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in

Hamdy A. (ed.), Tüzün M. (ed.), Lamaddalena N. (ed.), Todorovic M. (ed.), Bogliotti C. (ed.).
Participatory water saving management and water cultural heritage

Bari : CIHEAM
Options Méditerranéennes : Série B. Etudes et Recherches; n. 48

2004
pages 263-285

PARTICIPATORY IRRIGATION MANAGEMENT AND WATER CULTURAL HERITAGE: TURKEY COUNTRY REPORT

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SUMMARY – The transfer of the management responsibility of the irrigation schemes to farmers gained momentum in 1993. The size of transferred irrigation facilities reached 1.7 million hectares by the end of 2002. This figure corresponds to about 90 percent of total irrigated area developed by State Hydraulic Works (DSI). The operation and maintenance activities (O&M) may be transferred to village legal entities, municipalities, unions (irrigation associations) and cooperatives. Irrigation associations (IAs) have a prominent place in terms of both total size of land (91 percent of the transferred schemes) and average irrigated area (slightly more than 5,000 hectares). The main underlying reason for the acceleration of the transfers was the unsustainable financial burden of the O&M for DSI. The O&M cost recovery of DSI was around 40 percent before the acceleration of the transfers. Several encouraging results are observed following the transfers: The participatory approach has generated a sense of responsibility in allocating the available water; Irrigation efficiency has increased; Energy consumption for pump irrigation has decreased; Irrigation ratios have been considerably higher in transferred irrigation schemes compared to DSI managed projects. Despite the improvements in the post-transfer era, urgent legal reforms are required to place the IAs into a well-defined institutional and legal framework to secure the sustainability of the PIM.

Keywords: Participatory Irrigation Management **(**PIM), irrigation fee, cultural heritage.

INTRODUCTION

The system of water distribution, water pricing, fee collection rates, the equity in charging the water user and the maintenance of irrigation structures are principal factors determining the effectiveness of water use in irrigated agriculture. Participatory Irrigation Management (PIM) is an approach that is expected to provide the mentioned factors above adequately. The PIM can be summarized simply as a bottom-up participation practice by irrigation associations[10], water user groups, etc. to achieve a more effective water use.

Turkey is a Mediterranean country where considerable improvement in the application of PIM is recorded in a short time period. This country report evaluates the structure and development of PIM.

In the following section of the study, brief information about geography, climate and population is provided. In the latter section, the development of the participatory irrigation management and the relevant institutional structure are investigated. Socio-economic impacts are pointed out. Encountered problems during the transfer phase are mentioned and relevant recommendations are presented. In the fourth section, performance of selected irrigation associations (IAs) is examined via several indicators, such as; irrigation indicators, cropping patterns, sources of income, operation and maintenance expenditures, change in fee collection rates, vehicles and other equipment and personnel. The country report ends with the concluding remarks.

[10] Used as the synonymous for water user associations throughout the report.

GENERAL INDICATORS

Geography & Climate

Turkey occupies a total area of about 78 million ha, of which about 1.1 million is inland lakes. The country forms an elongated rectangle roughly 1,700 kilometers in an east-west direction and 1,000 kilometers north to south. On the east, Turkey has borders with Iran, Azerbaijan, Georgia and Armenia. On the southeast Turkey's neighbors are Iran, Iraq and Syria. On the south and west, the country is surrounded with the Mediterranean and Aegean Sea. On the northwest, Turkey has borders with Bulgaria and Greece. The Black Sea lies in the north of the country. Anatolia, except its eastern parts, is surrounded by seas and has a total coastline of over 10,000 km, including the Thrace and islands. Turkey forms a bridge between Europe and Asia, with about 3 percent of its land in Europe and the rest in Asia.

Turkey is under effect of both maritime and continental weather patterns, which cause extreme geoclimatic diversity when combined with a highly varied topography. The Mediterranean region (southern coastal region) is regarded as sub-tropical, characterized by hot, dry summers and mild, rainy winters. The Black Sea region receives rain throughout the year and lives both mild summers and winters. The Aegean Region (Western Anatolia) has mountains which run roughly east to west (i.e. perpendicular to the coast) and which are interspersed with grassy flood plains. It has also a Mediterranean type of climate with hot, dry summers and mild winters. Central Anatolia is a vast high plateau with an average altitude of 1,000 meters above sea level and a semi-arid continental climate, i.e. hot and dry summers.

Temperature: Turkey's climate varies widely across the country and within the geoclimatic zones. The regional temperature distributions indicate that negative (-) averages do take place in eastern parts in winter, however, between months, April and November positive (+) averages exist. In the southeast region, temperature averages surpass 30 Grad Celsius.

