This case describes the introduction of a new irrigation strategy in Tunisia, designed to address growing water shortages and to introduce reforms applicable to both modern large-scale and traditional smaller-scale irrigation systems.

**ABSTRACT**

**Description**

An arid country with limited water resources, Tunisia depends heavily on irrigated agriculture. The sector contributes 30-40% of the value of agricultural production, and is highly important in some regions. However, abstraction for irrigation accounts for 83% of the available water resources, competing with other uses. To conserve water resources and encourage demand management in the irrigation sector, a national water saving strategy was implemented. As part of the strategy, a number of reforms were introduced in the past few years, including the promotion of water users’ associations, an increase in the price of irrigation water, and the use of incentives to adopt technologies that water at field level. The strategy also introduced a number of supporting actions such as strengthening of applied research, improved agricultural marketing and capacity building in the irrigation sector. The integrated strategy has resulted in a marked and sudden increase in national awareness of water scarcity, and the value of water in the country’s economic development.

Specific measures introduced by the new strategy included:

- Creation of a legislative framework to promote water users’ associations and financial incentives for water saving
- Strengthening capacity in all water management sectors, including the management water users' association supervision, training of trainers, and improving farmers' awareness of the need to improve e irrigation practice
- An increase in water tariffs to reinforce users’ participation in cost management and to provide incentives for the adoption of water saving techniques.

**Lessons learned**

- Integrated reforms that take into account the technical, economical and institutional aspects of water demand can make a significant impact on water management and conservation
- To gain the support of farmers, reforms must seek to improve farmers’ incomes
- Financial incentives accelerate the adoption and use of efficient irrigation techniques.

**Importance for IWRM**

The irrigated sector in Tunisia is similar to that of other countries of North Africa and the Middle East. In all, the sector is characterized by high consumption and production of waste water, socio-economical constraints, and competition between users. In addition, the importance of agriculture to the social and economic life of the country makes the introduction of any irrigation management reform risky. The Tunisian experience can enrich the debate on the costs and benefits of establishing water demand management in agriculture.

**Main tools used**

- A2.3 Reform of existing legislation
- B2.1 Participatory capacity and empowerment
- B2.2 IWRM capacity in water professionals
- C7.1 Pricing of water and water services
- C7.4 Subsidies and incentives
1 BACKGROUND AND INTRODUCTION

Because of a growing scarcity of water resources, and faced with increasing demand from different water users, several arid countries have recently sought to rationalize their national water use. Managing the demand for water use in agriculture can save water in regions where the resource is already stretched to the limit. The irrigation sector faces not only the limits of available water, but also competition from other sectors, which are often more productive or of higher social priority.

The need to introduce integrated water resource management (IWRM) is probably the greatest challenge for irrigation agriculture at the beginning of the 21st century. The sector needs to decrease its pressure on water resources, while at the same time increasing agricultural production. To achieve this objective requires change at all levels, including the formation of irrigation networks and the introduction of new techniques for farm-level irrigation and improved overall irrigation management. New choices of crops and cultivation techniques are also needed.

Such changes have widespread economic, financial and institutional implications. They concern water pricing and access to equipment and other inputs, as well as changes in the way water in agriculture is managed.

Recognizing the importance of IWRM, Tunisia, as a Mediterranean nation with cyclical water shortage, has sought to update its water policies and develop coherent new strategies. Irrigation policy changes were embedded in a large nation-wide program of economic structural reform introduced at the end of the 1980s. The reform program, designed to stimulate faster, yet sustainable economic growth, while conserving rare and fragile natural resources, gave new attention to the water sector and agriculture.

This case study of Tunisia’s National Strategy for Irrigation Water Conservation presents the steps that were taken to strengthen IWRM and analyses the results of the policies that were introduced to rationalize agricultural water use. Because agriculture is vital to developing country economies, irrigation water reforms are risky, with the potential for unexpected negative social and/or economic consequences. The Tunisian experience can enrich the debate on the real and promising possibilities of demand management of agricultural water in countries with similar conditions.

