Comparative study between Moroccan water strategies and WFD

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Abstract. Water resources in Morocco are limited, and irregular in time and space. Furthermore, the water resources undergo a deterioration of their quality by the various pollutant emissions, such as domestic and industrial wastewater. On the other hand, these resources are increasingly scarce due to a continued growth in demand. A new water law has come into force in 1995 that provides a comprehensive framework for integrated water management. This new law constitutes an efficient juridical tool to develop considerable efforts for water use and mobilization in order to make them compatible with aspirations of socio-economic development of Morocco in the 21 century. The Water Law has a number of similarities to the Water Framework Directive. For example it specifies the establishment of Basin Agencies which evaluate, plan and manage the water resources in their respective river basin, in order to strengthen the institutional arrangements of water management. Other principles stated in the Law are; 1) water as a public domain, 2) regulation of development, distribution, and sale of potable water, 3) improvement of agricultural water development and use, and 4) security against illegal water resources development, or conduct which causes water pollution. The paper concludes that including water demand management in Moroccan water policy has required major changes in the institutional arrangements.

Keywords: Water management – Policies – Institutional reform – Water availability – Water use

Étude comparative de la politique de l'eau au Maroc et de la Directive-cadre sur l'eau

Résumé. *Au Maroc, les ressources en eau sont limitées et irrégulières dans le temps et l'espace. Elles subissent en outre une dégradation de leur qualité en raison des diverses émissions polluantes comme les effluents domestiques et industriels. D'autre part, ces ressources en eau se font de plus en plus rares en raison de la croissance continue de la demande en eau. Une nouvelle loi sur l'eau est entrée en vigueur en 1995 et fournit un cadre complet pour la gestion intégrée de l'eau. Cette loi constitue un instrument juridique efficace, qui permet par ailleurs de valoriser encore plus les efforts considérables consentis pour la mobilisation et l'utilisation de l'eau, et de les rendre compatibles avec les aspirations au développement économique et social du Maroc au 21e siècle. La nouvelle Loi sur l'eau présente des similarités avec la Directive-cadre sur l'eau. La Loi spécifie par exemple la création d'agences de bassins hydrauliques qui ont pour mission d'évaluer, de planifier, de développer et de gérer les ressources en eau au niveau du bassin respectif, afin de renforcer les arrangements institutionnels concernant la gestion de l'eau. Les autres principes mentionnés dans la Loi sur l'eau sont : 1) l'eau est un domaine public, 2) la régulation du développement, de la distribution et de la vente de l'eau potable, 3) l'amélioration du développement et de l'utilisation de l'eau pour l'agriculture, et 4) la lutte contre le captage illégal des ressources en eau et contre tout comportement pouvant entraîner la pollution des ressources en eau. L'article conclut en déclarant que le fait d'inclure la prise en compte de la gestion et de la maîtrise de la demande en eau dans la politique de l'eau marocaine a exigé l'apport de changements majeurs dans les arrangements institutionnels.*

Mots clés: *Gestion des eaux – Politique – Reformes institutionnelles – Eau disponible – Utilisation de l'eau*

I – Introduction

Morocco is a dry country with unevenly distributed water resources and erratic rainfall patterns. Therefore, the country has increased the number of dams from 12 in 1960 to 114 by 2006, which has led to a nine-fold increase in water storage capacity. Water problems remain serious, however, and reservoir water levels have decreased as a consequence of successive years of

drought. This has resulted in the need to use groundwater either as a supplementary or as the main source of water. Unfortunately, groundwater is being rapidly depleted as the drilling of a massive number of wells has overtaxed subterranean supplies (World Bank 2009).

Morocco is located in the northwest of Africa, and its climate is marked by sharp contrast in temperatures between the Mediterranean climate and desert. In addition the annual rainfall varies from less than 100 mm in the south and south east of the country to 1000 mm in the middle Atlas and greatly exceed 1700 mm on the Rif Mountains (Choukr-Allah, 2005).

The average annual precipitation in Morocco is 150 billion m3, varying year by year between 50 billion m3 and 400 billion m3. Annual evaporation is, on average, 121 billion m3. Of the remaining 29 billion m3, about 22 billion m3 of water are technically and economically exploitable. These exploitable resources are comprised of 18 billion m3 of surface water and 4 billion m3 of groundwater (Benbiba, 2010).

