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(The views expressed in this paper are those of the author, not necessarily those of CIHEAM.)

I - The economic significance of water

Water has been recognized as essential for human life since ancient times, and it is no wonder that it was one of the four basic elements (together with air, land and fire) identified by Empedocle and largely discussed by Aristotle and Plato. This central place given to water was not the consequence of a real shortage of water but probably due to the fact that only a very small fraction of available water – about 1% – was and still is readily available to people.

For a long time water was considered, together with air, a free good. It is only in recent decades that all elements necessary to human survival or to the quality of life have been given an economic value. Estimates about the quantity of water necessary to produce goods are astonishing: 300 to 600 units of water per unit of steel, 600 units of water per unit of nitrates, 250 to 500 units of water per unit of paper. In agriculture, the quantities of water necessary to produce a ton of wheat or a ton of maize greatly exceed the quantities necessary for industrial production. By adding up all uses one could estimate that the amount of water necessary per person per day is of the order of 2 – 4 m^3 depending upon the location of the country and especially upon the degree of its economic development: the use of water in global and *per capita* terms increases as the economy grows.

It is, therefore, no wonder that people in general and public authorities in particular have tried not only to increase the amount of water available, but also to use it in a more economic manner. In this connection, the recycling of water, including the use of sewage water and low quality water, has acquired a great importance as a means of extending the utilization span of available water resources. The combination of the perceived shortage of water and the increasing requirements has contributed to the setting-up of what we now call a "water policy".

Water, and especially high-quality water, now carries a monetary value. The water economy and the economics of water have entered the realm of public policy. In the decades to come the main competition between agriculture and the rest of the economy will not be felt on such scarce factors as land or capital, but increasingly on water. It is becoming the limiting factor *par excellence* not only for agriculture but also for industrial development and especially for urbanisation.

Considering the type of urbanisation which the world is experiencing, the supply of food to large cities may appear easier than the supply of water. Food is often brought from distant places or countries, but water cannot be transported in the same conditions and the use of sea water for industrial and agricultural purposes involves, for the time being at least, extremely high costs.

This situation is particularly acute in areas where rainfall is inadequate or is unevenly distributed throughout the year, or where capturing and utilising available water supplies is extremely costly because of the nature of the terrain or the distance to be covered. These phenomena are present in practically all Mediterranean countries. For all intents and purposes it could be said, so far at least, that there is no alternative to water as there have been alternatives to energy, raw materials and to some foods.

II - The need for a water policy

There are several aspects to the approach to solving some of the problems caused by the shortage of water. They range from the construction of large-scale dams with multi-purpose objectives such as energy production, irrigation, water supplies for cities, to small local projects aimed at the irrigation of small fields through the pumping of groundwater. The coordination of these various projects continues to be difficult for several reasons: the absence of an overall water development and management policy, the interaction of several government departments and the lack of communication and dialogue between the various present or potential users of water.

Of these factors, I attach a great importance to the need of improving communication between those responsible for the development of water and those in charge of its management. The economics of water – embracing all the possible sources and all the possible utilizations – has to become a major element of public policy in all Mediterranean countries. There are examples of lack of understanding of the precise goals of multi-purpose water works, of absence of strict cost-benefit analyses, and of the alternative uses of water, etc.

III - Agricultural policies and water

The above considerations mean that agricultural policies should integrate in their formulation process many, if not all, of the following elements.

1. Water being a limiting factor, all possible alternative uses – including different qualities of water – need to be studied. The notion of "alternative" use should apply within agriculture itself and between agriculture and the rest of the economy. Water, as much as other socio-structural factors, ultimately determines the relative size of the various economic sectors in a country: it is an important element in the trade-offs between agriculture and non-agricultural sectors. Agricultural officials often argue that the consideration of these trade-offs is not their responsibility. But if the resources of a country are not used in the most rational manner, all sectors of the economy will suffer, not only that sector which happens to misuse a resource as vital as water. The notion of "alternative" use thus has to be further developed to consider whether goods produced with water, such as electricity, could not under certain circumstances be better produced with oil, for example.

2. Agricultural policy objectives, such as income levels for farmers, degree of national self-sufficiency in food, will need to take account of the possibilities for the economic utilization of water. Some crucial questions need to be answered in this connection: e.g., will the production of food and fibre for direct use by the population acquire the dominating role, or will comparative advantage (even applied to agriculture alone) be allowed to play a greater role? An implication of this choice is the degree to which a country is prepared to participate in international trade on a competitive basis. This may be in conflict with the desire to ensure a high degree of food self-sufficiency irrespective of the cost involved.

