Administration of water resources

Institutional aspects and management modalities

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While water has always been important to people, recent pressures of population, ecology, geography and economic development have created new demands for water and call into question the old institutional arrangements for the administration of water resources. Drawing upon experience, largely from Spain and Latin America but including some examples from Europe, this paper examines the role that private enterprise and water cooperatives could play in promoting more efficient water use. The paper concludes that private management techniques under public control may prove useful but are no panacea.

Problems relating to water, which have always been important, are now at a crossroads as a result of the simultaneous occurrence of a number of factors. Some of these include the following.

Population. Water has always been in short supply in certain parts of the planet, and this has sometimes caused extensive disasters and even the disappearance of whole peoples. Today, and especially in the immediate future, we are faced with an expansion of this problem because of a substantial increase in the world's population, a fact which is particularly important in developing countries and in the urban concentrations that have grown in those countries. That is why there is an acute need to increase water resources to meet household needs and to use irrigation to increase agricultural yields.

Ecology. The availability of water depends in large measure on human actions affecting nature. Thus, we know that the disappearance of large numbers of trees has an influence on precipitation and that large quantities of water, both surface and underground, may be lost as a result of the impact of rain water loss.

Geography. It is very probable that certain regions will undergo changes in their precipitation regimes – some of them with a decrease in precipitation, not only as a result of weather changes caused by ecological actions, but also because of the consequences of the greenhouse effect, which is changing the overall climate of the earth.

Economy. Nevertheless, water is an abundant resource, and lack of water is due exclusively to economic causes: the most accessible reserves have already been used, making it necessary to use more expensive measures for abstracting remote resources, for reusing discharged water or, as a last resort, for making sea water potable. If energy was abundant and cheap, the problems would become much easier to deal with, but this is not the case, and we are probably moving towards a universal increase in the price of energy resources.

The somewhat alarming prospect described above reflects a substantial increase in demand and the inability of supply to meet that demand under satisfactory conditions. Nevertheless, there are some corrective measures available which are accessible to everyone and whose installation would affect national, subnational and local communities; ie the establishment of a legal regime which will facilitate the application of existing resources and encourage or legally require efficient and thrifty consumption.

At the present time optimization of the reutilization of water resources may have significant support in modern and widely disseminated thought on the de-bureaucratization of social processes. This emphasizes the possibilities contemplated here; that of

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incorporating users into the management of irrigation water and adapting entrepreneurial modalities, with public control, to other types of utilization.

Organization for the preparation of policies, planning and management of water resources

In this section we attempt to identify the main features of the organization of today's water resources, conceptually grouping systems and alternatives and exploring the foreseeable trends. As we shall see, there is no single formula and no universal model, because, as was observed in the first United Nations study on basins:

> There is certainly no single correct way to organize and administer a river basin programme. The plan of organization must in each case be fitted into the general government structure and into the cultural patterns and political traditions of the countries and regions which are involved.

We shall dispense with a comparative country-by-country study because we do not have sufficient up-to-date information, except with regard to the present arrangements by irrigation organizations in some major Latin American countries. There are, however, several analyses sponsored by the United Nations, both general analyses and analyses for specific countries, which although 15 years old have conclusions which are still valid.

Water has been considered a collective resource by all the important cultures of mankind, or at least by dominant cultures such as Rome, Islam and Hinduism, an idea which transcends to our own times, with certain modifications. At one extreme we find the socialist states and Israel with intensive administrative resources dedicated to water, and at the other extreme we find the humid countries, which respect the rights of riparians, or those which, with an ultra-liberal model, recognize priority rights in the appropriation of water resources. This is the case in the western USA. An intermediate position is occupied by legal arrangements patterned on the Roman tradition, such as the case of France, which did not export this system to its colonies. Spanish legislation and the legislation of the Latin American countries that have followed it start from a strictly public model, synthesizing the oriental tradition with the institution of royal rights, with attenuations determined by those for whom the water supplies are destined: municipalities and associations of irrigators.

