The Economic Value of Water and its Implications in the Mediterranean Basin

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The socioeconomics of water in the Mediterranean Basin offers the interest and difficulty of encompassing virtually the entire spectrum of situations of availability of this natural resource and very different socioeconomic situations. The problem of otherness arises. The other, unabundant, is unlikely to have access to or be able to read this text. Hence the interest in generating an understanding in the reader, who enjoys a good water supply and a good economic situation, of the other's situation. The other receives no salary and is unlikely to ever have one, his economy is marginal and non-monetary, he cannot take a shower, he may suffer thirst, hunger from time to time and a significant degree of malnutrition, he may suffer a water-borne infection which, if it does not kill him, will prevent him from going to school or working. All of this is due to an insufficient availability of suitably treated water and to socioeconomic inequalities. A similar situation arises in countries acknowledged as being developed in which it is sought to guarantee certain minimums free of charge in the provision of basic services to impoverished sectors of society. Many water policies implemented by the Mediterranean countries seek to achieve some day the requirements set forth in the Water Framework Directive (WFD), a policy which has little meaning in those areas where there are other socioeconomic priorities.

The Mediterranean Basin

The Mediterranean Sea is bordered by countries belonging to Europe, Asia and Africa and which offer striking differences in their geography, politics, socioeconomic structure, political alliances, level of strife, insularity, consolidation of their institutions, among other features. Just consider, for example, the differences between the Vatican, Monaco, Malta, Crete, Egypt, France, Bosnia, Palestine, Jordan, Kosovo, without including hydrographically relevant countries such as Sudan in the Nile basin, which raise issues concerning the sovereignty of water (which also affect the Tigris, the Euphrates or the Jordan, although they do not empty into the Mediterranean) or the newborn Macedonia, a truly Mediterranean country. One way to distinguish between countries on the north or European shore (part of the EU), on the south or African shore, in the east (both in the MENA region) and the islands is by their climate and hydrological features, the former with rivers fed by snow from the Alps, the latter with a steadily falling average annual rainfall and economic and social differences with a strong influence of historical, religious and political factors.

Just in the countries in the MENA region, the level of wealth, as measured by the GDP, varies between $1,290 and $16,180 per capita, with substantial inequalities in the internal distribution of income from one country to another. This region has one of the lowest water supply rates in the world and very limited resources. Several countries are included in the bottom 10% of the table of annual water availability per capita, exploiting non-renewable resources, exhausting groundwater supplies and degrading the quality of existing water and even the soil by deforestation, salinisation and erosion. The Mediterranean area may be affected by climate change, with a decrease in water resources and an increase in the demand for water. Agricultural output will fall and the environment will suffer severe damage: forest fires, soil salinisation, etc.

The Socioeconomic Value of Water

The application of economic concepts to the management and use of water (a non-substitutable good

in general terms) leads us to the dilemma of determining the market price. This principle of economics raises difficulties in application, as water for daily personal intake is not the same as water used for irrigation in which agricultural output faces a market price that decides whether it is better to produce or to import (alfalfa, cereals, tomatoes, milk…).

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In financial economics, the value of water is usually identified with the added value or cost incurred in location, collection, storage, control, quality assurance and provision to the user plus the depreciation of the investments made and a possible profit for the service rendered. The same is applicable to water removal (rainwater, wastewater, drainage) and water treatment systems. One could also include the cost of avoiding floods. This added value, after applying fairness, demand control and social policy criteria, becomes a rate or similar concept that is eventually seen by the user as the price of water. This aggregation of costs usually excludes those associated with the externalities caused by use. The net benefit for the user will be the difference between what he receives or thinks he receives with the water he uses and what it costs him or what he pays. In terms of use of water, there is consumptive use, such as water for personal intake, which is returned after a variable period and with changes (physical, chemical, biological) in its quality, and non-consumptive use, in which the water is returned almost immediately to the water cycle, with very little variation in its quality. Use may be the result of a more or less peremptory need (drinking, irrigating, bathing) or simple consumerism and may be solvent or insolvent depending on the price that must be paid.