Irrigation in Tunisia

With a Mediterranean coast to north and east, and the Sahara to the south, Tunisia has little rain, with poor distribution over time and location. Over the past four decades, the country has made considerable efforts to develop its available water resources. However the conventional exploitation of water will soon reach its limits; demand for water is predicted to exceed supply as population and living standards grow. Tunisia is forced to find confront this challenge and find a way of managing its water in the most rational way.

Most of the nation’s hydraulic infrastructure was constructed to serve special irrigation schemes, whose current area is estimated at 370,000 hectares. The infrastructure target of 400,000 hectares will be achieved in 2010, when the surface water system is fully operational.

The irrigation system is varied, and includes big dams, deep drilling, surface wells and treated wastewater. This variety has led to differences in the sizes and configurations of equipment and diversity in the management of individual irrigation schemes. As a result, production and productivity levels vary, depending also on local and regional climatic and socio-economic conditions.
Irrigation covers only 7% of total productive agricultural land, but contributes 35% of total agricultural production and 20% of agricultural export, and employs 27% of the labour force. Production from Tunisia’s irrigated agriculture is varied, including citrus growing in the south, and market gardening in the Sahel and Medjerda Valley. About one-third of the irrigated area is devoted to market gardening, and another third to tree crops; the remaining third is used for cereals (13%), fodder (10%) and other cultivation (10%).

Tunisia’s long-term objectives for irrigated agriculture are twofold:

- The development of intensive production of high value crops to meet the country’s needs in fruit, vegetables, dairy produce and industrial crops, and to export a surplus in citrus fruits, dates, early fruit and vegetables. In the long term, irrigated agriculture is expected to account for 50% of the total agricultural output.

- To complement rain-fed agriculture, whose production is more uncertain, by ensuring an irrigated supply of basic foods, such as cereals, in times of drought.

The problems and the challenge

Demand for water for agriculture is increasing, as agriculture intensifies in existing irrigated areas, and new areas are developed. Demand was estimated as 1,570 Mm³ in 1995 and is expected to increase to 2,540 Mm³ in 2010; this will amount to 83% of the total expected demand at the end of this decade.

This increase in agricultural demand for water will happen at the same time as an increase in the demand for water from two economically more competitive sectors -- tourism and industry. All this will take place in the context of Tunisia’s decision to open up its trade and markets to globalization. Globalization, among other things, requires rapid modernization and increasing interaction with international partners in all economic sectors, including irrigated agriculture, which is expected to improve efficiency and quality while reducing production costs.

This is a tall order, since the record to date shows that irrigated agriculture has not yet achieved anything like its production potential. Large irrigation schemes often do not use up their water allocations while irrigation efficiency at plot level is often highly inefficient – with levels of only 50-60%. In traditional irrigation areas (which are 75% of the total) there are high water losses in the transfer and management of irrigation at the field level.

The reasons for this varies from one scheme to another, but include:

- The limited technical skills of the farmers in new irrigations schemes, who were used to low-technology rain-fed agriculture.
- The equipment in some older schemes is degraded or obsolete, reducing the overall efficiency of the sector, and decreasing the reliability of local water distribution and quality of service.
- The previously heavy government role in irrigation operations, with accompanying low farmer participation in water management.
- Water prices were set too low to affect irrigation behaviour significantly or act as an incentive to limit water demand.
- The inability of collective networks to satisfy the exaggerated demand for water with negative consequences on the quality of the service obtained by users.
- Over-exploitation of underground water resources that has led to lowering water tables and salt intrusion in some areas – thus risking the longevity of affected irrigation schemes.
- The salt content of surface water in some schemes in the north and in oases rose also as a result of excessive water loss, requiring expensive and difficult decontamination and drainage solutions.
- Poor water management at the field level has reduced the fertility of agricultural soils
2 Actions taken: reforms of the irrigation sector

In response to these problems, the National Strategy for Irrigation Water Conservation was introduced in the 1990s. It contained various approaches, designed to improve water management and to raise the performance of the irrigated sector. These reforms have fundamentally affected the technical, economic, institutional and organisational aspects of water use in Tunisia. They have led to a new focus in irrigation -- on the management of demand rather than of supply, which for long had the objective of extending the scope of the irrigated areas.