There are, in fact, several cases where a country has tried to switch at the margin its agricultural production from export crops to products destined to the national market, despite its real competitiveness on international markets. This switch was motivated by the artificial character of the international market which is often the scene

of heavily subsidised exports by countries which can afford to do so.

In any such discussion it will prove necessary to consider the water requirements of each crop, the ability of each crop to use the type of water available and at the time at which it becomes available, and the degree of processing which can be sustained in the light of water requirements and availability. In fact, the food processing industry needs great quantities of water, and of high quality water in particular. There is no point in producing a raw material if it cannot be economically processed and marketed.

In situations of water shortage, it might be necessary to divert water from crops which consume large quantities of water per unit of output to crops which are less water demanding. Another interrelated question is whether to use a relatively large amount of water on a limited area of land or a relatively small amount of water on a larger area of land in order to make better use of the land resources and of the freely-provided solar energy. But this poses the question of the choice of crops to be produced and their purpose.

3. The pricing of water is a central element of any policy. It raises a number of dilemmas: e.g., should water be priced, at constant quality, differently in agriculture than in the rest of the economy? If a different pricing system is adopted that favours agriculture, it will certainly help agriculture but will make costs of production elsewhere more expensive and/or will involve a government budget deficit to cover the cost of such preferential treatment. If the pricing is the same, the allocation of water will be more rational, but may run against agricultural production objectives. In those countries where water, especially for irrigation, is considered to be a free good, a profound change in mentality would seem necessary.

Another dilemma is illustrated by the price of water in general. If the price is low (i.e., below cost) a possible misuse of water will result and the public budget will need to cover a possible deficit. Do we not have several examples of water being used to produce agricultural products at rates which are sometimes double those called for by rationality? If the price is high (not necessarily above cost) water will be better used, provided of course farmers and other users have the necessary education and information. In this event, i.e., a high price level, production costs are transmitted to the entire food chain.

This poses the problem of consumer prices. As many countries in the Mediterranean area (as elsewhere) experience high levels of inflation, there is a close link between the pricing of water (and ultimately of food) and an anti-inflationary policy. The trade-offs in the short-run are between the economic rationality of reducing the government budget deficit (when this becomes unsustainable) and the political desirability of maintaining food prices as low as possible. In the longer-run, however, prices must reflect real costs.

When pricing water for agriculture, consideration should be given not only to the cost of developing the water facilities but also of the various objectives pursued which are not necessarily related to agriculture. For example, if sewage water or other low-quality water is to be treated and improved before it is used by agriculture, part of the cost (probably a substantial part) should not be charged to agriculture but to city dwellers or to local government budgets.

4. Agricultural policies should be concerned not only with current production or with production in the short-to-medium term, but especially with the production capacity in the longer-term. This may pose difficult trade-offs in the utilization of existing water. An important trade-off will be between a maximum utilization of existing water – entailing in some cases its degradation – and a more rational utilization of water – preserving its quality for the future and not necessitating expensive recycling operations. Politicians are pressed by current problems: through what means would it be possible to make them aware of the long term consequences of present policies and practices? By improving existing techniques it might be possible to reduce the dangers which result from a maximum utilization of water.

5. Water will become the main point of interaction between agricultural policies and those for the protection of the environment. This will give increased strength to the need to preserve the quality of water but also to the need to recycle water and to improve its quality. Environmental considerations can become a stimulus for a more productive utilization of water. In this case the use of water cannot be dissociated from the use of fertilizers or other chemicals which is made possible by the very existence of water. If the

"polluter pays" principle were to be applied in agriculture, what would be the consequence for water use?

More research is needed in this area to alert politicians. Some may argue that concern with the environment, entailing a lower level of agricultural output, is a luxury that only highly developed and food self-sufficient countries could afford. I would argue that lack of respect for the environment is a danger that no country can afford because it reduces the long-term ability to grow food.

6. Agricultural policies will need to become better integrated with forestry policies and with soil conservation policies. In the absence of such integration, the water economy will increasingly suffer putting into jeopardy all the efforts which will have been made to upgrade its quality and to broaden the utilization possibilities.

7. Agriculture should become the motor for the development of an overall water policy, including the planning, execution and management of large multi-purpose water projects. The irrigation specialist and the economic analyst should work together to provide policy-makers with the information they require.

Besides the need to develop an overall water policy for the entire country, a programme aimed at the best utilization of water in agriculture should concern itself with all aspects ranging from the development of water resources to the planning of production, to the education of farmers, to the development of marketing channels, etc. If any of these steps are neglected, the entire system is likely to suffer and in some cases even to collapse. Water is God-given, but to make it a blessing, society must manage it adequately.