The basic requirement is about 2 litres of drinking water per person per day (l/pd). At least 20 l/pd of water must be available less than a kilometre away for the hygiene of people and their immediate environment (replaceable in part by sand). Otherwise, day-to-day life and individual and social activity will be hampered by the occurrence of disease. In some hospitals, the death rate in 1880 was up to 80 per 1,000 patients. However, by 1948 (the year that penicillin was discovered), the death rate had fallen to 2 per 1,000 patients (a 98.75% decrease) simply with the use of soap and water for washing. In cities, it is necessary to cover a series of common services that entail a consumption of about 100 l/pd (recommended as the minimum by the World Health Organisation [WHO]). In food production, several cubic metres of water are required to obtain 1 kilogramme of wheat, and even more to obtain 1 kilogramme of veal, particularly if the heifer is fed with feed or grain. On the contrary, very little water is required to obtain 1 kilogramme of rabbit. Food import is associated with a virtual water import that is equivalent to that required to produce the food. Water requirements for all human activities, including commerce, industry and food production, put annual water consumption above 1,000 m^3 per year and the recommended amount is between 2,000 and 3,000 m^3 per person per year (note the wide range in figures). Such volumes are quite impossible in many arid countries in the Mediterranean Basin. Resource availability varies considerably from one country to another, with a gross resource availability of 23,182 m^3 per person per year in Croatia, at one extreme and 126 m^3 per person per year in Malta, at the other extreme.

The use of river, lake and seawater to assimilate part of the waste produced by human activity is very badly viewed but is still an option that can be used with caution in certain situations to take advantage of the environment's self-purifying or assimilation capacity. By this means, financial resources can be directed towards other needs, facilitating a level of development that, in time, will attain sufficient capacity to minimize waste discharge into water or the environment. This practice of discharging effluents into water resources, although recourse to this should be limited, can be assessed economically against other methods of discharge or prior treatment.

Water in nature has a recreational or aesthetic use … and it is considered to be an environmental asset to be preserved. This takes us to the sphere of environmental economics, which is much more difficult to assess than financial economics. When all aspects have been taken into account in the economic assessment, it will be possible to decide how the water should be managed. This is a laudable goal that must be advocated and achieved when the time is right. The available water resources and the socioeconomic situation of each human group will define different conditions for the use and protection of water.

We should remember that in nature, water is used to transport and assimilate energy and matter and to support life. This water must be given legislative protection and the value of ecosystems must be enhanced to offset the lack of economic production that the same water would generate in another use. The same thing happens with water heritage and other infrastructures such as theme parks, golf courses and reservoirs, which store, retain flash floods, regulate water flows, allow navigation, produce electricity and other services, albeit they also have their drawbacks.

The Mediterranean Region in the Global Context

At the Dublin and Rio de Janeiro meetings, among others, in 1992 (World Water Commission) and at international conferences, it was agreed that in order to guarantee environmental improvement and to satisfy the needs of the population, it is necessary to increase the effort in technology (mobilise knowledge), finance (private sector investment capacity complementing the public sector) and institutional innovation (with the involvement of users). In the Mediterranean Basin countries, we find major differences in application between the continental countries and the island countries and between the countries in the north and the south, with a particularly sensitive area in the east. Among the international organisations that are involved with water in general and the Mediterranean in particular, there is the Organisation for Economic Cooperation and Development (OECD), the United Nations Food and Agriculture Organisation (FAO), the WHO, the World Bank (WB) and the United Nations Development Programme (UNDP). One concrete plan for the Mediterranean area is the Blue Plan, with organisations such as the Euro-Mediterranean Water Information System (Remide) and the Institut Méditerranéen de l'Eau (IME), which have written other articles for this publication.

The irregular climate of the Mediterranean Basin leads to irregularities in rainfall which require storing water during rainy periods so that it is available during dry periods. Rainfall can often be intense (torrential), causing severe floods even in desert areas. In such situations, the settlements formed near water courses may be seriously affected, with the risk of the loss of human life. The damage caused by flooding is very expensive and more than justifies the investment in early warning systems of extreme rainfall and in lessening the impact of floods through the use of natural spaces or water channelling and regulation systems. The periods of drought can also be very severe, also causing significant economic harm to society. For obvious reasons, during these periods, water supply to people is guaranteed and supply to other sectors is restricted. The downward trend in rainfall in the Mediterranean area is detectable but still not significant. However, the increase in the demand for water is very obvious, leading to increasingly frequent situations, not of hydrological drought but of structural drought due to the inadecuacy between resources and demand and of water infrastructures. Both extreme situations are currently the subject of study in the planning done by the EU and the other countries in the area.

