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Ismail Al Baz and Asit K. Biswas

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Water Pricing: Issues and Options in Turkey

OLCAY ÜNVER & RAJIV K. GUPTA

South-eastern Anatolia Project Regional Development Administration, Republic of Turkey Prime Ministry, Willy Brandt Sok. No. 5, 06680 Ankara, Turkey. Email: unver@gap.gov.tr, rgupta@gap.gov.tr

ABSTRACT *Water pricing occupies a central place in water sector reforms. The paper discusses its global importance and analyses the existing institutions and legal frameworks for irrigation water pricing in Turkey. In view of the gradually expanding large irrigation infrastructure in the South-eastern Anatolia Project region of Turkey, it makes a case for the adoption of full organization and management cost recovery for irrigation water supplies and the establishment of a volumetric system of billing in place of the present crop and area system.*

Introduction

The question of whether water is to be considered as a common good for collective social utilization without any cost or as an economic good requiring economic instruments for its management has been the subject of international debate for quite some time. This has been reiterated due to growing scarcity of water in many parts of the world, coupled with problems relating to the environment and inefficient organization and management (O&M) of large irrigation systems by the public sector. The user pays principle, based on realizing the full cost of water by rationalizing water pricing, was also discussed exhaustively at the second World Water Forum at The Hague, in March 2000. In this paper, the authors briefly touch upon the global need for reform in the water sector, specifically with a view to rationalizing pricing, before dealing at length with the existing situation of irrigation water pricing in Turkey. They describe the experiences of the South-eastern Anatolia Project (GAP),[1] where an irrigation system, designed to cover 1.7 million hectares of land, is under development. In the light of a pilot project on participatory irrigation management, the authors will also enumerate possible measures that are required to be taken for achieving a rational and practical water pricing policy.

Growing Global Need for Reform

Despite recognition of the necessity of water for the life and health of people and ecosystems, the resource has generally been taken for granted, undervalued and, consequently, overused and abused. The situation holds true for both developing and developed countries. For example, Canada's per capita water use rates are among the highest in the world and the prices charged for it among the lowest. In addition, Canadians have for a long time tended to undervalue

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in-stream uses in their water management decisions leading to costly long-term consequences. They, till recently, have been accustomed to an abundant supply of low-priced water maintained through government subsidies and an overemphasis on supply side management. But now it is being fast realized that nominal charges have encouraged the wasteful use of water necessitating larger, costlier infrastructure for the treatment, storage and distribution of water, and for wastewater treatment. Yet, the exorbitant investment required for this purpose cannot be met from existing funding mechanisms.

Similarly, household demand for piped water has been rising inexorably in England and Wales. Domestic consumption has risen from 85 litres per person per day in 1961 to 160 litres (Department of the Environment, Transport and the Regions & Welsh Office, 1998). But supplies are finite: only a limited number of reservoirs can be built and rivers tapped. And long before these physical limits are reached, the purely economic costs of new supply will also increase greatly. Already, about one-fifth of the total water industry expenditure in Britain is on investments in new storage, treatment and distribution capacity. The mismatch between demand and supply was particularly acute during the 1995 drought, during which even road tankering was used to supply water to some areas. Although April 1995 to November 1997 was the driest 30-month period on record in the south of England, and the year 1995 was the warmest year on record in the country, such adverse climatic conditions may be expected to recur more frequently in the future with the onset of global warming. Using water efficiently will therefore become ever more important. Water pricing, therefore, will have an important role to play.

In India, in view of seasonal and perennial water shortages in many parts of the country, constant lowering of groundwater tables, rapidly increasing electricity consumption for domestic water supply, spiralling capital costs of new water development projects, the increasing burden of government subsidies and the World Trade Organization obligation to reduce the aggregate measurement of support and direct production subsidies, there is a need to attempt multipronged efforts for water sector reforms, including water pricing.

Therefore, demand management and water sector reforms through the application of a combination of economic and non-economic measures are being attempted in many countries. They have ranged from irrigation management transfer to water user associations, encouraging private sector participation in public monopolies, the development of water markets and the introduction of tradable water rights and water pricing for sustainable water demand management. The ultimate objective of all water sector reforms is to encourage water conservation efforts and water use efficiency, minimize water wastage, enhance equity through greater and improved access to water resources and ensure long-term sustainability of irrigation systems and drinking water supply schemes in urban and rural areas.

Functions of Water Pricing

The use of pricing to counter resource misallocation is considered one of the major public policy measures by economists. Theoretically, and empirically as well, pricing has proved to be an efficient instrument, better than the other alternative, quantitative regulations. The Dublin Principle of 1992 allied to the United Nations Conference on Environment and Development (UNCED) process in the same year

Table 1. Water requirement estimates in Turkey (in km³)

Use/year	1998	2000	2030
Drinking and utility	5.7	6.4	25.3
Irrigation	28.0	31.5	71.5
Industrial	3.8	4.1	13.2
Total	37.5	42.0	110.0

Source: DSI (2002).

also acknowledged that water has an economic value in all its competing uses and should be required as an economic good, and the role of economic instruments in water management continues to be increasingly recognized as a legitimate tool.

Theoretically, water pricing may serve the following purposes.

- Financial: to cover capital investment and O&M costs of water services.
- Efficiency: to inculcate in the users awareness of the intrinsic value of resources and delivery systems and to discourage water wastage, strengthen institutional capacities and improve the quality of services.
- Equity: to reduce income distribution gaps and thereby achieve social justice.

Depending upon the situation and the context of reforms, there are certain enabling principles that can be used in structuring public policy for water pricing. These include marginal cost pricing, the ability to pay principle, the net benefit principle and full-cost pricing. These broad principles are put into practice through a variety of pricing methods (such as volumetric pricing, two-part tariffs, crop-/area-/time-based pricing and water wholesaling, etc.), which may differ from country to country, depending on the socio-economic and technological development levels a country has achieved.