Precipitation: Rainfall is scarce during the growing season in normal years in most parts of Turkey. Important fluctuations in precipitation occur from year to year. Overall, the coastal regions receive 800 – 1,000 mm rainfall. The northern coastal zone (the Black Sea Region) receives the highest annual rainfall (1,260 – 2,500 mm). The Central Anatolia receives the lowest rainfall (200-600 mm), which causes drought combined with summer months of high evaporation and temperature rates. The average annual rainfall in Turkey is about 643 mm.

Population

The population of Turkey is approximately 67.9 million, based on an average annual population growth rate of 1.6 percent per annum since the 2000 national census (SPO, 2002). However, the high population growth rates of almost 2 percent per annum in the last decade create the expectation that in the following years the growth rate of population will slow down.

When population is examined as urban and rural areas, an increase of 1 million 207 thousand persons in urban areas (41 million 439 thousand persons in total) and a decrease of 206 thousand persons in rural areas (24 million 600 thousand persons in total) was emerged in 2002 compared to 2001 (SIS, 2002). This resulted in the decrease of the share of the rural population in total from over 67 percent in 1960 down to 37.3% in 2002. Similarly, in the short run, it is not expected a significant change in the trend of migration. Instead, it is expected to continue at a similar rate according to SPO reports.

In 2002, a further narrowing in agricultural employment of 6.5% was observed compared to 2001, continuing the trend of last three decades, which means that the share of agricultural labor force in total declined continuously from a share of 63.77% in 1970 down to 33% in 2002. On the other side, while total employment in manufacturing sector increased by 4.1%, the constructions sector employment declined by 13.2 % in 2002. The services sector employment continued enlarging its

share by 4.6%. Currently, services sector holds over 40% of total employment, absorbing most of the labor supply.

Land Potential

With her diverse geological, climatic, vegetation and topographical features, Turkey rooms in most of large land groups found on the earth today. This richness also makes it possible to raise a diversity of crops, many of which are high in their quality.

In terms of their inherent limitations to tillage, lands rank from 1st class on which no tillage problem is confronted to class 8 where no crop farming is possible. In a wider grouping, the first 4 classes in this ranking are accepted as tillable whereas the other 4 constitute the group including forests and pastures that have to continuously remain with natural vegetation.

4,825,442 ha out of total cultivated land of 28,053,067 is 1st class land and since they have no inherent constraint they can maintain their fertility for long years even with minimum care. Of this 1st class land, 1,586,720 ha are fallowed for dry farming and 944,965 ha are not fallowed again in dry farming. In Turkey, 1st class land extends over 5,086,087 ha. Deducing 4,825,442 ha of land that is under culture from this total, it remains 260,645 ha. This final part consists of pastures (54, 669 ha), ranges (94, 482 ha), forests (7, 708 ha), bushes (5, 404 ha), settled areas (80,709 ha) and industrial plants, highways, airports etc. (17,673 ha).

The land of class 2 has some limitations to tilling and it covers 6,772,873 ha in Turkey. 6,040,590 ha of this total is presently under culture. The remaining 732,283 ha are used for other purposes including as pastures and ranges (444,477 ha), forests and coppices (13,112 ha), and finally as settlement areas, industrial-military zones, etc. (108,996 ha).

Coming to the 3rd class, this land amounts to 7,282,763 ha of which 6,036,224 are under culture. The remaining 1,246,539 ha consist of pastures-ranges (737,300), forests and coppices (420,315) and settlement areas and industrial-military facilities-premises (88,924 ha). The class 4 is the most problematic among all tillable land. This class of land covers 7,425,045 ha in Turkey and 4,877,061 ha are presently cultivated. However this land is highly prone to erosion and there are considerable losses since no preventive measure exists. 2,547,984 ha of 4th class land is also cultivable; yet 1,641,382 ha of this total are used as ranges-pastures and the remaining 846,063 ha as forests and coppices.

Lands of classes 5, 6 and 7, which are not fit for culture because of poor nutrient endowment, proneness to erosion, moisture or specific climatic conditions altogether make up 46,790,036 ha.

The present land use patterns according to studies conducted by the General Directorate of Rural Services are given in detail below in Table 1. The major problem in land use is the failure to use land in line with their varying features as a function of agricultural planning. Thus, one can see shrubs and heath, which cannot be considered as sources of agricultural production or forested areas, which must remain in 6th and 7th grades of land or ranges, whose normal place is in the class 6 in class 1 land that should be exclusively reserved for crop farming. On the other hand, one can also come across rainfed or irrigated farmlands on land of class 5 and 7. This rather distorted distribution prevents any informed use of agricultural inputs and further exacerbates the effect of erosion.