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Water and Health; Investments; Water and Population

Health is an indicator of social wellbeing and economic development. There is a direct relationship between health, water, food, education and employment and, in particular, between health and drinking water supply and wastewater treatment in order to prevent waterborne diseases and disease vectors in stagnant or contaminated water. Child mortality and school absenteeism diminish with a good water supply and drainage system. The same thing happens with adult mortality and work absenteeism.

As a general rule, the population of the Mediterranean area is supplied with drinking water and the populations without such a supply are falling steadily. The rural areas, 10% of the population, particularly in North Africa (152 million inhabitants, 72 living in rural areas), are the most affected by the lack of a drinking water supply although their incidence is decreasing continuously (in 2004, 86% of the rural population had a supply of drinking water), although at a slower rate than in urban areas (96% of the population). Coverage by a drainage system is also im-

proving in these areas (91% in urban areas and 62% in rural areas).

Most of the population lives in cities and coastal areas. This leads to a high, very localised demand for water and the generation of wastewater which may pollute the coast and the final reaches of rivers and streams, and makes it difficult to reuse the water further inland due to the need for pumps and additional water transportation structures. In such areas, structural imbalances between demand and resources are common, requiring collection, storage, transportation and treatment infrastructures to rebalance water availability and supply in the country and provide water to the population where and when it is needed and with the required quality. These infrastructures absorb financial resources that could be used in other public investments demanded by the population, such as schools, hospitals, roads, etc. The limited financial resources available to governments render it necessary to choose where to make the investments from among the many societal demands. Worldwide, it is estimated that 84 billion dollars are needed to achieve the Millennium Development Goals (MDG). The average benefit expected with these investments in water supply and drainage with respect to the cost incurred ranges between 4 times the investment in the case of home connection and 12 times in the case of specific supply and drainage points (streets, squares). If there is a price for supply, it is easy to calculate attractive financial formulas for amortising investments made with public or private capital. Successful application of a water rate (its collection and entry of private capital) requires: conviction (participation), legal coverage and social, political and government stability. The use of private capital, which usually receives a return of about 5% (low compared with other activities), releases government's resources so that they can be used for other social demands and puts into motion a process of privatising water supply services. This usually does not happen with drainage systems, which it is usually more difficult to incorporate into price systems and to privatise. When the population is more scattered, territorial groups covering large areas of population and water use are formed in an attempt to attract private investment and management – the Galli Act in Italy and the Local Water Entities (not active) in Catalonia (Spain).

Legislative requirements concerning quality of drinking water and treated wastewater have a strong influence on investments and operating and monitoring costs and, as a result, on socioeconomics. When the WHO's quality recommendations are taken as a non-sufficient minimum, a process of increasingly restrictive regulations (principle of prevention) in the quality of drinking water is initiated, which in turn increases its cost.

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Certain water infrastructures may entail a lower initial capital outlay but higher operating costs (usually in energy consumption) that can be included in the price of water. As the infrastructure work is completed in a short time, amortisation of the capital expenditure can be begun earlier (less interim interest), with a shorter payback period. As a result, such infrastructures are attractive to private capital operating under a concession (which is common in the Latin area of influence) or privatisation system but possibly more onerous for the population and technology and obsolescence-dependent. Furthermore, the lower capital outlay enables private investment to increase the number of facilities and increase market share. For private capital to become involved, the population must be able to pay the price charged for the water. This is not the case of the more depressed economic strata of society or for all conceptions of public service for religious or tradition reasons. The cost of the water rates may be onerous for depressed economies or saturate many people's capacity for accepting price increases for services. Decisive, clear, equitable action by governments is required to ensure a price structure matched to social needs and economically balanced to enable maintenance of the drinking water supply and drainage service. In countries with average citizen income levels, investment requirements in water supply and drainage do not exceed 0.1% of the GDP and maintenance of the system may account for 0.2%. However, in a low-income country, these figures increase to 0.43% and 0.67%, respectively, which is much harder to bear for

a weak economy. The fight against pollution increases these figures to 0.75% for rich countries (very strict quality standards) and between 0.3 and 6% for economically weak countries.