The new circumstances

Everything has changed rapidly in recent years, and water has been no exception. The new characteristics have exerted strong pressure on environmental policies and on general features of the institutions and organizations that operate with them. We shall consider only two determining factors, scarcity and environmental perspective, which no doubt sum up and represent the rest.

Scarcity. There has been a considerable blurring, if not a total disappearance, of the distinction between arid and humid countries, which transcends the difference between the respective legal water regimes. In every environment, water is a limited element which has come to have an economic value, regardless of what the pluviometric conditions are, except in the case of large rivers which flow through unpopulated areas. But even in the heart of the humid tropics, supplying water to population centres involves serious problems, which are very familiar to the inhabitants of the great cities of South America and Africa.

It is also true, however, that the prosperous agriculture of California is not properly served by the crude legal system first introduced by settlers and miners. In fact, the criterion of 'reasonable use' of water has brought this alternative close to the concessionary European approach. The exhaustion of resources, or at least the rise in their prices, has had a negative effect on solidarity in water affairs, blocking or hampering the transfer of water from regions or nations which have a surplus of water to those which have a shortage.

Groundwater, which has traditionally remained somewhat on the margin of strict administrative regulations, has been gradually made unavailable to land users. Wells are no longer an innocent and arbitrary means for abstracting water volumes intended to meet household or farm needs but are instead genuine mining operations which may involve several aquifers. The natural mechanics of water is taken into account by legislators, who tend to make the regime of groundwater very similar to that of surface water.

The convergence of ideologies and systems relating to water, caused by the growing pressure on resources, has resulted at one extreme in the gradual socialization of individualistic arrangements but at the other extreme in a perceptible liberalization of those regimes which had been rigidly administered.

The search for effectiveness in the management of water is now tending to favour decentralized models along the traditional line of irrigators' associations, but it also champions, in urban environments, the adoption of organizations of an entrepreneurial type which can replace classical bureaucratic services.

The environmental perspective. The reduction in the availability of water resources coincides with the en-

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vironmental concern of our own time, and this, as we shall see below, promotes the adoption of new forms for the administration of water.

The conjunction of the concerns about scarcity and environment has motivated experts to accept, in the ordering of water, the concept of the unity of water, with consolidation of resources obtained from any and every source and the adoption of the basin as the fundamental unit for public intervention.

But the interests of nature do not always coincide with the interests of water use; on the contrary, in some cases there are polemical and conflicting points of view. Nevertheless, basins constitute the most significant unit for the purpose of the structuring of public arrangements affecting water resources. Many countries, such as France, Spain, Mexico, China, Argentina, Venezuela etc, centre the objectives of their policies and their administrations on the basin.

A basin-wide scale is perfectly suited to promoting the purposes of the integrated planning of water availability, anti-pollution strategy, connections with economic development and the like. However, for maximum use of the advantages afforded by the basin approach and the water unity approach, rivers must run entirely, or at least substantially, through a single national territory and there must be no stretches or major tributaries controlled outside its frontiers.

In the case of international rivers which flow through land-locked countries, keeping these considerations valid will require the establishment of agreements between states, which are usually not easy to put into operation.

While conditions may not be ideal for the establishment of an administration that covers all areas, it is possible to obtain satisfactory results if the utilization and exploitation of water is based on long stretches of the river which coincide with the jurisdictional limits of a specific political or administrative unit, despite possible tensions and disagreements at the international or intranational level between the authorities situated upstream or downstream.

The same solution may be used for the handling of water management in the case of rivers that are tributaries of other major rivers that are sufficiently large and substantial.

At the ultimate extreme of water systems we find canals and diversions which are used to supply water for irrigation and for cities and industries. These subunits can be considered to operate independently, although logically they depend on the main channels for the initial input of water. At the user level it is possible to make arrangements for the final distribution and also to arrange operations which are designed for the treatment, reuse and recycling of waste water.