Water Resources Potential

Turkey is not a “water-rich” country as it is often presumed. The country is also vulnerable to facing water shortage problems in near future unless necessary interventions are made. This problematic status of the country in regard to water derives from several factors including the following: Difficulty of controlling resources as a result of a problematic topography; unbalanced regional distribution of resources and precipitation; and utilization of water resources through regional, discrete and short-term projects instead of long-term planning for integrated water management on catchment basis.

Table 1. Present Patterns of Land Use (Source: GDRS, 2003)

Utilization	**Class I-IV (ha.)**	**ClassV.-VII. (ha)**	**Total (ha)**	**Sum Total (%)**
Dry Farming	16,284,000	4,971,248	21,255,248	27.3
Irrigated Farming	3,488,144	104,243	3,592,387	4.6
Irrigated with Insufficient Water	722,734	39,539	762,273	1.0
Vineyards,-Orchards & Special Crops	1,284,439	1,159,160	2,443,599	3.1
Pastures	384,361	262,330	646,691	0.8
Ranges	2,587,949	18,270,528	20,858,477	26.8
Forests	1,004,330	14,180,549	15,184,879	19.5
Scrub-Heath	453,970	7,589,126	8,043,096	10.3
Non-agricultural	356,841	213,313	894,153	1.2
Other		3,060,788*	3,060,789	3.9
Water Surface		1,158,109**	1,158,109	1.5

Notes: * Including 323.999 ha (Class VIII), ** (Including class VIII)

- Total potential surface runoff 186 billion m^3
- Annual utilizations water 95 billion m^3
- Utilization surface runoff from neighbor country 3 billion m^3
- Annual reserve of groundwater that can be surfaced 12 billion m^3
- Total utilization water 110 billion m^3

Total utilization of water can be seen above in details, as well. Moreover, per capita water usable is 1,735 m^3 and potential per capita water is 3,690 m^3. Looking at some other countries and the world average, it is seen that Turkey is among those facing water shortage in term of per capita usable water endowment (Table 2).

Table 2. Usable Water Potential in Some Countries and Continents [m^3/capita/year] (Source: SPO, 2001a)

Iraq	2 020
Lebanon	1 300
Turkey	1 735
Syria	1 200
Asia (average)	3 000
Western Europe (average)	5 000
Africa (average)	7 000
South America (average)	23 000
World (average)	*7 600*

Today, it is accepted that a country should have annual per capita water potential of 10,000 m^3 in for being classified as “water rich.” Turkey, however, is quite behind this threshold with the figure of 3,690 m^3. Furthermore, the State Institute of Statistics (SIS) projects the population of Turkey as 80 million in 2025. So, it is possible to conclude that per capita water potential in Turkey will further fall to 1,300 m^3 by that year. It is possible to figure out further pressures on water resources deriving from population growth and changes in water consumption patterns. It should also be noted that all these estimates are based on the assumption that existing water resources and potential are transferred to coming generations as they are now. This indicates that Turkey has to utilize her water resources efficiently and rationally to safeguard future generations.

Utilization of Water Resources

As a result of projects developed by various agencies, including DSI as being the first, in charge of developing water resources, total water consumption in Turkey rose to 38.9 billion m^3 as of the end of 1998. Breakdown of this total figure until 2000 is available in Table 3.

Table 3. Actual water consumption in Turkey, 1990-2000 (Source: SPO, 2001a)

Year	Total water consumption [10^6 m^3]	Potential use (%)	Water consumption by sectors					
			Irrigation		Drinking-Use		Industrial	
			10^6 m^3	(%)	10^6 m^3	(%)	10^6 m^3	(%)
1990	30,600	28	22,016	72	5,141	17	3,443	11
1992	31,600	29	22,939	73	5,195	16	3,466	11
1998	38,900	35	29,200	75	5,700	15	4,000	10
2000	42,000	38	31,500	75	6,400	15	4,100	10

Of 38.9 billion m^3 of water consumed in 1998, 32.9 billion m^3 comes from surface water resources, while 6 billion m^3 is provided through groundwater reserves. Sectoral breakdown of utilized surface water resources is as follows: Irrigation (82 %), drinking-use (10 %) and industrial purposes (8 %). Corresponding percentages for the utilization of groundwater is, respectively, 39, 37 and 24.

Water Consumption by Sectors and Needs Analysis

Water consumption projections were made for the year 2030 on sector basis by considering the needs of growing population as well as rapidly developing sectors of industry and tourism. These projections are based on the assumption that DSI and other relevant agencies, including private sector companies develop their projects so as to make available 110 billion m3 of water by 2030. Table 4 makes it clear that all sectors will increase their water consumption considerably. This clarity also brings along the necessity of investments for the purification and reuse of consumed-polluted water.