Water Resources of Turkey

The average annual run-off of the country is about 186.0 km³. But there are seasonal and temporal variations in water availability. The total safe yield of groundwater resources has been determined to be 12.0 km³. It is estimated that 95.0 km³ of surface run-off and 9.0 km³ of groundwater could technically be developed for consumption purposes. Today, the actual consumption from surface water is 33.3 km³ per year, which means that only 35.0% of the surface water development potential is being consumed presently. The actual annual consumption of groundwater is 6.0 km³. The agricultural sector is the major consumer of water in the country and will continue to be so, for many years to come (Table 1).

Irrigation in Turkey

Irrigation development in Turkey is carried out by the public sector, represented by the Devlet Su İşleri (DSI) (State Hydraulic Works) and the General Directorate of Rural Services (GDRS), and by the private sector (farmers and groups of farmers). The DSI, under the Ministry of Energy and Natural Resources, is a governmental organization which is responsible for almost all aspects of water resources development in Turkey: that is, to construct protective structures against floods and torrents; to construct irrigation and surface drainage systems; to construct big dams and hydro-electric power generation plants; to operate and maintain dams, irrigation and drainage systems; to supply water for drinking, domestic and industrial purposes for cities with a population larger than 100 000; and to investigate, search and develop surface water and groundwater resources. By the end of 2000, the DSI had completed the construction of 204 large dams and over 350 low dams and developed 2 252.000 hectares of irrigation schemes. The responsibility for on-farm development and minor irrigation works belongs to the GDRS, under the Prime Ministry. The GDRS deals with land levelling, land consolidation, subsurface drainage works and the irrigation network of minor irrigation projects. The GDRS is also simultaneously working together with the DSI on the large irrigation projects and the small-sized projects of groundwater irrigation co-operatives. According to comprehensive studies carried out by the DSI, 8.5 million hectares of land could be economically irrigated. Development achieved so far, as of December 2000, is as follows.

Irrigation Management in Turkey

In Turkey, as is the case in many other countries, the irrigation schemes developed by the state are operated in two ways:

- irrigation management by the government;
- irrigation management by local authorities, co-operatives and irrigation unions in irrigation district (IDs).

Since 1954, Turkey has had a legal framework under the law coded 6200 concerning 'The organization and duties of DSI', allowing the transfer of management responsibility for publicly constructed irrigation schemes to local authorities and water unions. The establishment, membership and rights and obligations of IDs are governed by three principal legal instruments: Municipality Law 1580 of 1930; the Transfer Agreement between the DSI and the ID; and the statute (*tüzük*) of the ID. They are established under municipality law, the use of which appears to have been dictated by administrative convenience rather than its appropriateness to managing relatively complex irrigation and drainage systems. The law allows district councils or municipalities (public corporate bodies) to form higher-level corporate bodies (unions) for the management of a jointly utilized infrastructure such as roads or water supply (Figure 1). The use of the law has been seen as a means of avoiding the need to draft specific legislation (Uşkay, 2001).

The ID consists of several villages; the DSI identifies ID boundaries and prompts village administrators to apply by preparing the ID statute in a standard DSI format and submitting it to the General Directorate of Local Administrations of the Ministry of the Interior. The council, typically with 30–50 members, consists of mayors and village administrators (*muhtars*) as 'natural members' and a number of 'selected members', who are chosen by natural members. The DSI is an observer member. The irrigation board typically has seven members. The general secretary and accountant are board members and the remainder are elected from council members. The chairman is elected for a two- to five-year term.

Before 1993, the DSI's policy focused on transferring only small and isolated

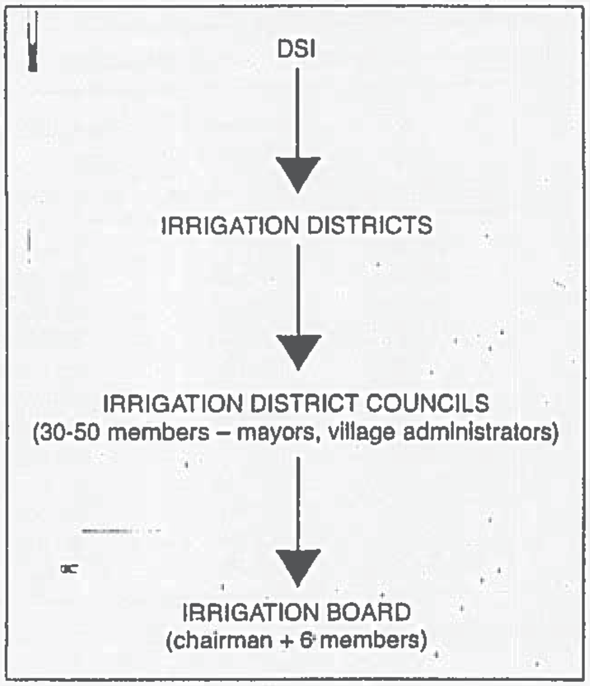

Figure 1. Irrigation districts. *Source*: Based on information provided by the DSI.

schemes, the management of which was difficult and uneconomic. Until 1993, small schemes, the total area of which was about 62 000 hectares, were gradually transferred to users. The DSI's policy shifted from transferring only small and isolated schemes to an accelerated approach of transferring large schemes as well as small and isolated schemes.

The main underlying reason for accelerating the transfer programme has been the financial burden of O&M for the DSI and the government, which was becoming unsustainable. O&M cost recovery (rate of collection of water fees) has been unsatisfactory (about 41%). The present government's general policy of promoting privatization has also been a contributing factor (Uşkay, 2001).

As of the end of 2000, a total of 4.3 million hectares (net) have been equipped with irrigation infrastructure in Turkey. Of this area, the DSI has developed 2.0 million hectares, mainly under large schemes, the GDRS has developed 0.97 million hectares as minor schemes, the DSI and GDRS have jointly developed 0.34 million hectares served from groundwater supply and farmers individually have developed 1.0 million hectares (Table 2). As of the end of 2000, the DSI has transferred an area of about 1 620 000 hectares, which corresponds to 84% of the total area developed by itself (Table 3).