The organization of water administration depends in considerable measure on the options adopted for the internal distribution of state powers.

National administration. This is the predominant type of administration, especially in small countries which are strongly centralized and have water shortages. The most significant example is that of Israel, where a transverse canal brings water from the humid end to the dry end of the country, with uniform contingents and prices that extend to the sub-uses of that water, all of which is under a single administration. However, this model is also applicable to those states, large or small, which do not have a regional or federal structure or which, although they may have them, have a weak decentralized structure or need to concentrate resources and efforts on a central basis.

The centralized structure of a water organization does not produce a single system; instead, there are sub-modalities depending on whether the administration is concentrated in a single department or ministry or whether powers are dispersed among the various units that affect water management, from the health, planning, economic, public works, industrial and other points of view.

The centralized approach emphasizes the unitary process of decision-making, which is compatible, to a certain degree, with functional basins or sub-basins. Moreover, the centralized approach includes some features of decentralization, that is to say, a system in which the management bodies include representation by users, enterprises and municipalities.

Water administration has become more complicated as we pay more attention to the problems of pollution and of the conservation or renewal of natural resources. This has created pressure for including in a single organization a number of interrelated but functionally heterogenous powers, such as the management of national parks or the protection of the atmosphere.

In the UK we find the most important example of a super-ministry which, since 1970, has combined the responsibility for water resources with the struggle against pollution, as well as the conservation of nature. France too has created a multi-inclusive organization but with much less substantial content. Other countries have established specialized Ministries of the Environment which also incorporate responsibilities for water resources, eg Norway, Finland, Canada and Denmark.

A more common arrangement is the creation of environmental ministries or agencies whose functions are merely coordinative (as in Italy) or the assignment of such authority to ministries with previous authority over water or public works (as in Sweden, the Netherlands and Spain).

In Latin America the solution chosen by Venezuela, which since 1 April 1977 has had a Ministry for the Environment and Renewable Natural Resources, substantially includes all authority over water, pollution and nature in that one ministry. Colombia has had since 1973 a National Code of Renewable Natural Resources and Environmental Protection, but it does not have a comprehensive organization; this is also the case in Mexico, which in 1971 was the first Latin American nation to adopt legislation in this sphere.

An additional complicating factor is introduced by the creation, beyond basin organizations, of sectoral state administrations that have extra-ministerial autonomy, although they are theoretically subordinate to ministries which, among other tasks, handle water supply and water purification. This is the case of INOS in Venezuela, the former water authorities in the UK and the authorities existing in many other similar administrative systems.

States and regions. The second governmental level with tasks related to water is the level of territorial demarcations constitutionally endowed with their own powers, which in many cases are expressly applicable to the waters which run through those areas. This is the case, for example, in the USA, Brazil and Argentina.

In large nations, rivers usually flow through more than one state jurisdiction, and there are responsibilities, such as those relating to energy or navigation, which affect the entire federal community. The solutions to this problem include the subjecting of certain activities to federal jurisdiction, recourse to federal courts, agreements between states etc.

Schemes for the distribution of powers, based on the anachronistic survival of legislation from the nineteenth century, have given rise to conflicts and insecurities which could be better solved with other rules. Thus, the Spanish constitution reserves for the central administration the task of national planning, the adoption of general basic norms and the management of water in inter-regional rivers, while leaving to the regions the administration of their internal basins and the enforcement of state law.

Municipalities. In all parts of the world, local municipalities play an important role in the distribution and supply of water to population centres and in the treatment of recirculated water. The combination in a single administration of powers relating to the protection, distribution, purification and possible reuse of water intended for urban or industrial use exerts a strong influence in favour of a comprehensive approach to those tasks and makes it possible to reclaim the costs of purification from the total amount of water supplied.

The fact that decisive powers in this respect are concentrated in the hands of municipal government does not imply that management in the true sense should necessarily be handled by those authorities; it is possible to assign those powers at the bottom level to the private sector, while creating at the top level intermunicipal complexes which adopt a comprehensive approach to the satisfying of water needs, giving rise to the creation of super-communities and consortiums, which are frequently metropolitan in scale.