The most important aspects of the Strategy are described below.

Rehabilitation and Modernisation (Tool A2.3 Reform of existing legislation)

New irrigation systems were created and old systems rehabilitated to increase ease of management, especially of water demand, allowing for flexibility of water allocation among sectors within the system. Water is managed less at the system, and more at the farm or field level. Flexibility is further encouraged by promoting conjunctive use of surface and underground water, and by building of storage reservoirs in the heart of the systems. Wherever possible, each irrigator can control and measure his own water use. Although the introduction of this new technology is expensive, it is farmer-friendly and can have a positive effect on overall productivity.

Figure 1 Roles of participants in management of water
Decentralisation and Irrigator Participation (Tool B2.1 Participatory capacity and empowerment)

The Strategy calls for active participation of irrigator organisations in managing the irrigation systems, by introducing the following:

- A progressive disengagement of government in such tasks as servicing and maintaining of control structures, and transfer of day to day responsibility to Groupements d’Interêt Collectif (GIC) or Water Users’ Associations; government retains responsibility for servicing and/or replacing larger structures.

- A reduction in direct and indirect water subsidies, aimed at getting the GICs to pay for the cost of water, and therefore managing the irrigation in a more economically rational manner.

- Support for the GICs to enable them to play a dynamic role in infrastructure management of infrastructures and subsequent agricultural development.

Part of this decentralization involved dissolving the twelve Development Offices that had previously managed the public irrigation systems. At the same time, the Regional Commissions for the Development of Agriculture (CRDA), one in each Governorate, have been restructured. Their role is now management of water allocation at the governorate level, leaving the GICs to operate at the local level (See Figure 1 above).

Today, as shown in the figure below, there are 960 GICs. They are managing 60% of the total public irrigated area; by 2006, they should be managing 100%. These self-managed structures are operating within codified rules and are competent to manage their systems. As public bodies, their status enables them to recover water taxes, thereby distributing the costs of running the system, and allowing each user to benefit as needed.

Figure 2 Increase in number of GICs

Community management has had positive results: the inefficient government management of infrastructure has come to an end, while users now recognize the long term potential value of their own role in maintenance of the system and increased agricultural production.

However, despite the success of most GICs, the value of the large water-awareness programs and the continued availability of technical, administrative and financial assistance for the GICs, some groups are still not operating optimally. The difficulties they have encountered are essentially due to:
- The reluctance of irrigators in some of the large, previously government managed systems to change, since they had profited from the previously highly subsidised water costs

- The limited irrigation management skills of some GIC

- The absence in the rural areas of private sector suppliers of servicing and maintenance skills and equipment. Where the private sector is not available, General Interest Groups have to turn back to the government to obtain these services.

**Irrigation Water Pricing (Tool C7.1 Pricing of water and water services))**

During the last decade the Strategy has sought to rationalize the pricing of irrigation water in terms of (a) costs, (b) variations among systems, and (c) national priorities, notably food security. Since 1990, the price of water has increased from about 22mil/m³ (US$0.016) to about 100mil/m³ (US$0.07), an increase of about 9% per year, in real terms. This increase covers the major part – some 90% - of the increased operation and maintenance costs of the irrigation systems compared with only 57% at the start of the programme, and shown in Figure 3.

To improve coverage rates even more, the Strategy now calls for the progressive introduction of biannual water billing, in the larger irrigation systems in the north.

**Figure 3 Increase in cost recovery %**

![Chart showing the increase in cost recovery % from 1990 to 2000]

Initially irrigators vigorously resisted the continual increases in water prices. But accompanying pro-farmer measures, such as price liberalization for irrigated crops, and the awareness campaigns demonstrating to farmers the value of water economy in their fields has, over time, tempered their reactions.