Table 2. Irrigation development in Turkey (hectares)

Potential for irrigation projects	8 500 000
Projects in operation	4 300 000
DSI	2 250 000
GDRS	970 000
Farmers	1 080 000
Projects under construction	752 970

Source: DSI (2002).

Table 3. Irrigation areas constructed and developed by the DSI

	Irrigation area (hectare) and management system				
Year	DSI-operated	Transferred	Constructed by DSI for other agencies	Operated by groundwater co-operatives	Total
1985	1 111 722	44 241	14 277	220 630	1 390 870
1990	1 320 092	60 811	15 142	230 125	1 626 170
1991	1 370 024	61 068	15 142	241 660	1 687 894
1992	1 400 846	62 620	15 142	244 120	1 722 728
1993	1 439 805	72 042	15 392	263 740	1 790 979
1994	1 279 087	267 362	15 392	270 165	1 832 006
1995	624 852	978 576	15 642	278 780	1 897 850
1996	482 775	1 190 334	15 752	290 515	1 979 376
1997	445 438	1 279 039	15 746	317 925	2 058 148
1998	325 756	1 483 931	15 746	329 485	2 154 918
1999	313 452	1 529 454	15 746	343 910	2 202 562
2000	342 210	1 537 128	15 746	358 910	2 253 994

Note: Unless stated otherwise, the area figures show net area.
Source: DSI (2002).

Therefore today, O&M responsibility for about 1.6 million hectares has been transferred to irrigation unions, municipalities, village authorities and co-operatives (Figure 2). The effectiveness of this transfer and legal and institutional bottlenecks will be explained later.

Water Pricing in Turkey

Based on the type of irrigation management, the issue of water pricing has to be approached differently for schemes operated by the government and those operated by irrigation unions.

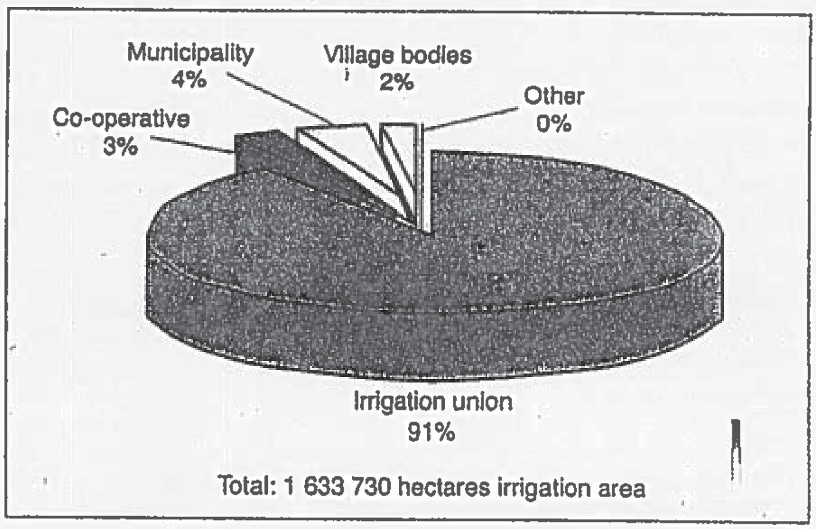

Figure 2. Distribution of transferred irrigation. *Source*: DSI (2002).

Determining Operation and Maintenance Charges and Preparing Water Tariffs for DSI-managed Irrigation Schemes

The legal legitimacy of water pricing for the schemes operated and maintained by the DSI is grounded in Article 26 of the DSI law, which states as follows: "All expenditures done to operate the schemes are paid by the beneficiaries themselves (except the flood protection facilities, reclamation facilities and the facilities which make navigation convenient)".

Here, the water pricing means recovering the costs of services from the users. Therefore, the DSI does not sell the water to users with a price determined by full-cost calculations, but recovers the costs of water transmission from the source to the field. That is why the main terminology used is 'O&M charges' instead of 'price of water' or 'pricing water'.

The two main inputs in the preparation of water tariffs for irrigation management by the general directorate of the DSI are:

- O&M expenditures;
- estimated irrigable areas.

O&M expenditures are those that have to be incurred to operate the schemes and keep them ready for the service (providing sustainability). These expenditures consist of two main sections as operation costs and maintenance costs. Operation costs include personnel (the total wages paid for permanent and temporary personnel working at operational services in a fiscal year), vehicles (the total cost of vehicles used for operation activities) and energy–oil expenditures (consumed in pumping units which are constructed and used for irrigation and drainage) that are made mostly in an irrigation season. Other expenditures include the expenditures for operating the scheme, such as telephones, electricity, water, heating and rent. Maintenance costs are the annual or periodical expenditures made for sustaining expected services from the schemes before any problem arises, repairing the damage and performing weed control. Figure 3 states the O&M expenditures for the last couple of years. It can be noted that expenditure has declined after 1993, ever since the DSI adopted the accelerated transfer programme.

The estimated expenditures would be for irrigable areas (based on crops) that are determined for both gravity and pumping irrigation schemes in the preparation of water tariffs. The following factors are taken into consideration in the determination of these areas: the 'water user information form', which is filled in by users before the irrigation season, including the type of the crop which the users will plant and irrigate; the number of hectares; information related to irrigation; and other information such as farmers' tendencies, past applications, marketing opportunities and product supply and demand. In this way, estimated areas (including first and second crop areas) that can be irrigated by the scheme in a season are determined.