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Water policies in the Mediterranean Basin vary. In Libya, the *Man-Made* River project will mine aquifers in the country's hinterland to remove the water. Tunisia is privatising the construction of desalination plants in the tourist areas on the coast. In Spain, where the water supply service is highly privatised, the government has ruled out water transfer projects and has given priority to membrane desalination plants as the primary solution. Generally speaking, the water rates do not cover the full cost of supply and drainage and much less the cost of managing the entire water cycle, as recommended by the WFD. By increasing the price paid by the user for the water consumed, the intention is to act on the demand side of water rather than on the supply side. In theory, thanks to the price elasticity of demand, a price increase would decrease water consumption. This is not absolutely true. Domestic elasticity is very rigid as it depends on the facilities installed and also on habits in the use of water. As a result, demand has no consistency or memory and consumption returns to prior levels after a certain time has passed. Price is not sufficient by itself to decrease consumption. Elasticity is greater in industrial consumption and much greater in agricultural uses. Elasticity is a market concept which requires the existence of substitutive goods, which is not the case of water.

Food and Agriculture: Reuse; Efficient Use

Agriculture and livestock raising are at the base of food production, the obtainment of economic resources and deeply rooted as a survival instinct. In the Mediterranean Basin, 108 million people live with a water availability no greater than 1,000 m^3 of water per year, which makes them poor. 65 million live in a situation of water shortage, as they have access to less than 500 m^3 of water per year. To maintain this precarious situation, in many areas there is excessive exploitation of both surface and underground water resources, causing in part, in the case of the latter, salinisation of aquifers due to the infiltration of seawater or other reasons. Adverse health effects caused by the reuse of water for irrigation have created an image of dangerousness. The greatest danger is the irrigators' lack of knowledge and judgement. It is possible to irrigate many trees and plants with wastewater, provided that it has undergone some preliminary treatment. This provides a cheaper source of water with the advantage of added fertilising capacity (phosphates, nitrates) thanks to the organic matter that has not been removed in an expensive tertiary treatment process that is not necessary. It also saves on additional fertiliser. The WHO's recommendations for water quality for reuse in irrigation are sufficient from a health viewpoint for the crops indicated and do not incur high treatment costs. The EU gives more restrictive recommendations. This makes sense for watering recreational areas such as golf courses or theme parks, as their users can pay for the tertiary treatments required to provide a reusable water quality that poses no health hazards. Regulations apart, it should not be forgotten that, unless it is removed beforehand, reused water usually has a higher salt content, which poses a significant hazard for soil fertility if it is not leached (by rainwater or periodic watering with less salty water). Given its scarce natural water resources, which were insufficient to satisfy urban demand, Malta already recommended reuse of wastewater for irrigation back in 1884, reserving natural resources for drinking water. Reuse in Malta goes further than irrigation, as it is also used for industrial services (port). The Spanish Mediterranean coast has a long-standing tradition of processing wastewater for reuse in irrigation and also in the maintenance of wetlands, and is starting to restore aquifers with this water. In the reuse of water, the issue of cost distribution has yet to be settled. Wastewater is usually discharged into the environment with a secondary treatment; however, for most reuses, a tertiary treatment and an additional distribution network are recommended, which entail additional costs.

On another scale, agricultural production over extensive areas is favoured in the Mediterranean by the

area's climate and the number of hours and intensity of sunshine, but it requires water for irrigation. Products such as cereals, maize, cotton, sugar cane enable mechanisation of work, including harvesting. Other crops such as vegetables and fruit are usually less mechanised and require human labour for harvesting, particularly horticultural products and early fruit. Early production is rewarded with higher prices. The south Mediterranean coast has land and labour generally available and water available in particular areas (Atlas, Nile), which favours implementation of intensive farming and early crops for export and domestic use and will no doubt contribute to socioeconomic development and increasing contacts between countries in the basin.