In Morocco, the volume of water available per inhabitant per year, an indicator of a country's wealth in terms of water, is about 1000 m3/capita/year. Scarcity is often defined as starting from this point. At present, the available water varies between 180 m3 per capita per year for the areas known to be poor in terms of water resources (Souss-Massa, Atlas South, Sahara) and 1850m3 per capita per year for areas of the basin of Loukkos, Tangiers and Mediterranean Coast, known to be relatively rich. It is probable that the water resources per inhabitant will reach around 720m3 per capita per year towards 2020. At this time, about 14 million inhabitants, i.e. almost 35% of the total population of the Kingdom will have less than 500 m3 per capita per year at their disposal (Choukr-Allah, 2005). Water scarcity is thus becoming a permanent situation that can no longer be ignored when drawing up strategies and policies concerning water resources management in Morocco.

Table 1: Water Resources Availability.

Basin	Population (Millions of inhabitants)	Water resources availability (m3/ capita /year)
Loukkos, Tangiers and coasts	3.645	1353
Moulouya	2.448	1065
Sebou	7.918	0996
Bou Regreg	9.076	0109
Oum Er-Rbia	6.171	1232
Tensift	3.131	0546
Souss-Massa	3.250	0362
Atlas South	2.606	0735
Sahara	0.625	0168

Source: AGR/DDGI (1999).

The hydraulic assessments prepared within the framework of planning studies, carried out at the level of all the hydrologic basins, (table 1) show the available water per person per year for all Moroccan basins. Moreover, during the last decades the water quality has degraded as a consequence of pollution originating from various sources of (domestic, industrial, agricultural wastewaters etc.).

The paper outlines the Moroccan legal and institutional framework compared with the European commission's Water Framework Directive ((2000/60/EC; WFD), followed by a description of the Moroccan water plan. Subsequently, both environmental and economic aspects of the policies are discussed.

II – Legal and institutional framework

Morocco has instituted, within law 10/95 (OB 1995), river basin agencies (RBA). Their mission includes contributing to water resources protection. The role of RBA's will be discussed in some detail later in the paragraph. Other principles stated in the Law are; 1) water as a public domain, 2) regulation of development, distribution, and sale of potable water, 3) improvement of agricultural water development and use, and 4) security against illegal water resources development or conduct which causes water pollution.

The water-related strategy rests on a fundamental principle which considers water as a limited resource requiring optimal management and protection against all forms of pollution. The institutional organization in Morocco is based on 3 levels, including the major stakeholders involved in the water domain (see Fig 1).