O&M water tariffs are prepared according to the principles in Article 28 of the DSI law. In Paragraph C of Article 28, it is stated that the O&M charge "is obtained by dividing the total expenditure of the last year by irrigated area". DSI-constructed and developed irrigation areas are irrigated by gravity irrigation (using natural slopes of the land) and pumping irrigation (elevation of water by pumping stations for the high-altitude areas). In the areas where the

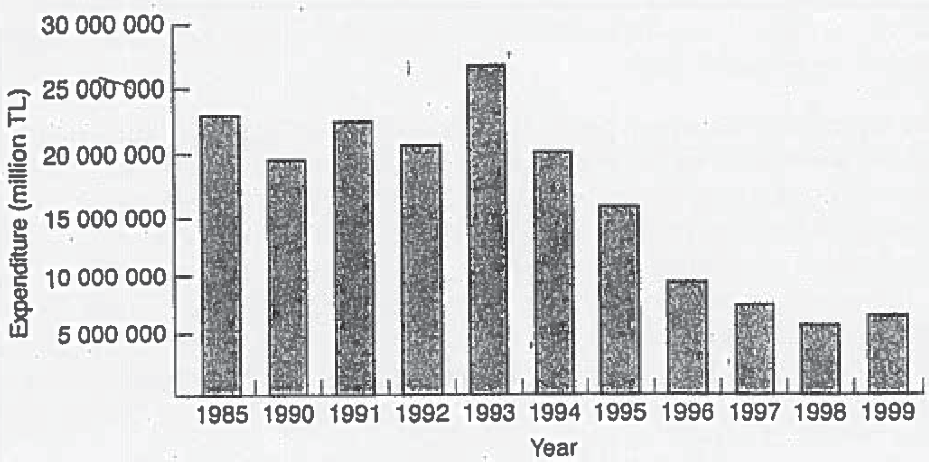

Figure 3. O&M expenditures in DSI-operated irrigation schemes (according to values converted to 1999 prices). *Source*: DSI (2002).

surface water is not adequate, groundwater pumps are installed for using groundwater in irrigation.

Since pumping irrigation is more expensive and difficult than gravity irrigation, the schemes in water tariffs are divided into two main groups:

- gravity irrigation;
- pumping irrigation.

The schemes, which are divided into two main groups according to the water supply method, are subdivided based on criteria given in Table 4.

Based on these criteria, gravity irrigation is divided into three subgroups while pumping irrigation is divided into two subgroups for the tariff. These are shown in Table 5.

After determining O&M expenditures and estimated irrigated areas, while keeping total cost taken as a basis for the tariff fixed, O&M charges per decar are established to recover cost according to the crop types in estimated irrigable areas in an irrigation season to groups which are included in the irrigation (1 decar = 1000 m^2).

Water tariffs come into force after the declaration of the Council of Ministers' decree in the *Official Gazette*. The Council of Ministers also has the right to declare discounts for the purpose of encouraging irrigation, using water consciously and protecting schemes.

Table 4. Criteria for water tariff

Social criteria	Location of the scheme
	Irrigation development conditions
	Crop type
	Price of the crop
Economic criteria	Yield
	Market conditions
	Ability to pay of farmers
Ecological criteria	Precipitation
	Temperature

Source: Based on information provided by the DSI.

Table 5. Subgroups for water tariff

Water supply	Group	Regions
	I	Eastern Anatolia
Gravity	II	Inner parts
	III	Coastal lines
Pumping	IV	Eastern Anatolia and inner parts
	V	Coastal lines

Source: Based on information provided by the DSI.

O&M charges based on tariffs considering expenditures and estimated areas in DSI-operated schemes for the year in question are calculated by the DSI and the collection is done by regional book-keeping directorates associated with the Ministry of Finance.

Assessed debts are paid by two equal instalments at the end of February and April.

In case O&M charges are not paid on time, the application of a 10% penalty is ruled by Article 32 of Law 6200, which explains that "assessed debts are paid within instalments and periods determined by Ministry of Public Works. The amount which is not paid on time by debtor is collected with 10% penalty by General Directorate according to decrees given in the Law of Public Assets Collection Method". Table 5 makes it clear that the recovery of water charges is not at all satisfactory.

The method preferred by the DSI does not anticipate economical water use by beneficiaries and encouragement of them to use new technologies in their enterprises but anticipates an allocation that ineffectively tries to create a cost–benefit balance.

Irrigation Water Pricing by Water User Associations

Water pricing activities of IDs are parallel to those of the DSI since the authorization of these organizations on that matter is limited to the authorization transferred by the DSI, that is given to the DSI by Law 6200.

In other words, action by water user organizations on water pricing, as stated in the DSI law, is limited to recovering maintenance expenditures for keeping the scheme ready for service and operation expenditures for transmitting water from the source to the farm.

Although the DSI and water user organizations have parallel methods on water charges, different practices exist in the determination of expenditures, the application of tariffs and the collection of charges, due to the laws they refer to. These differences can be gathered under the following topics.

- The expenditures of that year to be determined by an estimated budget before the irrigation season.
- The application of the tariff according to defined conditions to be based on qualifications of the scheme (scheme under the responsibility of each organization) and region.
- Making the collection in the same year and deterrent penalties applied to recover charges that cannot be collected.

Water user organizations have to work with a balanced budget from the standpoint of revenues and expenditures. Therefore they have to determine expenditures of that year for the scheme under their responsibility and form a budget only to recover these expenditures. Each association determines its own expenditure budget, which includes all kinds of expenditures necessary for the maintenance of schemes and for irrigation management at the beginning of the fiscal year. In this budget, investments for the irrigation scheme (machinery, equipment, the construction of new schemes and the renewal of schemes) are also included. However, capital investment cost is not included in O&M charges. Each association determines its would-be irrigable area and crop types using water user information forms and many other methods. Tariff studies, which are prepared using estimated budget and would-be irrigated figures, show differences among the water user organizations. Each association uses different methods depending on qualifications of its own scheme and region. These methods can be categorized as follows.

(1) Area-based:

- crop-based (Turkish Lira/decar (TL/da));
- fixed charge (TL/da);
- crop-based depending on irrigation times (TL/da);
- fixed charge depending on irrigation times (TL/da).

(2) Volumetric:

- based on water amount consumed (TL/m^3);
- based on water consumed hourly (TL/m^3).

Water user organizations mostly use the 'area- and crop-based' tariff method. This type is used mostly in gravity irrigation schemes. In pumped irrigation schemes, the volumetric method is used. Factors that are taken into account while water user organizations choose the tariff method are: the method should be easy and practical; lack of data for calculations; and water charge per unit area is intended to be low.