There are numerous exceptions to this model, which lead to state intervention, either because of the previous failure of municipal management, as in the case of the water authorities in the UK, or because of the weakness of these structures, or because a highly centralized political regime has been adopted.

More frequently, there is supportive intervention from the central administration for the abstraction of quantities of water, storage in reservoirs and the creation of large conduits to distribution points.

It seems logical that the organization of water management should be adjusted to the specific functions involved, with an attempt being made to see to it that these have a suitable territorial scope and that they are assigned to authorities with the most appropriate powers.

General water planning. Water planning is naturally a task for the highest level of government and constitutes the common framework for other policies, including those relating to economic development, although we must express our reservations concerning the real chances for any integrated and ambitious planning.

The final sanction of such planning would have to be decided upon by the higher political organs: parliaments, national water councils and their equivalents.

Redistribution and transfers. Redistribution and transfers constitute an important subdivision of general planning. It seems logical that if in one area of the nation the rain is plentiful and the rivers carry the water to the sea, while in other areas there are conspicuous shortages, water should be transferred between areas, especially if we bear in mind that in humid areas the climatology and orography may be unsuitable for agriculture, while the dry areas possess abundant solar energy and plains that may be suitable for cultivation.

It must be stated, however, that transfer operations, whose rationality and advisability seem evident, are ultimately restrained by popular reactions

against them, fed by impulses which are probably emotional; as a result of this, not only in California but also in Texas, where there are similar conditions, water transfers which seem highly desirable have been defeated by the overwhelming majority of voters. In Spain too, adverse popular reaction in some regions prevented the construction of the so-called Ebro water transfer system, although there were also objections to it of a different nature.

Participation in the use of water

Communities of irrigators

It seems advisable for many reasons to integrate the ultimate users of water into the cycle of water management. No one knows better than they how to facilitate water administration, taking due account of their own interests in optimizing water resources. However, public intervention cannot be eliminated because there may be conflicts within the community which might create pressure for an allocation different from that made necessary by economic considerations. Frequently it is the final destinations of scarce water resources that are being disputed, for example, between the tourist sector, the industrial sector, the agricultural sector and the traditional population centres. But once the distribution of the available water has been decided and, in some cases, once the necessary works for expanding the quantities of water transferred have been constructed, it is advisable to introduce participatory components which will avoid the creation of an expensive and often unworkable bureaucracy, promote the thrifty use of water and play a part in the peaceful distribution of the amounts of water allocated.

Joint management of water may be found in many water applications: eg industry, urban settlements, purification, reuse of waste water etc. However, the most signficant application is irrigation, giving rise to communities of irrigators, which is an associative formula of very ancient origin. Such associations were organized in Spain and from there, combining at the same time with the Germanic tradition of collective property, were carried to Latin America, where in some cases it merged with pre-Hispanic cultures, coming down to the present time in countries such as Argentina, Mexico, Colombia, Ecuador, Peru, Chile and Venezula.

The simplest scheme of such models is based on the administration of the amount of water carried by a canal, aqueduct or natural watercourse to a number of outlying irrigable farm properties. The farmers themselves, grouped into an association of the cooperative type, share the water among themselves and prescribe terms and waiting times when, as normally happens, the water volume is not sufficient for simultaneous use by everyone. On this basis, it is possible to make expansions with regard to membership or content, giving rise in the first case, to second-level associations which cover various diversions or branches of watercourses that have the same origin. It is even possible to have third-level associations, ie hydrographic confederations on a basin-wide scale, in which the public participates.

With regard to their content, the communities of irrigators may legally have additional powers to impose fines, apportion costs and approve ordinances. Frequently they are also empowered to construct hydraulic works and to repair existing ones.