Projections given below also presupposes that 8.5 million ha of land (net figure is 7.34 million ha) that is economically irrigable will be brought under irrigation by the year 2030 and, total consumption of irrigation water will reach 71.5 billion m3 by the same year. The target is to reduce the share of irrigation water in total water consumption to 65 % by introducing and promoting modern irrigation techniques.

Table 4. Water consumption trends in Turkey, 1990-2030 (Source: SPO, 2001a)

Year	Total water consumption [10^6 m^3]	Potential use (%)	Water consumption by sectors					
			Irrigation		Drinking-Use		Industrial	
			10^6 m^3	(%)	10^6 m^3	(%)	10^6 m^3	(%)
1990	30,600	28	22,016	72	5,141	17	3,443	11
1997	35,645	32	26,415	74	5,520	15	3,710	11
2000	42,000	38	31,500	75	6,400	15	4,100	10
2030	110,000	100	71,500	65	25,300	23	13,200	10

In projections regarding drinking-use water, it is assumed that the present rate of population

growth which is at present 2% on annual terms will somewhat slow down and the population of the country will be around 90 million in 2030. Assuming progressive trends in welfare and relevant standards, the present per capita water consumption of 250 lt/s is expected to rise to 500 lt/s, approaching closer to the European standards. The sector of tourism in Turkey is also flourishing and its water consumption is estimated to be around 5 billion m^3 in 2030. Adding these figures up we reach the figure 25.3 billion m^3 as total drinking-use water needs of the country in 2030. Additionally, assuming that the industrial sector enjoys an average annual growth rate of 4%, 13.2 billion m^3 is found as the total water need in 2030.

PARTICIPATORY IRRIGATION MANAGEMENT (PIM)

Development of PIM

History of Irrigation

Anatolia located at the crossroads of many antic civilizations has witnessed various water facilities during the last 4,000 years. Central, western, southern and southeastern parts of Anatolia room in many water facilities built by Hittites (2000 BC), Urartu (1000 BC), rulers in the Hellenistic period, Romans, the Byzantine, Seljuk and the Ottoman. Some of these facilities are usable even in our day. Remains of other facilities are visible in many parts of Anatolia as examples of fine engineering skills. The first modern irrigation and drainage facility in Anatolia dates back to 1908-1914 (the ottoman period) as “Çumra Irrigation and Drainage Project” (FNCI, 2001).

Starting with the republican era, the State gave priority to the drainage of swampy areas as part of combat against malaria and then introduced some small irrigation projects. Upon the establishment of the General Directorate of State Hydraulic Works in 1954 upon the law no. 6200, investments in projects, such as, dam-reservoir construction, pumping, regulation and irrigation networks etc. were intensified. The General Directorates of Village Services and Agrarian Reform were established mainly for the regular extension of on-farm development and land rehabilitation services accompanied by efforts to ensure efficiency in irrigation. In this overall framework, the development of water resources having a flow of more than 500 lt/second fall within the mandate of DSI while smaller surface flows are developed by the General Directorate of Village Services. In Turkey, 58 to 80 percent of total investments in agriculture in the planned period have targeted the development of land and water resources. In the period 1963-80, 20 to 33 percent of State investment budget was allocated to land rehabilitation and irrigation investments. This share turned out to be much lower (around 10 percent) in the 90s (FNCI, 2001). Problems relating to the utilization, sufficiency and reliability of water resources have raised serious concerns throughout the world and, consequently, the model “Devolution in Irrigation Management” has come to the fore as solution starting from the 50s.

The first examples of devolution were observed in the US, France and Taiwan in 1950s, 60s and 70s, respectively. Latter, the model of devolution secured as place as a national approach during the 80s and 90s in many countries including Chile, Peru, Mexico, Brazil, Senegal, Sudan, Somali, Pakistan, India and Turkey. For instance, it is “transfer” in Indonesia, “delegation of management” in Mexico and “participatory irrigation management” in Turkey.

Rationale and Outcomes of Transfers

Even in the period 1954-1994, when irrigation facilities were largely operated by DSI, the management-operation-maintenance (MOM) of these facilities was conducted in cooperation with “local water management units” or “Irrigation Groups” in villages and administrative districts on the basis of voluntary participation and membership.

- It is now widely accepted that irrigation facilities must be owned and managed by their beneficiaries in order to ensure efficiency in irrigation.
- The performance of existing irrigation associations presented some good practices indicating that such associations can handle this work better than state enterprising in terms of fairness, neutrality and economic efficiency.