Existing Realities of Irrigation Management

Against the above background of the legal and institutional network for water pricing in Turkey, the authors will attempt to discover some underlying realities that are hindering the evolution of a rational, efficient and practical water pricing system. While doing so, the authors will also refer to some of their experiences of irrigation system development in the GAP region of Turkey.

Flaws in the Current Framework of IDs

The membership of the IDs, under current legislation, is not composed of individual water users but of the local government administrative units in the area concerned. The heads of these administrative units (mayors or *muhtars*) are, by virtue of their office, *ex officio* members of the council of the ID, together with further members selected from the local administration, who have been elected by a diverse electorate for general administrative purposes and not for the specific function of managing an irrigation and drainage system. The council of the ID (its basic representative organ) is thus not directly accountable to water users. The functional linkage between the consumer of irrigation services and those responsible for their management is thereby broken, with the dual result that inefficient management can shelter behind administrative status, and the consumer (irrigator) is unable to exercise direct control over elected management. As a result, the ID often does not look after the interests of the majority of its customers. The chairman and board members, who are usually large landowners, can, and do, favour themselves, and other individuals, with exemptions from paying water charges or extra water supplies, and tend to reduce water charges to below sustainable levels.

The governors' office approves ID establishment. It has the power to review ID council decisions which must be approved, and this includes work plans, budgets, accounts, staffing, borrowing and external contracts. The governors' office must approve the ID annual budget and can correct errors, delete items beyond the legal power of the ID, include extra items and change water charges. The governors' office must also approve the ID regulations manual, though none have been produced so far. The main constraint on effective performance of the governor's office is its lack of technically qualified staff, which results in checks being restricted to administrative procedures only.

The transfer agreement, signed between the DSI and each ID, transfers responsibility for the management of irrigation infrastructure to the ID and sets out the responsibilities of each party. Both in the lack of detail of its provisions and in the absence of any major obligations imposed on the assignor (the DSI), the current transfer agreement falls considerably short of the requirements of a document of this legal status. The transfer agreement does not transfer any title to assets. Administratively, the programme simply represents an internal transfer of responsibility for irrigation system O&M from one department of the state (the DSI) to another (the ID, a newly created local government administration), and specifies that the ID will recover its costs from users of the system. Thus, the transfer programme has little to do with participatory irrigation management as this is commonly understood. The transfer agreement imposes no obligations on the assignor other than a generally worded obligation to train staff of the assignee and to provide 'O&M instructions' and technical assistance to the ID. Specifically, the transfer agreement makes no reference to minimum and legally enforceable 'water entitlement' accorded to the assignee, or the conditions under which the assignor might be legally relieved of his obligation to supply water, or any reference to drainage systems. The requirement for a system and equipment inventory and status report at the time of transfer is included in the transfer agreement, but has not been adequately implemented for current IDs in the GAP region.

The transfer agreement, on the other hand, imposes relatively detailed maintenance obligations on the assignee; failure to fulfil these can result in termination of the transfer agreement without, however, any precise procedures or time frame being prescribed.

Finally, the document makes reference in highly general terms to the obligation of the assignee to recover investment costs from users and repay these to the DSI, without however specifying the principles or time frame of this cost recovery. No mention is made of any obligation of the ID to reimburse the assignor's 'up-stream' operating and maintenance costs.

Overall, the transfer agreement is lacking in detailed provision, and as a contractual document is seriously inadequate. The assignee is unable to estimate what costs may eventually be imposed on him and enjoys, in legal terms, little more than the status of an 'occupant-at-will' of the assignor; he has therefore (like any agricultural tenant-at-will) little incentive to invest long-term in the system. This lack of incentive for long-term investment is underlined by the wording of the provisions governing termination by the DSI of the transfer agreement; no reference is made to any legitimate claim by the ID on assets generated in the course of its operation.

The DSI retains formal ownership of the irrigation system. It retains specific rights for the following regulatory actions.

- Inspection of ID budgets, though this does not seem to be undertaken in the GAP region.
- Approval of ID maintenance plans and budgets, in practice undertaken by insisting that the allocation is 30%. However, IDs do not usually spend this allocation, as they have no available funds.
- Approval of water charges, though these are generally set at DSI-recommended rates (there is external influence on water charge rates from representatives of the DSI and the governor's office and the 'recommended' water charge is usually accepted by council members).
- Annual inspection of irrigation structures and maintenance works, which has not been undertaken in practice.
- Undertaking maintenance directly, if the ID fails to do so.
- Obtaining information on ID activities. Standard monitoring pro-formas have been developed by the DSI, and are completed by the ID, though information quality is poor.
- Control over use of water other than for irrigation within the ID and of any modifications to the irrigation system. In practice no action is taken on, for example, irrigators pumping directly from main canals to areas out of gravity command, and IDs are altering systems to increase capacity, using poor construction, without incurring penalties.
- Control over water allocated to the ID.
- Right to terminate the ID.

In practice, the authors have observed that there is little or no supervision of IDs' performance by the DSI at present, in the GAP region, and no system to correct IDs' management errors or omissions has been developed.

Financial Management

The accounting systems employed by IDs are those prescribed for local government administration, which have little relevance to the financial management requirements of a water enterprise and do not include the vital function of asset management. There is no standard procedure for IDs for their expenditure and income codes and distribution of costs. A pilot study on the management, operation and maintenance of irrigation systems in the GAP region (Halcrow–Dosar Joint Venture, 2000) focused on budget distributions by programme head and expenditure code for three IDs in 1999 (Table 6).