**Field-Level Water Conservation Program (Tool B2.2 Training and awareness raising, C7.4 Subsidies and incentives)**

Despite the fact that significant efforts have been employed since the 70’s to promote modern field irrigation techniques, traditional gravity irrigation persisted throughout the irrigation schemes, with enormous water loss. From 1993 a new coordinated program was put into place, with several simultaneous components: a major awareness program for farmers, specific training for advisory technicians and irrigation engineers, support for research and development into new irrigation techniques, establishment of new national and regional organizations (a national evaluation committee and regional committees for local coordination) and encouragement for the involvement of the private sector (equipment and service suppliers), etc

The Water Conservation Program picked up momentum from 1995 onwards, furthered by the political decision to increase of the rate of subsidy for modern irrigation equipment from the earlier level of 30% to 40%, 50% and 60% respectively for large, medium and small farms.
A mid-term evaluation of the Program showed a high rate of adoption, with 223,000 hectares (62% of total irrigated land) now being irrigated with modern equipment, with increases of about 70,000 ha since 1990. Adoption is increasing at a rate of some 25,000 hectares per year. At the present rate, as shown in Figure 4, it is expected that new equipment will be in place throughout the system by 2003.

By the end of 2000, the Water Conservation Program had achieved investment of over 335 million DT (US$254 mn), of which 167 million DT (US$123 million) was in the form of subsidies and the balance direct investment by the irrigators. With regards to the enormous investments granted in this field and to the questioning which persists about the profitability, the following results of the first evaluation appear encouraging:

Field-level irrigation efficiency has increased from 50-60% on average to 70-85%, thanks to the newly introduced techniques (improved gravity, sprinkler and drip irrigation). The improvement in efficiency has allowed some significant overall water savings in the irrigated systems, i.e. about 210 million of m3 or 10% of the total. If all the irrigated areas adopted the water conservation systems, the efficiency improvement could be 25% of demand.

A yield increase of 70% was noted in market gardening and tree crops, resulting in occasional national over-production of certain produce (especially tomatoes). On average, market gardeners’ profits increased by 97% (from 2690 DT/hectare (US$1980) without water conservation equipment to 5310 DT/hectare (US$3910) with equipment), while citrus farmers increased their profits by 30% (from 5970 to 8080 DT/ha, US$4400 to 5950 per ha).

In summary, at the end of the first phase of the Program, the conclusion is somewhat mixed. On the one hand, water saving is not very substantial in volume (because irrigators have not yet fully mastered the modern technologies), but on the other, water is now used to better economic effect at both the farm and national level.

3 Outcomes

The reforms instituted through the National Strategy for Irrigation Water Conservation have established key demand management instruments in the irrigation sector, which extracts more than 80% of Tunisia’s available water resources. Early results of the Strategy can be summarized as follows:

- After strong growth in water consumption following the extension of the irrigated areas, and water losses incurred in operating new schemes, consumption has started to decline, and over the past five years has stabilized, despite the successive droughts over this period.

- At the same time, production for the irrigated sector has increased considerably, at a faster pace than for agriculture as a whole, as shown in Figure 5, below.

- State funding has been withdrawn and irrigators are effectively involved in the management of the irrigation schemes, especially in financial management.
4 Lessons learned

Despite the social and economic importance of irrigated agriculture in Tunisia, and the critical role of water in an arid country, it has proved possible to introduce major reforms that have restructured the sector and improved its management and productivity. Positive lessons learned include:

- Isolated reforms, attempted in the past, had limited results. The National Strategy for Irrigation Water Conservation has been successful because of the integration of technical, economic and institutional elements.

- Reforms worked better because they were set up progressively, with time and care taken to adapt measures to maximize the interest and involvement of all parties, especially the irrigators and their professional organizations.

- The establishment of a system of financial incentives accelerated the adoption of effective irrigation techniques.

- The improvement of the irrigators’ revenues remains the best guarantee for continued farmer support for the instituted reforms.

However, certain weaknesses have also been revealed. It has been suggested that the cost recovery approach has been insufficiently used in improving irrigation efficiency. More sustained attention should be given to marketing constraints, such as product quality and quantity control and processing. Managers should learn to take account of market forces in planning production targets in irrigation schemes.
5 References


6 Organisations and people

Mr Abdelkader Hamdane, General Director
Direction Generale du Genie Rural et de l’exploitation des Eaux, Tunisia
Phone: +216 7 1 78 17 56 fax: +216 7 1 28 80 71
Email: hamdane@francite.com