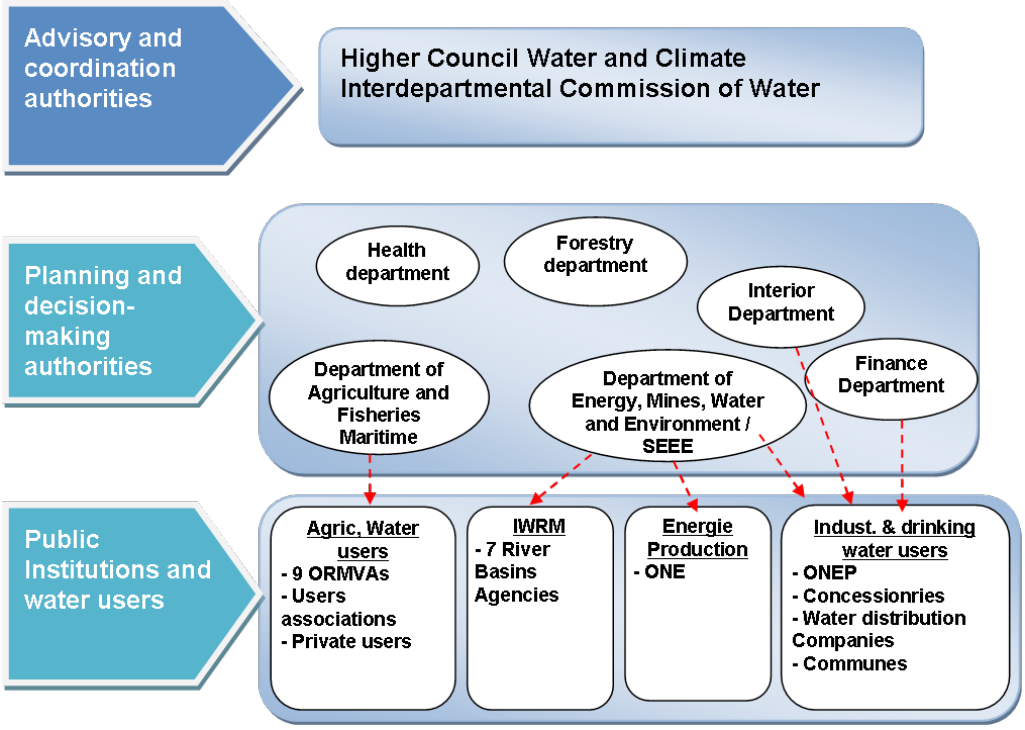

Figure 1: Major stakeholders involved in the water domain. (Ouassou *et al.,* 2005).

The Water Framework Directive outlines an overall strategy for water management and mentions a number of important aspects, namely: river basin management, whereby water resources are managed in an integrated manner at a catchment level. The implementation of the first step of the WFD — basin characterization (pressure and status, identification of main water management issues, definitions of environmental objectives) has been implemented through the water

strategy of Morocco. However, it is very complex implementing these principles (dealing with the catchment area in its entirety, integrating a high number of water usages and users, implementing multidisciplinary strategies).

The declaration of a 'water' law in 1995 was a major breakthrough in Moroccan water policy. The aim was to rationalize water use, providing access for all to this resource and reducing disparities between cities and villages, intending to ensure water security all over the country. This law provided Morocco with some effective technical, financial, and institutional tools in order to face the most crucial challenges in the water sector. In addition, the Government created River Basin Agencies to implement a decentralized water policy in line with national guidelines; encourage the participation of all regional and local players and specifically water users in the implementation of this policy; and finally implement this policy in a framework of partnership and participation, in line with the guidelines expressed in local development plans (Saleth and Dinar, 2004).

In this way the Moroccan water strategy complies with one of the major objectives of the WFD which is the objective to reach a good water status based on participatory river basin management planning. It includes a five-yearly plan which specifies programmes of measures requiring the consultation and active involvement of all stakeholders.

The River Basin Agencies have the responsibility of managing and regulating water resources besides their role in developing and supplying water. They have to monitor and regulate water use and water quality as well as plan and organize flood control and water-related emergencies within their respective basins' (Doukkali, 2005). Morocco is divided into 9 major river basins, with long-term water resources development policies planned and specified in Integrated Master Plans. Establishing these plans mainly aims to estimate water demand from different sectors such as potable and industrial water, irrigation and hydropower generation, and to determine optimal integrated scheme of the water resources development. The first RBA pilot (Oum Er Rbia) was created in 1997, six others River Basin Agencies in 2002, and two more River Basin Agencies were defined by the year 2009. The RBAs in Morocco are special as they are based more on projects than on the river systems and therefore, their boundaries are defined both by hydrology and demand areas. Moreover, as agricultural agencies actually manage them, they integrate water delivery with the provision of farm inputs (Saleth and Dinar, 2000).

An important responsibility of the RBAs is to prepare their river basin management plans based on the principles of IWRM. The RBA Water Master Plan, as specified in Article 16 of the water law, is a constituent part of the National Water Master Plan. It must be formally approved by decree. The twenty-year Master Plan summarizes available water supplies in a river basin and proposes allocations to municipal, industrial and agricultural users. The water plan also prescribes measures for groundwater exploitation and indicates the conditions for granting of permits to water users. Moreover, the Master Plan can be reviewed and amended every five years if changing conditions warrant amendments (Doukkali, 2005).

III – The Moroccan national water

Morocco will not only focus on increasing water supply but also on further demand management in the future, in view of the decrease in potential water resources, depletion of underground water due to over-development, sedimentation in dams, and deterioration of water quality.

Although Morocco has a centralized political structure, water administration is comparatively decentralized and demonstrates functional specialization. The Directorate General of Hydrology under the Secretary of State of Water and Environment (SSEE) plans and develops water resources. Furthermore, the nine Regional Authorities for Agricultural Development (RAADs) under the Ministry of Agriculture and Fishery (MOAF) develop and maintain water distribution networks, acquire and distribute water, collect water charges, and provide farm inputs and

extension services. Local governments and farmers play a stronger role in water distribution and system maintenance in smaller systems, including areas depending on groundwater. 'The National Office of Potable Water, again under the SSEE, acquires and distributes water not only on a retail basis to households and industries in major urban centers but also on a bulk basis to municipal/provincial governments' (Saleth and Dinar, 2000).

