crop varieties that are tolerant to salinity and water stress; and
 - Protect water bodies from pollution

National Master Plan

In order to ensure equality of water distribution, improve drinking water quality and set up a short and long term strategy for water storage, transfer and economical management of the various interconnected catchments, the Ministry of Agriculture and Water Resources invested in developing a digital master plan to simulate and compare water resource needs for the different sectors for different time horizons. The model is based on the introduction of projected cases of production and usages. Thus, the simulation can take into account several criteria to determine the water balance:

1. The demand development perspective by considering several trends for each sector of demand;
2. The initial storage in dams and the available groundwater resources;
3. The type of the hydrologic year defined as being average dry or wet;
4. The possibility of mixing water with different salinity water sources; and
5. Planning horizon and time step simulation.

About 10,000 types of simulated scenarios lead to the development of regional water balance maps indicating regional shortages and deficits. Further, this tool was used as a decision support system to plan for the construction of the remaining dams and the additional mobilization infrastructures in order to prevent water shortages until the year 2030.

Analysis and Challenges

Tunisia will shortly be faced with the problem of a water deficit between its consumptive uses and its water productivity. Aware of this problem, managers and policy makers are giving particular attention to improvements in water supply and mobilization programs. The aim of these programs shall be mainly to:

- Enhance water productivity with an integrated management perspective;
- Promote treated sewage water and its development, and
- Control the different economic sectors of water demand and protecting the available resources from losses and pollution.

The rate of mobilized water will reach 95% in the year 2011 (Benabdallah, 2007), and will reach its limits by 2030.

Several general challenges are facing Tunisia include:

- Conjunctive management of groundwater and surface water is being used in dealing with urban water demand in drought periods, and will need to be extended to the wet years and applied to agricultural water demand;

- Agriculture is the largest water consumption sector. Therefore, there is a challenging opportunity for water conservation in this sector to conserve significant water resources;
- Reducing the distribution losses within the irrigation and drinking network is among the priorities of the water saving program;
- Understanding the vulnerability of soils and plant to salinity and to water stress could translate into improvement in soil moisture conditions, adequate drainage systems design, reduction in water intake and optimal farm environment; and
- Protecting the hydraulic structures and water reservoirs from sediment buildup will be a continuing challenge. A ten year water and conservation program was established with the objective of recovering additional water resources and protecting large reservoirs from rapid silting and losing their valuable storage capacity. This program is based on the construction of 1000 hill-dams, 200 mountain dams and the reforestation in the watershed behind the major reservoirs.

Yemen

Yemen, with a total area estimated at 527 970 km², is located on the south-western edge of the Arabian Peninsula. Apart from the mainland it includes many islands, the largest of which are Socotra in the Arabian Sea to the far east of the country and Kamaran in the Red Sea. The country is bordered by Saudi Arabia in the north, Oman in the east, the Arabian Sea and the Gulf of Aden in the south, and the Red Sea in the west.



Main stakeholders of Water Resources

Government of Yemen has established four national-level agencies: National Water Resources Association (NWRA) for water resources management, National Water and Sewerage Authority (NWSA) for urban water supply, General Authority for Rural Water Supply Projects (GARWSP) for rural water supply, and General Department for Irrigation (GDI) for irrigation infrastructure. Under a reform program launched in 1997, urban water supply responsibility is being progressively decentralized to autonomous Local Corporations for Water Supply and Sanitation (LCWSS). Irrigation, dams and watershed management are under the responsibility of Ministry of Agriculture and Irrigation (MAI). In 2003, a new Ministry of Water and Environment (MWE) was established and for the first time, all agencies dealing with water and environment – with the notable exception of the Ministry of Agriculture and Irrigation (MAI) and its GDI – are now under the new ministry. While the MWE is generally responsible for sector investment planning and the coordination between all water sector agencies, it is currently still at a capacity development stage. MWE also include the Environmental Protection Authority (EPA).

Main features of National Water Sector Strategy and Investment Program

Yemen has in late 2004 adopted a consolidated strategy for the water sector as a whole – the *National Water Sector Strategy and Investment Program* (NWSSIP) that was initiated through a comprehensive multi-stakeholder process spearheaded by the MWE. The NWSSIP adopts the vision of IWRM and develops a coordinated set of policies and objectives for five water sub-sectors:

1. Water resources management;
2. Urban water supply and sanitation;
3. Rural water supply and sanitation;
4. Irrigation and watershed management; and
5. Environmental protection.

In the water resources management, the strategy targets five objectives, which are to:

- Ensure greater degree of sustainability;
- Give priority to domestic needs of rural and urban population;
- Improve water allocation while considering just distribution and social norms;
- Promote efficient water use and maximize economic benefits; and
- Establish a realistic and holistic water approach among the general public.

In the irrigation and watershed management, the strategy targets the following objectives:

- Achieving sustainability through protecting the water resources;
- Reducing the exploiting of groundwater;
- Improving water use efficiency;
- Developing new water resources; and
- Conducting institutional restructuring.