We may note that the expenditure budgets for each ID are very similar, as all have a similar area and the expenditure is linked to quasi-fixed incomes per unit

Table 6. Collection/assessment ratio in DSI-operated irrigation schemes

Year	Assessment + arrears (million TL)	Collection (million TL)	Collection/assessment ratio (%)
1985	6 512	3 248	50
1990	65 786	27 418	42
1991	109 408	38 904	36
1992	175 676	61 635	35
1993	255 342	99 081	39
1994	435 598	185 696	43
1995	682 770	296 386	43
1996	988 266	411 629	42
1997	1 736 542	711 389	41
1998	1 980 034	729 015	37

Source: (DSI, 2002).

area. This takes no account of the ID's needs for operations, maintenance or investment.

The major source of budgeted ID income is the water charge, which accounts for 85% of the total, coded under sales of municipal goods. Minor sources of income in the budgets include small membership fees, operating incomes, presumably mainly interest payments on bank balances, or on outstanding water charges, fines and gifts. Budget incomes must always equal budget expenditure.

It should be noted that this budgeted income does not represent the true income of the ID, for three reasons: collection rates; collection of arrears; and access to credit. Some IDs have very poor collection rates for water charges (at 60% of the budget), whilst others approach 100%. The budget makes no provision for undercollection of water charges, which should be part of both the budget estimate and the water charge calculation. Late payments of water fees are not included in the budget estimates. Some IDs have now obtained access to grant financing from the World Bank Participatory Irrigation Management Investment Programme for purchase of equipment, and to dealer credit for maintenance equipment. Another very important factor is that amongst them 33%, 23% and 28% of budgeted expenditure was spent on maintenance and the rest on establishment costs, which again is a reflection of their poor financial management.

Water Charges and Cash Flows of IDs

Water charges of the IDs are currently based on crop and area planted. In the long term, as water availability constraints are recognized and farmers adapt their cropping patterns, the area of crops planted will fall and, as a result, ID income will fall unless unit rates for water charges are increased. In the short term, it is impossible for the ID to predict income before planting, as there is considerable work involved in collecting accurate areas planted and the amount charged per member is based on a complex calculation. Because the charge is based on the crop, farmers are less willing to pay before harvest.

Cash flow analysis of current ID budgets shows that, even if cash collection is timely, which is often not the case, cumulative cash flow is negative for much of the financial year, in particular during the maintenance period, and for much of the peak irrigation period. The approved budget cannot be implemented and IDs are forced to default on payments and/or fail to carry out planned activities. Even with timely cash collection, analysis of their budget by GAP has shown that there is a borrowing requirement of 3% of the annual budget, and no source of credit is available to the ID (Halcrow–Dosar Joint Venture, 2000). Most IDs take care not to allow expenditure incurred to exceed income to date by more than about a month's salary payments.

Most IDs are, therefore, very short of cash, which is managed by deferring or cancelling activities that can be deferred (for example ID1 in the example quoted in Table 6 carried out less than TL2 billion of a budgeted TL35 billion of maintenance), delaying payment of salaries, which is common practice, and in extreme cases delaying payments to suppliers and failing to pay withheld taxes.

Water charges based on crop and area planted will result in declining ID income unless unit rates for water charges are increased. Therefore, there is a case for adopting realistic water pricing.

Need to Adopt Realistic Water Pricing

Current water charges are substantially low as compared to the cost of providing water, and do not even fully cover the local O&M costs of the IDs. For example, in the GAP region, for gravity-fed systems such as the Harran Plain, annual O&M costs for the DSI have been estimated at about US$10 per decar (DSI, 1992), or twice the current water charges. (Due to galloping inflation in the last year, the water prices have been substantially raised but so have the O&M costs. Therefore, the ratio between the cost and price has not changed much.) IDs can only operate at their current water charges by obtaining free water supplies, failing to cover overhead costs and deferring maintenance, which is what is occurring.

The levels of charges required to cover different levels of services were reviewed in a study (DSI, 1998), which estimated that water charges to cover O&M costs of the irrigation system would be six times the (then) water charge for cotton (which has been increased only to adjust for inflation during the current economic crisis); the charge to cover O&M costs of irrigation, other services (drainage and land levelling rods) and ID overheads would be 12 times the (then) water charge; and the water charge to cover full O&M costs and financing of the capital asset would be 31 times the (then) water charge. These ratios still remain valid, and are a measure of the inappropriateness of current charge levels.

A large proportion of the GAP area will be supplied with pumped water. For example, 46% of the area to be supplied from the Atatürk dam requires pumping. Kayacık is part of a complex pumped/gravity system, and the total lift required at Kayacık is several hundred metres. The O&M costs of these pumped systems will be considerable higher than for gravity systems, and variable, depending on the lift required. This has been reflected in higher water charges for DSI pump schemes, though these have been much lower than the real cost, which would be 10–20 times the current level of water charges. For example, the Birecik system had a power requirement for pumping equivalent to over US$50 per decar per year in 1999, nearly 20 times the (then) cotton water charges. Despite revisions in recent years to offset the impact of inflation, the situation has not changed much in real terms.

Added to the O&M costs is the issue of recovery of capital investment costs. Officially, the DSI stipulates that these costs should not be realized for seven years, which is the grace period. But there is no well-defined mechanism laying down any modalities for their recovery later on. The capital cost of schemes in GAP is estimated at US$290 per decar for distribution systems and US$150 per decar for the head works and dams, which might be attributed to power generation rather than to irrigation. A further US$157 per decar is spend on roads, land consolidation, land levelling and so on. Future costs of drainage works might amount to US$260 per decar. Recovering the total investment of US$900 per decar over 20 years, without interest, required US$45 per decar per year, in 1999 about TL20 million, compared to a water charge of TL1.3 million for cotton existing at that point in time (Halcrow–Dosar Joint Venture, 2000).

The water pricing policy for pumped schemes is not developed, but unlike gravity system maintenance, they consist mainly of costs that cannot be deferred. If the systems are operated by the DSI, and current policies of providing water free of cost to IDs continue, there will be very substantial and ongoing demands on the government budget, which might become unsustainable. If IDs are expected to operate these systems, or pay the operator for their cost, there will be a need for very much higher water charges. This would have a major effect on irrigators, influencing their selection of crops, water management and investment in improved irrigation. Deferred maintenance on all IDs will eventually result in higher O&M costs, and the additional costs resulting from supply failures. This will either require external assistance for rehabilitation or substantial increases in water charges so that IDs can undertake the work, for which they are, legally, responsible. If the government is unable to maintain growing subsidies in the form of free bulk water and system repairs, then water charges need to increase considerably.