Water policy and water administration were significantly affected by the water law of 1995. It states that the Supreme Water Council (involving all major water sector stakeholders) the key organ for national level water policy and the RBOs - each covering one or more RAADs - as the regional nodes of water administration. The national and basin water plans are to provide technical framework for formulating both national and regional water management strategies. By advocating users pay principle and full cost recovery, the law allows the imposition of water abstraction and pollution taxes. Although the new law views water as a public resource, it does permit authorized use rights and recognizes also the water rights obtained under the 1914 law' (Saleth and Dinar, 2000).

The latest ministerial reorganization brought together mines, water, and environment under the Ministry of Mines, Water, and Environment. This can strengthen the administrative cohesion between water and environment sector agencies and can support the development of integrated water resource management policies. The ongoing programs for canal lining, pressurized supply of canal water, and the application of sprinkler and drip systems are vigorously pursued to enhance water use efficiency (Kerfati, 2001). Although more institutional changes are required, the basic institutional conditions for water management improvement have been established (Saleth and Dinar, 2000).

In order to recover the cost of water supply Moroccan government has granted autonomy to public urban water supply agencies and the privatization of urban water supply in cities such as Casablanca, Rabat, and Tanger. The privatized water supply in Casablanca provides an example of how the urban water sector may be organized differently. Similarly, the use of a revolving fund to provide loans to urban users both for water meter installation and for retrofitting water appliances is also an innovative way of having users self-finance urban water conservation (Saleth and Dinar, 2000).

The major objectives of the water resources sector plan in Morocco are to continue the regulation and institutional reform implementing and applying all the decrees of the water law 10-95. Also, the preservation and protection of the water resources and the fragile zones, the protection of water quality and development of measures to prevent their pollution, the protection of ground waters (groundwater contract), and sensitive zones by developing water shed basins, oases, humid zones, natural lakes and coastal region (Kingdom of Morocco 2001). In the mean time the water plan encourages the management and development of the supply by increasing the use of non-conventional water resource, including desalinization of 400 Million m3 per year, the reuse of treated wastewater at a rate of 300 Million m3/year and efficient uses of rainfall water harvesting. The plan includes also a programme of capacity building of the water department.

IV – Environmental aspects

A national monitoring programme of the water surface, ground and coastal water quality has been set up by the Secretary of state in charge of water and environment. Since 1999 several national reports on water quality for the years (1999, 2000, 2003 and 2009) were published and over 700,000 analysis per year are processed to measure several indicators of water pollution including physical, chemical and microbiological parameters.

Potable water supply will be doubled before 2010 to cope with the 4% per annum demand increase. The rate of the urban population connected to potable water networks in their homes

will be raised to 94% in 2010, from 85% in 1999. The access rate to public water supply system in rural areas will also be increased as in 1999 it was only 38% in. In addition, privatization of water resources development sector will be promoted (NODW - FAO 2001).

The actual total volume of sewage discharged in Morocco is estimated at about 600 million m3; 48% of these waters are discharged into the rivers or applied to land, the rest is discharged into the sea. The pollutant load from wastewater is estimated at around 131,715 tons of organic load, 42,131 tons of nitrogen and 6,230 tons of phosphorus. Therefore, to comply with the WFD, to protect water resources and reduce the pollution a national sanitation and sewage programme is developed to improve sewerage collection, the treatment of both industrial and domestic wastewater, and increase the reuse.

The preparation of the national water quality protection plan included a diagnosis of the quality of water resources, an analysis of sources of pollution and their impact on water quality, and the preparation of a water quality protection plan for the country in general. Morocco has budgeted about 4 billion Euros for sewerage projects between now and 2015 within the framework of the national plan for reducing urban pollution.