In the water supply and sanitation, the strategy targets the following objectives:

- Expanding the coverage of water supply and sanitation;
- Sustaining the financial resources for the WSS services;
- Separating between regulatory and implementing agencies;
- Applying the decentralization approach in implementing WSS services;
- Involving of private sector; and
- Developing knowledge and skills.

In the environmental protection, the strategy targets the following objectives:

- Securing equity in water access;
- Maximizing water use efficiency; and
- Securing sustainable natural resources, specifically water resources that are adequate in quantity and quality.

The NWSSIP is targeted for five years (2005-2009) and principally oriented towards MDG achievement. In the field of rural WSS, however, MDGs goal achievement was considered unrealistic and therefore targeted at 50% (“half the MDGs”).

In order to achieve these goals, the NWSSIP investment program for 2005-2009 totals about \$1.5 billion, of which about \$1 billion is committed by government and donor funding.

Main features of National Water Policy

To achieve the water strategy, Yemen sets up some guiding principles that cover the different aspects related to natural resources management, socioeconomic objectives, institutional aspects and water governance. The main features of the policy are:

- **Principles of good natural resources management**
 - ✓ Integrated water resource management and the basin management approach; and
 - ✓ Management of the resource for achieving efficiency and sustainability
- **Social and economic principles**
 - ✓ Priority to domestic uses, with due consideration to equity and poverty aspects;
 - ✓ Allocative efficiency, so that water can flow to the use that pays the highest return, respecting basic domestic water needs for the poor;
 - ✓ Water supply concerns are to be balanced by demand management measures, including the use of economic incentives to reduce the demand;
 - ✓ Enhancing national and household food security through market-driven growth rather than self-sufficiency; and
 - ✓ Fiscal, agricultural and trade policies to be factored into water sector policy.

- **Institutional principles**
 - ✓ Water sector governance and capacity building are considered a priority;
 - ✓ Decentralization, participation and user organization are key policy principles;
 - ✓ Role of the private sector is emphasized;
 - ✓ Role of the public sector in financing is clearly defined; and
 - ✓ Regulatory function is separated from service delivery.

Policy instruments

The following are the policy instruments identified for the implementation of the National Strategy and Plan:

In water resources management:

- Developing regional water resources plans;
- Supporting water user associations, community-based organizations and water basin committees;
- Implementing, monitoring and enforcing the law;
- Strengthening and improving institutional and sector coordination; and
- Designing and implementing NWSSIP monitoring systems.

Rural Water Supply and sanitation:

- Improving project/scheme implementation;
- Broadening the range of partners;
- Widening technology choice and adapting appropriate ones;
- Integrating sanitation and hygiene in rural water schemes;
- Ensuring and protecting water resources and their quality;
- Improving targeting and sustainability; and
- Directing available finance to priority needs.

Urban Water Supply and Sanitation:

- Expanding coverage;
- Deepening the reform program after evaluation;
- Developing a regulatory framework;
- Monitoring support and policy functions;
- Achieving financial sustainability of water utilities;
- Subsidizing the low income segments of the population;
- Promoting private investments and public private partnerships;
- Continuing capacity building and improving performance;
- Enhancing community participation;
- Securing additional water sources for cities; and
- Formulating a policy for sea water or brackish ground water desalination.

Irrigation and watershed management:

- Reducing groundwater exploiting;
- Securing farmers water rights;
- Improving and applying incentives;
- Applying advisory services, agriculture extension services and applied research;
- Applying cost recovery of the irrigation schemes;
- Constituting water user associations and enforcing their role;
- Dealing with Qat as any other crop;
- Applying integrated watershed management;
- Revising the plan of dam building;
- Re-defining the role of the Ministry of Agriculture and Irrigation (MAI);
- Improving institutional coordination in the water irrigation sector;

- Enlarging the share of The Agriculture Fisheries Production and Promotion Fund;
- Increasing the role of the NGOs; and
- Implementing an agriculture plan.

Environmental protection:

- Reinforcing the role of the Environmental Protection Authority (EPA);
- Applying water quality control through active and broad participation of all the stockholders;
- protecting Water resources; and
- Activating environmental monitoring and the regulatory role.

Analysis and challenges

The water strategy, policies and action plans of Yemen are comprehensive. The Implementation and action plan is equally well itemized and structured. The investment program is massive, if related to the country's low Gross National Income (GNI). Yemen's GNI was 9.1 billion USD in 2002. The annual average water sector investment in the period 2005-2009 is budgeted to be 308 million USD, which is around 3 percent of the country's GNI. Slightly over one-third of that sum will come from donor funds.

At the policy level, the NWSSIP identifies the key sectoral problems and is clearly operationalized. However, the sectoral budget allocations for the next years remain clearly insufficient to implement the whole array of water policies underlying the NWSSIP and continue to exhibit an urban bias. The effectiveness of the developed strategy and plan is at risk due to the structural deficits at the operational level (MWE, NWRA, NWSA, LCWSS), in particular the lack of professional and competent human resources to carry out the huge management and development tasks in the water sector. It is certainly not enough to develop institutionalized coordination mechanisms between the MWE and the MAI as suggested in the NWSSIP. Instead, institutional and organizational improvements with view to IWRM require policy decisions at a higher political level.