Countries want to guarantee a minimum of basic products (cereals, oil,…) and depend less on international markets with their associated price oscillations. In general, the countries in the Mediterranean Basin have a calorie intake in the diet in excess of 3,000 kcal. In the south, calories are obtained mainly from plant products, with a strong presence of cereals, while in the north, the calories are obtained from animal-based products (mainly dairy and beef and not from free-grazing animals). In the countries in the east and south, the surface area that is irrigated is increasing due to the internal demand for food and the dependence on imports, in some cases, for up to 50% of their food requirements. In some countries, the irrigated surface area has grown by 120% during the period 1980-2000. The varying availability of water has meant that the average volume of water used for irrigation per capita ranges between 921 m^3 and 180 m^3 with similar rainfalls. On the contrary, in the north, cereal growing is decreasing in favour of products subsidised by the Common Agricultural Policy (CAP); conventional irrigation is receding and being replaced by support irrigation. The impact of the virtual water imported in food products (both plant and animal-based) by countries in the south and east Mediterranean ranges between 200 and 840 m^3/person, affecting cereals and meat products, as the countries use the scarce water available for local production of high-value foods. Agriculture accounts for 65% of the water demand in the Mediterranean Basin, ranging between 48% in the northern countries (except for Spain 60% and Greece 80%) and 80% in the other countries, including the islands. Water consumption per hectare depends on each area's aridity index and is influenced by irrigation techniques, but not so much as may be thought. Productivity can be defined as the percentage GDP contributed by agriculture with respect to the total but it is only one of many indicators of the country's production structure and level of socioeconomic development. Productivity per cubic metre of water used depends on the crop and the time of year. It must also be remembered that behind the basic agricultural output, there is a food industry that creates jobs by adding value to this output. This does not happen with imported products, which often arrive from abroad as finished products ready for sale. As a general rule, there are no industrial agglomerations or industrial sectors that are major water consumers in the Mediterranean Basin, although there is a lot of industry. Past energy crunches led governments to perform audits to improve efficiency and introduce minimisation practices. Industry has sufficient financial, technological and organisational capacity to implement water consumption and waste production minimisation plans, so we are dealing with an efficient sector. Thus, the added value per cubic metre of water used in production by the Mediterranean chemical industry is greater than in central Europe and the Mediterranean electricity generation industry uses seawater and air to cool and not water from lakes and rivers.

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Except for countries such as Egypt (on the Nile) and certain parts of the Atlas range, hydroelectric power production is low in North Africa, the islands and the east Mediterranean. On the other hand, the north (including Turkey) does have hydroelectric power production although with virtually no future growth capacity.

Water-Based Ecosystems; Tourism

There is considerable interest in preserving both marine and continental ecosystems. In the case of the continental systems, this implies taking less water from the environment for various uses that will compete with each other to obtain it and guarantee a water supply for the ecosystem with sufficient quantity and quality to enable it to perform its functions, maintaining a natural dynamic that usually requires definition and decision. Situations should be avoided in which this desire to preserve leads to conflict by marginalising the development of part of the population. The EU model has become generalised and is being progressively implemented in the countries on the north Mediterranean and some of the islands. Other countries are trying to adapt it with the hope of joining or moving closer to the EU. This requires enhancing the ecosystems' economic value and offering alternatives for social development to the groups who look to receive more water to improve their situation. All of this must be managed with the active involvement of the water's users.

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Thanks to the benign Mediterranean climate, the general tendency for population to move from north to south Europe continues to hold great appeal. This includes settlement on the coast of the occasional or regular summer or winter visitor but also the permanent migration of pensioners and even professionals. The process is particularly noticeable on the European coast and the islands and some countries in the south and east Mediterranean (Tunisia, Morocco, Turkey). The political and social stability of the south Mediterranean countries and their idiosyncrasy and natural appeal will generalise this population movement, which in turn will entail the creation of jobs and water supply infrastructures that will be useful for each country. Likewise, the preservation of ecosystems (such as the Ichkeul National Park in Tunisia) will add tourist appeal. We can say that tourism contains the germ of a certain socioeconomic homogenisation in the Mediterranean area.

Conclusion

Water is and will continue to be a hotly debated and complex issue for the entire Mediterranean but it is also a basic element for the development of countries and the wellbeing of societies. It requires participative and responsible management, particularly in the Mediterranean Basin, characterised as it is by enormous time and space irregularities in the distribution of this natural resource.

The reuse of water, the joint management of resources, users´ technification and participation, particularly in agriculture, the guarantee of importing virtual water with food at an affordable price, and use of tourism as a source of income for creating infrastructures, and specifically water infrastructures, and jobs, are all factors to be considered in the search for a solution to the shortage of water resources and for sustainability in the socioeconomic development desired by all Mediterranean countries.

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