Last, we should mention that in some cases these associations are voluntary in nature, while in others they are compulsory, where membership in the association is a requirement for the ownership of irrigable land or simply for the irrigated cultivation of land which may belong to others.

The provision of water-based services by the private sector: organizational alternatives

The provision of water for irrigation

The users and irrigators who have set up associations, in addition to participating voluntarily or mandatorily in water management may also build channelization works, including the construction of dams and reservoirs, and new types of irrigation projects or the expansion of existing ones.

Spanish legislation has, since the first Water Act of 1866, permitted this type of action, making it possible for irrigators to construct dams and canals for themselves by means of an administrative grant, receiving assistance for that purpose from the state or collaborating in meeting the cost of hydraulic works, through the payment of taxes and charges, until the works become their property.

These modalities of action for the expansion of available resources are present in many ordering systems, such as those of Peru and Bolivia, among others, and have been influential in the adoption of modalities for the expansion of irrigation in other countries.

The Spanish Act of 2 August 1985 maintains the possibility of constructing works for irrigative water use by private individuals. If an appropriate concession is granted for this purpose, this can be binding on other persons provided that the petitioners are supported by half the owners of the land concerned.

Under the same act, the local water communities enjoy the benefits of forced expropriation and are required to construct such works and installations as the

administration orders them to construct. Those works may serve to avoid misuse of water or to maintain repair of the public domain.

Delivery of water

By delivery or supply of water we mean the provision of such resources in order to meet non-agricultural needs, including in particular those arising from human settlements in housing units and associated structures, as well as those of industry, either incorporated into urban centres or constituting independent complexes. The delivery or supply of water is normally the object of a public service but may also possess other special features, either traditional or innovative.

Water as an entrepreneurial product

Water, as a resource which is extremely scarce, may be the object of private individuals' activities identical or comparable to those of a manufacturer.

Delivery from high points. Ordinary public water services are based on the previous abstraction of volumes of water and its transport to points where conduits are connected to domestic supply networks. The previous phases may be the responsibility of the state if they go beyond the capacity of the municipalities, but they may also be the responsibility of private individuals who sell water to local or equivalent entities, an operation comparable to what is done for the supply of energy.

Surface water operations very seldom involve private enterprises because ordinarily all the phases of the service have been transferred to public hands; however, water supply at the highest points of the watershed may remain in private hands as regards the abstraction of water from underground aquifers. In Spain, under the legislation prior to 1985, whenever groundwater was brought to the surface, the resulting volumes were assigned to the person who had undertaken their extraction. This is still continuing in a way, through the concessionary route, for the region of the Canary Islands, where the water supply is extremely deficient and the recently enacted norm provides for water production by private entities.

Individualized discontinuous deliveries. Individualized deliveries are today the object of a profitable industry which finds ancient precedents for modern public services, the water sellers or their equivalents, who provide water to the public as one more item of merchandise.

Under individualized deliveries, we include all modern modalities of water supply, regular and irregular, that do not use piping. These range from mineral water in small containers, frequently consisting simply of water which is guaranteed potable, to water brought in large containers for household or office use and, lastly, water delivered by special tank trucks.

Potabilization. This is regarded as a classic case of the industrial creation of a product, when sea water or brackish water is converted, by means of appropriate industrial installations, into a resource useful for human or industrial consumption. There are regions that now depend almost exclusively on this type of supply, which is still expensive but which may become cheaper in the foreseeable future.

Recovery. Water recovery involves obtaining recycled water whose quality is higher than that of the water obtained from a previous use. It differs from the preceding process in that it is usually more economical because the treatment is chemical or biological and not physical. The resulting water is normally used for industrial, municipal or agricultural purposes and usually comes from municipal plants, but it may also be handled in private entrepreneurial dealings, as happens in Alicante, Spain, where a mixed enterprise called ENMARASA has been established for that purpose.

Privatization of the public water-supply service

Almost all water-supply services for population centres are public in nature, preponderantly municipal; this is understandable if we take account of the predominant general interest and the fact that such a service has the characteristics of a natural monopoly.