The economic effects of low water prices are negative, as users are given inappropriate price signals for what is and will be a scarce resource. Incentives to improve efficiency of use of the resource are weakened or are absent, and it will be used wastefully, reducing the overall return to the nation. As irrigation in the GAP region approaches full development, there will be severe limitations on water for the developed area, by which time it will be better if water is properly valued and users have developed the means and made the investments required to use water efficiently. This will increase the command area, increase irrigation efficiency and reduce the problems of high groundwater tables and the need for drainage.

Water pricing policy should be at least able to cover the full O&M cost of supplying it, including the costs of bulk water. Given an overall shortage, economic theory suggests that the true opportunity cost of water should be charged, which includes the capital development costs, the costs of overuse (drainage costs, for example) and the value of water for other uses (power and industrial use).

Ability to Pay

The ability of farmers to pay substantially increased water charges has been examined in a few studies (DSI, 1994, 1998). Detailed crop budget analysis in these studies indicated that irrigated farms could pay water charge rates, and that gated pipe is profitable in cotton, with capital costs of 35 times water charges and O&M costs of seven times. Drip systems, with capital costs of 150 times water charges and O&M costs of 30 times water charges, are marginal, and require high-value crops. The precise ability of farmers to pay is variable, depending on crops and production levels, and the model outcomes depend on the assumptions made, but are clearly many times the current water charges. Full recovery of O&M costs for gravity systems is certainly feasible, and full recovery of capital costs is also possible. For expensive pumped water, the ability to pay may be marginal, especially for the higher areas and full cost recovery may not be feasible with low-value crops. However, it may be possible to recover full O&M costs, with water charges some 20–30 times the current levels.

The willingness of irrigators to pay for water at levels required to cover costs will be questioned. In financial and economic terms irrigators should be willing to pay if they obtain an adequate return, and this is shown to be the case in private irrigation. Private investors in irrigation, for example tube wells, are willing to invest both the capital cost and substantial O&M costs in full, but a long history of subsidized public irrigation has led irrigators to view the benefit as a right, and reduced willingness to pay.

Volumetric System

The crop and area system provides no guarantee of the irrigation management organization's income, and makes it impossible to predict future incomes, as both depend on irrigators' planting decisions. There is a particular problem where the irrigated area is being expanded, as irrigation management organization near the head of a system can deliver more water than will be possible at full development, and earn higher incomes. As irrigated area contracts the irrigation management organization's incomes contract, or water charges have to be considerably increased, probably at a time when the irrigation management organization maintenance costs are increasing. This would result in irrigators seeing their costs rising as the level of service is declining and reduce confidence and willingness to pay. Linking water charges to crop area also leads to farmers using poor returns as an excuse not to pay, and to farmers demanding the right to pay after harvest rather than at the time services are undertaken. This can have very negative effects on the irrigation management organization's cash flow.

On the other hand, volumetric charges would provide a fairly stable income for the irrigation management organization, as the overall volume of water available would be known and would have to be determined by the bulk water supplier well in advance. Water charges might have to vary from year to year to take account of changes in supply. For example, in a low water supply year water charges would increase to allow the irrigation management organization to cover its largely fixed costs. This would act as a pricing signal to water users to lower their demand for water.

The crop and area system establishes no water right, and encourages free-loading (rent-seeking) behaviour. Irrigators compete to establish as large an area as they think can be irrigated. The temptation to steal water is considerable but a market is not possible.

Table 7. Allocation of annual budget by programme head and expenditure code for the ID in 1999

Budget (billion TL)		ID1 104	ID2 87	ID3 108
Percentage of expenditure by programme head				
General management and aid services	101	32	38	74
Cleaning and environmental services	112	0	0	17
Agricultural services/park, gardens and nursery services	116	62	46	0
Unallocated	910/94	6	16	9
Total (%)		100	100	100
Percentage of expenditure by expenditure code				
Salaries	100	29	29	29
Staff expenditure	200	1	1	1
Goods and services	300	8	14	6
Materials	400	9	9	9
Office equipment	500	2	5	0
Machinery and vehicles	600	10	3	19
Maintenance	700	33	23	28
Other	800	2	0	0
Unallocated	900	6	16	9
Total (%)		100	100	100

Source: (Halcrow-Dosar Joint Venture, 2000).

Charging on the area of land owned would have to be combined with strict allocation of water, at least at the tertiary level, in proportion to the area of land, which is also the basis of the design of irrigation infrastructure in the GAP region. This implies that the irrigation management organization must have effective control of tertiary outlets and must distribute water according to the agreed plans. Irrigators on a given tertiary could then decide what they will grow with the water they are entitled to. The irrigator may decide not to grow crops at all but to transfer their water to another, either on the same or another tertiary, subject to the (limited) capacity of the irrigation system to carry the extra flow. A water market could develop and allow more productive farmers their areas.

Therefore, volumetric charges would allow a water market to develop directly. Each tertiary would be entitled to a given total volume of water in a season, and to a given maximum volume in peak periods. Sales of water within a tertiary would be direct and simple. Sales between tertiaries, or between the irrigation management organization, would be dependent on irrigation system capacity constraints, but would not be difficult to manage, once volume measurement and systems were in place.

The crop and area system has no incentives for water use efficiency, as the amount paid by irrigators is not related to the water delivered. Whilst peak season efficiency is encouraged by overall restrictions in supply, irrigators are free to waste water when there is spare conveyance capacity, and this is shown to be happening in practice. Water is allowed to escape to drainage, night-time irrigation is avoided. Individual irrigators have no incentives to conserve total water supply over a season.