- Even when DSI fixed annual water charges with a view to the cost of operation and maintenance of facilities, the Council of Ministers could interfere by subsidizing these charges, which in turn jeopardized the financing of the operation of these facilities.
- As a result of some gaps in legislation, the amount collected as fees from water users was gradually decreasing. Moreover, some political and administrative factors started to hinder fair and equitable service delivery.
- Overall austerity measures introduced by governments led to deficits in what can be allocated for the MOM of irrigation facilities.
- There were further problems in the conveyance and distribution of irrigation water since DSI field personnel shrank over years while total area irrigated by DSI was expanding.

In most irrigation schemes, uninformed irrigation practices, poor MOM as well as defects in the system of agricultural training and extension lead to serious problems including excessive water use, erosion, rising water table, salinization, alkalization, etc. The state budget mostly suffered heavy burden in the MOM of irrigation systems since it could collect little from farmers as irrigation fees while larger and larger areas were brought under irrigation. With its shortage of personnel, DSI was mostly unable to meet the maintenance and renewal needs of many facilities.

Water-Irrigation Facility Transfers and Their Outcomes

Until 1993, small networks irrigating areas smaller than 2,000 ha had gradually been transferred to water users. Besides, DSI also encouraged participatory approach by facilitating the formation of water user groups with limited responsibility in terms of operation and maintenance. Through these initiatives, irrigation facilities covering about 52,000 ha of land were transferred to various organizations until 1993. Starting in 1993, DSI introduced its “Accelerated Transfer Program” in selected areas. The launching of this initiative was effective in transferring facilities covering 10,000 ha of land only in 1993. In early 1994, DSI launched its transfer operations in 4 pilot areas. Backed up by farmers, this initiative was successful in transferring irrigation facilities covering 193,320 ha of land, which was about the double of what had been foreseen earlier (103,000 ha). The process of transferring has been continuing since then.

As in Table 5, while almost 10,000 ha of land were transferred in 1993, there was a jump to 195,000 ha in 1994. The original plan for the year 1995 was for the transfer of 140,000 ha of land. However, with the push of an unforeseen demand in the total size of transfer turned out to be over 700,000 ha. The process continued without losing momentum and the size of total transferred irrigated land reached 1,704,475 ha as of 1 December 2002. This figure corresponds to 89 % of total irrigated land whose irrigation facilities are to be transferred.

Outcomes of accelerated transfer operations were also appreciated by international organizations. The World Bank, for instance, referred to the transfer process in Turkey as a model to be considered by the countries of Balkan Peninsula, North Africa and Middle East and suggested visits to Turkey to observe and examine the model. Consequently, staff and experts from more than 30 countries have so far visited Turkey for this purpose. Meanwhile, international organization active in the field of irrigation proposed that the second round of the seminar, “International Participatory Irrigation Management” to be held in Turkey. Upon the affirmative response of DSI, this seminar was held in Antalya from 10 to 17 April 1996. The seminar was participated by 126 persons including the following: 58 high-level officials, including ministers and parliament members from 16 countries; 12 representatives from international organizations; 16 staff members from various sections of the World Bank (making 86 guests); 25 officials from the headquarters and regional directorates of DSI; 13 representatives from organizations taking over irrigation facilities and 2 representatives from other national ministries.

Table 6 below also gives the distribution of irrigation facilities by types of transferees. It is seen that, irrigation associations (IAs) have a prominent place in terms of both total size of land and average irrigation area. There are also irrigation facilities transferred to village communities; however, the irrigation area of most of these facilities varies from 15 to 200 ha and thus their average irrigation area is also small. IAs have control, on average, 5,129 ha of land; however this size may be as large as 30,000 ha in some cases.

Institutional Structure

Table 5. Transfer Plan and its Realization [ha] (Source, DSI)

YEARS	PLANNED		REALIZATION		MODIFIED PLAN	
	Annual (ha)	Total (ha)	Annual (ha)	Total (ha)	Annual (ha)	Total (ha)
1988	-	-	1,789	55,034		
1989	-	-	3,386	58,420		
1990	-	-	2,391	60,811		
1991	-	-	257	61,068		
1992	-	-	1,552	62,620		
1993	-	-	9,422	72,042		
1994	103,958	176,000	195,320	267,362		
1995	140,000	316,000	711,214	978,576		
1996	120,000	436,000	211,758	1,190,334		
1997	120,000	556,000	88,705	1,279,039		
1998	120,000	676,000	204,892	1,483,931		
1999	120,000	796,000	45,523	1,529,454		
2000	120,000	916,000	89,215	1,618,669		
2001	84,000	1,000,000	45,061	1,663,730		
2002	50,000	1,050,000	31,006	1,704,475		
1 January – 15 September 2003		50,000	77,147	1,771,883	55,264	1,750,000
16 September-31 December 2003		1,050,000	- 21,883	1,750,000		
2004	50,000	1,150,000			50 000	1,800,000