There are large organizations which handle these tasks, but all of them have administrative origins and connections; in Latin America, we may mention INOS in Venezuela, COPASA in Minas Geraes, EMOS in Santiago, Chile, CAYCASA in Cali and Servicio de Agua y Drenaje in Monterrey. Nevertheless, there are also private suppliers in some parts of the world, specifically in Japan, although in general, with the exception of the USA, such services supply industrial complexes, new urban settlements or only parts of cities.

In Europe it is only in France and Spain that there are important water entities, the Compagnie Générale des Eaux and the AGBAR Corporation, respectively. These are certainly highly efficient private profit-making water-supply services, constituting authentic holding companies which include service companies that supply municipalities or particular areas, holding concessions from the respective local governmental bodies.

Modern trends. Although the general tone is that of providing direct and indirect service through *ad hoc* enterprises created by municipalities or substitute state entities, the new liberalizing trends have also made themselves felt in developing countries, often in the face of requirements imposed by international financing bodies.

The privatizing climate, or at least the restructured climate, although it does not appear to have resulted as yet in immediate achievements, nevertheless affects many nations which today are contemplating revising and modernizing their organizations and institutional structures.

The need for careful reflection in the face of the liberalizing option. The enthusiasm aroused by the privatizing alternative for public services in general and water services in particular should be tempered by due reflection on their advantages and disadvantages, especially with regard to the less industrialized countries.

The positive aspects of privatization are beyond question because this type of management guarantees higher effectiveness and efficiency, especially with regard to saving water, reducing waste on the part of users and decreasing the amount of water losses attributable to management. The approximation to market conditions makes it possible to establish a better administrative climate and facilitates the optimal allocation of resources. In many cases there will certainly be no other alternative if we wish to deal with the needed expansions and if we are to obtain adequate financial resources. It may also be possible through better utilization of already existing facilities to avoid the need to undertake new and costly impoundment and transport works. We should remember that the most attractive resources are those which come from savings.

But even in the industrialized nations there are no traditions and practices that would permit a substantial approximation of market conditions for water, or even those of an imperfect market.

A comparative study carried out in 15 European countries brought out important differences in the rates collected for the sale of household water: US$0.87/m^3 in Belgium, as contrasted with US$0.22 in Italy; there were also great differences between cities in the same nation, including differences in Italy which amounted to as much as 500%.

In most of the nations in which the survey was conducted, consumption is measured with a water meter, but the tariffs are generally different (lower) for an initial quantity and are more expensive thereafter, contrary to what is done in the United States. In the UK and Norway, however, consumption is estimated on the basis of the size of the dwelling of the taxable value of the property.

In the developing countries the circumstances of water service are still problematical in the light of their current entrepreneurial rationalization. In the first place, we should recall that if something is to be privatized, it must be public in the first place, and in many developing countries the service simply does not exist or is so defective that it does not satisfy minimum requirements. Futhermore, the evaluation of consumption is generally based on indicators rather than on the installing of meters, and this gives very little support for greater rigour in economic evaluation.

Unfortunately, in some parts of the world what is important is that there should be some kind of water supply, no matter what kind, and in others it is highly unlikely that it will be possible to collect any amount of money whatsoever for the rudimentary services provided to marginal urban neighbourhoods. Even in countries with a somewhat developed water-supply system, public health interests continue to play an important role, and therefore the expenses incurred for the collectivity cannot be individualized without further work.

Notwithstanding the undoubted difficulties of the situation described above, rates for water should be collected on a quantified basis from all those who can pay, and in fact, if possible, a small amount should be collected (even if only collected nominally but forgiven in practice) from families with very low incomes. Only in this way will it be possible to palliate one of the major defects in water use where water is scarcest, namely, the waste of water.

For this purpose, the introduction of private management techniques under public control may provide useful and sometimes indispensable support, although it will never be a panacea.

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