One of the most complex development problems and the most serious challenge that Yemen is facing is the problem of water resources scarcity and over-exploited aquifers. As a result of the over-exploitation, alarming depletion of groundwater is occurring in a number of basins (Sana'a, Amran, Sa'adah, Rada'a, Rasyan, Tihama, Abyan and Tuban). Another challenge is to provide a larger part of the urban and rural population with safe drinking water and sanitation services. At the end of 2005, 58% of the urban population and only 37.5% of the rural population had access to safe water. This water reality imposes on Yemen the challenge of reducing the existing unsustainable use of water resources through improved management and better planning for its rational utilization and development.

Yemen's Water Sector Strategy and Investment Program for the years 2005-2009 (NWSSIP 2005) is a very well elaborated strategy with concrete financing and action plans. It remains to be seen how well it has been implemented in practice at the end of this first time frame.

Conclusions

A brief compilation of water policies, strategies, and plans of selected Arab countries (Algeria, Egypt, Jordan, Morocco, Palestine, Syria, Tunisia and Yemen) has been conducted in this desk review. The reviewed documents were highly variable in style and content. The water strategies of Yemen, Egypt, Jordan, and Palestine could be considered the most comprehensive in IWRM approach. The National Plan of Yemen is the only one that addresses the MDGs.

Countries are often using the terms strategies, plans, and policies interchangeably with no distinct separation in their usage. Similarly, countries have been using water management,

integrated water resources management, and water governance interchangeably which reflects a “following the trend” reaction to the new terms the keep emerging in the international water community. Interestingly, different countries deal with the institutional setup of the water sector and the division of responsibilities among ministries in various ways, especially when it comes to private and public sectors roles, drinking water, irrigation water supply, and sanitation services roles.

Recommendations

The several key areas that need to be addressed to complement the current national efforts, in transitioning towards developing efficient national water plans and effective implementation of IWRM and good water governance, may be concluded as follows.

National plans

- To ensure sustainable socio-economic development:
 - current national water plans need to be financially supported and efficiently implemented
 - Others countries need initiate and improve their national water planning activities;
- Refraining, as much as possible, from business as usual scenarios and measures;
- Issues and actions should be prioritized to initiate the cycle of reform in water management;
- Preparation of emergency and crisis management programs putting in mind the substantial financial resources needs;
- Develop water quality management plan to accompany any water plan
- Emphasizing the local and regional dimensions in the proposed national plans especially in the different basins.
- Investment planning should be considered as an integral part of National Water Plans

Stakeholder participation

- Mechanisms for stakeholder and civil society consultation should be in put in place;
- Financial models and legislative frameworks to encourage private sector participation of without compromising the rights of the poor by the profit private sector;

Institutional and legal Reform

- A clear vision for the most appropriate national institutional setup for managing the water sector has to be studied;
- The tasks of each institution should be clearly defined and reflected in an officially endorsed national water plan with an organizational chart and job descriptions for all staff;
- Legal amendments which empower selected entities (NGOs for example) to collect fees and conduct local action plans should be established;
- Review existing standards for enforceability, and pass the pending water management laws, environmental law and environmental impact assessment laws
- Innovative mechanisms for Law Enforcement need to be introduced.

Capacity Building and Public Awareness

- Capacity should be assessed and improve through tangible activities
- Different programs should be provided to enhance public awareness on water saving and environmental protection through different ways including media, schools, ..etc.

Research and database

- Applied research is needed to further study the potential negative impacts on the environment and public health;
- Central databases and a coordinating body for data and information management should exist in the water sector at all levels (national and regional);
- Research should play an important part in pressing water issues such as:
 - Finding the appropriate agriculture techniques to confront water scarcity and poor water quality;
 - Evaluating the real potential and vulnerability of aquifers and their possibility of recharge;
 - Finding alternative sources for water storage and supply; and
 - Defining the real potential and limits of reclaimed water.

Water resources management

- Better management of Groundwater that is tapped by thousands of informal private wells with no licenses, no water metering and no charges or taxes for the tapped volumes;
- Developing a comprehensive plan to collect and treat all domestic and industrial waste water and reuse of the treated waste water and agricultural drainage water in irrigation;
- Setting up shared water rights through cooperation with neighboring countries;
- Setting up the most appropriate cost/sharing, cost/recovery mechanisms within each sector along with a framework for implementation;
- More attention is needed to develop integrated water and quality management approaches taking into account both surface and groundwater through the use of modeling and decision making tools;

Governments, international agencies and donors

- There is a need to increase support especially to countries lagging behind in the IWRM and/or national water planning process.
- For those countries that have responded to the WSSD Plan of Implementation and have IWRM/national water plans well underway, funding needs to be found for implementation.
- Better coordination among the international actors in this field, including bilateral donors, international and regional organizations, development banks and NGOs is critical, especially to avoid duplication and wasted time in water related capacity building and technical assistance activities.
- The link between poverty alleviation and national water planning must remain at the forefront

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