Table 6. Distribution of Transferred Irrigation Facilities by Transferees (15.09.2003) (Source: DSI)

Transferee	No.	Share (%)	Area (ha)	Share (%)	Average Irrigation Area (ha)
Village Legal Entity	224	28.4	64,998	2.0	161
Municipality	135	17.9	57,288	3.2	430
Irrigation Association	315	45.0	1,612,904	91.0	5,129
Cooperative	64	8.3	65,661	3.7	1,156
Other	4	0.5	1,032	0.1	258
TOTAL	*742*	*100*	*1,771,883*	*100*	*2,473*

Only a well-thought irrigation planning and its consistent implementation can help us avoid such problems as erosion, rising water table, salinization, alkalization, etc. and take us to an optimum level in water-yield relationship.

Embodying so much investment and human toil, the basic aim of irrigation projects is to increase agricultural output, contribute to national economy and guarantee the welfare of farmers through transition from rainfed to irrigated farming. This requires the development of a high-yielding farming system where irrigation water is allocated and used efficiently. Experience of long years indicates that irrigation facilities need to be transferred to their users to achieve the best performance.

Transfer of Irrigation Facilities

The rationale behind this transfer is to encourage farmers to commit themselves to the MOM of irrigation facilities, ensure their active participation in irrigation activities and to reduce the financial burden of the State related to the costs of MOM. Hence, the transfer of irrigation facilities has gained pace after 1993 and significant distance has been covered in this path.

According to the legislation on the transfer of irrigation facilities, the basic principle is to transfer not the proprietorship of facilities but the *responsibility in their management, operation and maintenance.* Facilities such as dams, reservoirs and electric pumping stations are constructed by DSI. These facilities are either operated by DSI or transferred to water users. The General Directorate of Village Services (GDRS) is also engaged in the construction of irrigation facilities, but these facilities are smaller in scale. These small-scale irrigation facilities, on the other hand, are transferred to village communities, municipalities, cooperatives or some other organizations. As to groundwater pumping facilities where deep boring, pumping and electrification works are handled by DSI while the GDRS organizes irrigation works they are to be transferred to cooperatives under the Law no. 1163 on cooperatives.

In the transfer of State constructed irrigation facilities to water users' organizations, different procedures apply with regard to investing organizations. For example, while small-scale facilities of the GDRS are transferred to cooperatives, DSI gives priority to irrigation associations (IAs) especially when large irrigation facilities are concerned. Thus the transfer of irrigation facilities can be summed up in three categories as (i) transfer of facilities constructed by DSI, (ii) transfer of facilities constructed by the GDRS, and (iii) transfer of facilities constructed jointly by DSI and GDRS.

Forms of Transfer

i) Unofficial Transfer: Small irrigation networks using small surface reservoirs are constructed by the GDRS. The GDRS may transfer the operation and maintenance of these small-scale facilities to local organizations or directly to farmers without any official contract. After transferring, the GDRS does not interfere to the management and operation of these facilities except in cases where large-scale maintenance work is needed.

ii) Joint Participation in Management: This is a procedure called *water user group* that has been expanding its scope since the 60s in relation to DSI constructed facilities. Here, farmers' participation is ensured by leaving operation and maintenance services on reserve and tertiary canals to farmers.

A *water user group* can be defined as follows: organizations or legal entities formed in line with principles agreed upon in a contract acted by DSI and water users that are in charge of conducting cleaning, repair and maintenance works at the level of reserve and/or tertiary canals and also undertaking irrigation water allocation at this level during the relevant season.

More specifically, these groups help and contribute to the work of DSI by collecting requests for irrigation water, preventing illicit or non-programmed water intake, assessing crop yield and conducting land surveys. As to maintenance-repair work, they take care, as much as they can, of reserve and tertiary canals, related artworks and service paths. In return to these services,DSI applies about 40% discount to fees to be collected from farmers for operation-maintenance costs. Many of these groups have now turned into IAs.

iii) Full Transfer; is the transfer of the MOM of facilities constructed, in construction or to be constructed by DSI to public or private legal entities of water users under the provisions of a contract acted in-between and upon the approval of the related Ministry.

Organizations Eligible as Transferees

There is no legal barrier to the transfer of DSI facilities to Public Law legal entities (i.e. village communities as legal entities, municipalities, unions) or to Private Law Legal Entities (i.e. cooperatives) and the act of full transfer takes place upon the voluntary decision and request of such legal entities. The type of entity to which any facility is to be transferred is determined by local people

in regard to local circumstances. Entities eligible as transferees and corresponding legislation is given below.