But volumetric charges ensure that all users minimize the waste of water. If the irrigation management organization is paying a bulk water charge, it will take steps to ensure that all water delivered to a tertiary outlet is paid for. Irrigators will, in turn, take care to ensure that no water is wasted in the tertiary system by using all of the water diverted and ensuring that no more than the amount required is requested at the tertiary outlet. In canalette systems, designed for 24-hour irrigation, the practice of night-time irrigation will be encouraged. As overall constraints develop in the water supply, these savings will become important, and are most easily introduced during the establishment of an irrigation management organization.

The crop and area system would be fair and equitable where there is no limit to the water delivered and the full area of the scheme can be irrigated. As long as water charges were related to the crop water requirement, irrigators would be paying for what they used, subject to reasonable water efficiency being obtained. Where water is limited, as it is for the whole of the GAP region, the system becomes inequitable as free-loading (rent-seeking) behaviour develops and some irrigators seek an unfair proportion of the supply. This could only be avoided if water delivered were controlled.

Volumetric charges are very fair and equitable, as the user pays directly. The use of water has to be measured accurately, but, as shown above, this is also required for apparently simpler charging systems. If water is being measured, then volumetric charges are clearly beneficial.

Though the most difficult system to implement, volumetric charging has substantial other benefits and is the system of choice. To operate the apparently simpler systems under the circumstances in GAP will probably also require control of water distribution, and therefore of measurements, in which case the costs of operating a fully volumetric system would be small. The easiest point at which to establish volumetric water charges is during the design of the system, when it is easy to include the required flow measurement structures, and during establishment of a new irrigation management organisation, before vested interests build up under alternatives. So the system should be introduced on future irrigation management organizations to be established in the GAP region.

The volumetric system would involve measurement of flows into the irrigation management organization system and measurements of flows at the outlets of tertiary systems. Division of flows to irrigators on a tertiary would be managed by the development of water scheduling, which has been implemented in the GAP management, operation and maintenance pilot project based on agreed number of siphon hours. There are inevitable practical complications for implementation: for example, areas irrigated directly by secondary systems or irrigators pumping out of main canals would need to be accommodated. Whilst a water charging system cannot prevent free loading (rent seeking) or water theft, it should be possible to agree on a fair distribution and to make it clear where this is failing, to allow other irrigators to bring pressure to conform.

Conclusion

Water pricing must cover the full economic costs of water to reduce the financial burden on the state to ensure efficient water use. Cost recovery in Turkey currently covers a fraction of the actual total costs and no allowance is made for depreciation of the infrastructure, which is unsustainable, and government funding is still required. Distribution costs and maintenance costs must be recovered, and a gradual ramping up of water charges is required. Water charges should, in the medium term, include costs of the main canal operator, for which there is the ability to pay. Ideally, payment for water at each stage of the distribution process will provide the incentives for each operator to perform.

The political choices are stark: either the government must meet and maintain rapidly growing subsidies to irrigation, including the major rehabilitation cost of systems where IDs have failed to undertake maintenance and the external costs of inefficient use of water (which are the inevitable result of an underpriced resource) or water charges have to increase several-fold.

The political choices are uncomfortable: water charges have to be enforced to ensure full collection, which requires effective action to be taken against defaulters, which, in practice, means that irrigation supplies must be denied them.

The political choices are immediate: the area under irrigation in the GAP region is growing rapidly. If water charges are to increase, this could be more easily achieved by reaching agreements with landowners before irrigation investments are made than by trying to raise charges to existing users.

Water distribution needs to be based on volumetric charging at the tertiary outlet, which requires irrigation groups to be formed, and flow measurement systems to be installed and operated. Water distribution must be equitable for irrigators and for irrigation management organizations on a main canal system, which also requires flow measurement. Flow measurement systems are feasible and practicable in the newly developing irrigation systems in the GAP region.

Changes in the law to allow irrigation management organizations to own or hold on long leases their irrigation infrastructure would help to ensure sustainable maintenance and development, once management standards are adequate. Against the background of inadequacies in the present conception and legal framework for IDs, the DSI has, since 1997, initiated a process of drafting new and generic legislation governing the status and operation of water users' unions (WUUs). Since WUUs would be established on the basis of generic legislation, their current status as organs of local government administration under the Municipality Act would change. WUUs (unlike IDs) would be required to register all irrigators in their areas as members, though it is unclear whether the term 'irrigators' includes both owners of farmland and tenants. WUUs would be empowered to federate together to establish 'superior organizations' (subject to the approval of the DSI). Presumably, therefore, such a federation could be empowered to take over the management and operation of the main canal and drainage systems. Due to more autonomy in operation, they might gradually adopt realistic water pricing. However, at present the tabling of the aforesaid law has been slowed down due to inter-departmental struggle to not relinquish the control they had hitherto been exercising over the irrigation management organizations.

The politico-administrative structure is gearing up for structural transformation in view of Turkey's impending accession to the European Union and the recent success of the International Monetary Fund–World Bank structural reform programme for offsetting the biggest ever economic crisis. This provides a positive atmosphere for undertaking water sector reforms, including water pricing.

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Note

1. GAP (Güneydoğu Anadolu Projesi) is the Turkish acronym for South-eastern Anatolia Project.

References

Department of the Environment, Transport and the Regions & Welsh Office (1998) *Water Charging in England and Wales: A New Approach*, Consultation Paper (London, HMSO).

DSI (1992) State hydraulic works, *Irrigation Master Plan* (Ankara, DSI).

DSI (1994) *Effect of Irrigation on Farm Budgets*, Technical Discussion Paper 23 (Ankara, DSI).

DSI (1998) *Development of Effective Water Charging Measures in Project Area, A Report* (Ankara, DSI).

DSI (2002) *Agricultural Water Pricing in Turkey, A Discussion Paper* (Ankara, DSI).

Halcrow–Dosar Joint Venture (2000) *Management, Operation and Maintenance of GAP Irrigation Systems* (Ankara, GAP).

Uşkay, S. (2001) Irrigation development and management in Turkey, paper presented at the First International Mediterranean Irrigators' Meeting, Marcia, Spain.