Moroccan government, furthermore, put a plan in place to reduce the damage of flooding. The preparation of the national flood protection plan included the formulation of a typology of floods, a study of the vulnerable sites, establishing maps of zones vulnerable to droughts and flooding as well as prevention measures to be adopted for each site. Furthermore a study on the institutional context and the preparation of a detailed action plan was performed. All those steps have been completed and the resulting action plan combines physical realization with institutional measures such as the formulation of a number of decrees dealing with the organizational and legal aspects of flood protection.

V – Economic aspects

Incentives for efficient water use

The considerable fall in the domestic and industrial demand for water can be explained essentially by the several steps taken, aimed at rationalizing the use of drinking water in Morocco. These include (i) progressive pricing (water fee base on 4 categories); which, while favoring access to drinking water among low income social groups, acts as an incentive against wastage (Doukkali *et al.,* 2002); (ii) Campaigns to raise awareness of the need to save water; (iii) The installation of a system of payment by vouchers for public bodies. This category of subscribers used to pay for water consumption by internal administrative accounting procedures which were typically cumbersome and took no account of water saving (iv) Providing staff accommodation with meters and withdrawing shared meters; and (v) The introduction of the private sector in the distribution of the water.

In the agriculture sectors, Morocco still has a low value of the mobilized water, particularly due to low efficiency in irrigation (80% is now surface irrigation). Therefore, Morocco launches major operations, including a program for conversion of gravity irrigation system into drip irrigation systems (560,000 ha), improved efficiency of drinking water, protecting water resources and the fight against pollution by national sanitation and sewage treatment in 2006, solid waste, industrial pollution (4 billion Euros will be invested in the national programme of sanitations), improving the collection and reuse.

The strengthening of capacities of the agencies for irrigated areas (ORMVA) and their carrying out of the trials/demonstrations of improved technical packages for irrigation, as well as the training of staff and farmers, will result in the adoption of those improved techniques by a number of farmers. The benefits of those techniques will be additional crop production at lower costs and less water use.

Cost recovery: 'the polluter and user pays' principle

For drinking water two instruments were adopted through the law 10-95, including a pollution permit system that stipulates that every outflow is subject to an approval, and that every outflow is subject to payment of a charge. As mentioned before the concessions for water distribution in four large cities (Casablanca, Rabat, Tangers and Tetouan) were granted to private water companies. The privatization efforts in the urban water and sanitation sector indicate the growing commitment of the government to quality of services, managerial efficiency and financial sustainability (Doukkali, 2004).

This positive experience of private management of the urban water sector, encouraged the Morocco government to experiment with public–private partnership (PPP) in the irrigated agriculture sector with the initiation of the first-ever public-private–partnership project (Lamrani & Marin, 2002). Under this PPP initiative, two projects were planned for the construction of a transmission pipeline (Guerdane project) and a distribution network (Gharb project).

VI – Conclusion

In order to achieve good water resource management, Morocco is divided into 9 major river basins (RBA), with long-term water resources development policies written down in Integrated Master Plans. On the whole, the achievements of Morocco to realize specific objectives in integrated water resources management are considered satisfactory. The achievements include the establishment of an institutional framework for the creation of a River Basin Agency at the national level; improving the government's capacity for water resources planning; improving water use efficiency; increasing effectiveness of existing hydraulic infrastructure; introducing water pollution control measures. The key elements of an institutional framework for integrated water resources management are in place, namely: a national water master plan, a national water quality protection plan, a national flood protection plan and the recommendation of a study on water pricing.

'The paradigmatic shift from water development to water allocation requires a radical reorientation of water institutions. The challenge lays not so much in having allocation-oriented water laws and policies as in building an allocation-oriented organizational structure out of an existing water administration with insufficient skills and resources' (Saleth and Dinar, 2000).

The Moroccan government is convinced that for the irrigated agriculture sector transferring the managerial responsibilities, including cost recovery and system maintenance, to WUAs is the main path towards further decentralization. Decentralization in the urban water sector is performed by creating autonomous and financially self-dependent utility-type organizations for the provision of urban water services. To acquire financial viability and physical sustainability of the Morocco water sector, and to improve cost recovery, water quality grading, quality standards, and pollution control regulations are implemented (Saleth and Dinar, 2000).

Strong integration of water demand management in water policies was very effective in strengthening the country´s water security. The involvement of the private sector in water resources management was an effective solution to water resource management problems. Moreover Morocco is developing a New Water Plan in synergy with WFD for implementing sound water policies and achieving a Common Vision for water management.

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