Table 7. Entities Eligible as Transferees and Corresponding Legislation

Public Law Legal Entities	*Legislation*
Village Legal Entities	Village Act no. 442
Municipalities	Municipality Act no. 1580
Unions	Municipality Act no. 1580
Cooperatives	Cooperatives Act no. 1163

1. Village Legal Entity: It is a public law legal entity. It is the smallest local government. Transfer to such entity can take place if the irrigation facility concerned serves farming land that totally belongs to the village of the entity. In regard to acts pending on the preference of villagers, the Village Act no. 442 cites the *construction of small canals to be used communally for the irrigation of crop fields and orchards.*

2. Municipality: Municipalities are subject to the Municipality Act. No. 1580. Like the case in village legal entities, transfer of an irrigation possibility to a municipality is possible only when that facility serves exclusively to the municipality concerned.

The Municipality Act no. 1580 reads, *Municipalities and villages may join in unions in order to mobilize their endowments jointly for the fulfillment of legally compulsory works assigned by Governorates or for the accomplishment of some other work of their own choice.*

In Article 26 of the same act it is stated that: *It is the duty of Municipalities to clean communal irrigation canals in the municipal area, maintain roads and poor roads and charge fees for such services. Other duties of Municipalities include the drainage of water pooling in farmlands, orchards and vineyards as well as refreshing and cleaning waters of public and private pools.*

3. Cooperative: The Cooperatives Act no. 1163 defines the cooperative as follows: *Legal entities with variable partnership and equity formed by individuals, private administrations, village communities, municipalities or associations to safeguard specific economic interests of their partners and respond to their occupational and subsistence-related needs through mutual assistance, solidarity and collateral.*

4. Unions: Unions or “Unions of Local Governments” as they are referred in the relevant legislation are legal entities formed under the Law no. 1580. They are at present the leading transferees.

5. Others: Other than four categories given above, transfers can also be made to universities and research institutes although they are few in numbers.

Identification of Facility to be Transferred

Until 1993, priority in transfer used to be given to those facilities remote from main operation and maintenance units, lacking any organizational preparation for operation and maintenance and not fitting to the framework of State operation. After 1993, however, facilities with large irrigation areas have also been covered in transfer operations.

Larger irrigation facilities may be transferred without being split or, depending on the status of transferees as well as local circumstances, transferred in divided units. What is observed during the process of dividing into units is to avoid from creating units too small for irrigation purposes and leaving reserve, tertiary and drainage canals to the responsibility of a single transferee. While delineating units, such natural boundaries as main discharge and streambeds are taken into account.

Procedures Followed in the Transfer of Irrigation Facilities

In the transfer of irrigation facilities in operation, in construction or to be constructed by DSI, it is observed that *the facility is an integrated unit with its irrigation canals, drainage, service paths and artworks* and the following procedures are followed:

a. In case the transferee is an irrigation association, first there should be such an entity in place. Establishment of such an association depends on the decision of Municipal Councils within the irrigation area when municipal areas are concerned and of village communities in case of smaller areas;
b. Following any decision to that effect, by-laws of the association is prepared. There is a model by-laws prepared by the Ministry of Interior usable for this purpose with appropriate modifications. While working with by-laws, municipalities and/or village communities may apply orally or in written to DSI to benefit from its opinions and accumulated experience;
c. In the next step, all relevant documents (by-laws and decisions) are submitted to the administrative authority for examination and approval. Upon their examination and approval, Governors send these documents to the Ministry of Interior. Association is officially established upon its publication in the Official Journal after the approval of the Ministry and Council of Ministers:
d. Upon the official establishment of the union, its member local governments have to identify members of the council of the union and gather its first ordinary general assembly within one month. The general assembly convenes at the place and date designated by the administrative authority;
e. Procedures outlined so far are relevant in cases where the MOM of the facility are to be transferred to the union or association. When the transferee is a cooperative, this cooperative must have been officially established and its Management Board must have applied to DSI for transfer. When transferees are municipalities or village communities, it is sufficient to have a council decision and apply to DSI. The ensuing procedures are relevant for all;
f. Then model contract and, depending on the nature of irrigation (pumped or gravitation), transfer contract is arranged. The authorized signature is that of DSI Regional Director on behalf of the transferring authority and of the president of the organization concerned on behalf of transferee.
g. These documents are then sent by the Regional Directorate to DSI HQ to secure the approval of the Council of Ministers;
h. When the HQ secures the approval of the Council of Ministers, it sends a copy of this approval document to the region. This marks the completion of transfer procedures. Date of the approval of the Council of Ministers is accepted as the official date at which transfer has taken place.

Irrigation Operations

Irrigation operations in Turkey take five different forms depending on the authority overseeing irrigation. These are the State, local governments (municipalities and village communities), irrigation associations, irrigation cooperatives and individual irrigation.

State Managed Irrigation:

DSI is the only unit engaged in this form of irrigation. DSI is engaged in irrigation activities and services through its own service units by using its own means and public investments. As of 2003, DSI irrigation covers 9.6% of all land under irrigation. This is a considerable burden on the state budget since this irrigation is rather costly, clumsy and sometimes irrational. These derive from such factors as uncollected irrigation fees, insufficient sanctions on non-payers, high costs of repair and maintenance and shortage of personnel.

Irrigation by Associations:

Irrigation Associations are established on the basis of Articles 133 and 148 of the Municipality Act no. 1580 and Articles 47 and 48 of the Village act no. 442 by adopting the model by-laws issued by the Ministry of Interior. The managing body of an association consists of a council, president and a commission. The technical staff of an association would cover a Secretary General (an agricultural engineer), maintenance engineer and an accountant. In irrigation seasons, irrigation technicians may be recruited if needed. As of 2003 there are 315 such irrigation associations in Turkey covering a total area of 1,612,904 ha. Existing irrigation associations manage the irrigation of 91% of all land under irrigation.

Irrigation Management by Cooperatives

Irrigation cooperatives are established by the GDRS under the Law no. 1163 on Cooperatives upon the supportive opinion of the General Directorate of Organization and Support of the Ministry of Agriculture. Cooperatives undertake all MOM works in the facility concerned.

Irrigation cooperatives are established for the operation of small-scale facilities constructed by the State or for ensuring the sustainability of irrigation services organized by farmers themselves by raising funds to cover relevant maintenance costs. The management of irrigation cooperatives comprises the General Assembly, Management Board and Board of Auditors. Cooperatives may also recruit and employ various administrative and technical personnel. As of 2003, there were 67 irrigation cooperatives in Turkey covering a total irrigation area of 65,661 ha.

Irrigation Managed by Local Governments (i.e. Municipalities, Village Councils and Legal Entities)

This irrigation system takes place when irrigation facilities are transferred to entities mentioned in the heading. The GDRS is mostly involved in this system. It is not possible, however, to say that these systems can work as efficiently as they should since these transferees are actually local government units that have to carry out work in many other fields and mostly lack experience and expertise in water management. Out of total irrigated area in Turkey, 34,998 ha are irrigated by Village Legal Entities and 57,288 by Municipalities. This corresponds to a share of 5.2% in total irrigated area.

Irrigation by Private Persons

This category comprises cases where individual farmers are engaged in irrigation through facilities they constructed on their own means and by taking necessary official permission. Here the private farmer also undertakes maintenance and repair work. Although one can come across some cases of private irrigation, total land under this type of irrigation is negligible.

In Turkey, there is some degree of uncertainty in both surface and groundwater based irrigation. While private irrigations from groundwater reserves are subject to official permission, it is not easy to identify or prevent unlicensed uses. Moreover, unfortunately there is no reliable data on the use of groundwater even when this use is licensed.

Socio-Economic Impacts[11]

It is felt that the transfer of O&M services to the Water User Organizations (WUO)[12] has had significant and quantifiable positive impact on the O&M issues both from the technical, financial and social point of view.

The participatory approach by the users generated a sense of responsibility that had not existed before to better use the resources and the facilities and protect them. Besides good management of water resources, farmers are also provided a chance to communicate further about marketing opportunities, acquiring agricultural inputs, etc.

Water use is more reliable and equitable, the plots situated at the upstream or the downstream of the irrigated land are equally served. WUOs are putting the rules and implementing them by themselves in irrigation management, whereas they were only followers of the rules put by the government before the transfer. This leads to more reliability and less conflict among the users.

All farmers are members of the IA's, and regardless of their political preference they are equally served as a member, which means that political influence does not play a role on service providers. There is the fact that users pay their bill, 'not the state' as previously. Equitable service and rights of users is the key issue. If this is not provided, the president of the IA is not reelected or obliged to resign which means that there is a social pressure for unfair application.

[11] Parts 3.3 and 3.4 are mostly based on Döker, et.al. (2003), and Svendsen and Nott (1999).
[12] WUO occupies irrigation associations (IAs), cooperatives, village heads, municipality.

The chairs of the IAs are obliged to provide services regardless of the political tendency of the communities that fall under the service area of the associations. Simply, there is no political influence in water distribution, tariff setting or in any other steps.

The 'user pays approach' has increased awareness in water savings, as well. The IAs charge a fine which is issued by the Ministry of Finance periodically for all government credit for non-payment and they levy fines for illegal connections and for misuse or wastage of water and/or damage caused to the infrastructure. There is a mutual supervision mechanism, carried out locally on a continuous basis, and by each member, which brings social pressure and efficiency in this process. On the whole, the collection rate increased from 42% (irrigation by DSI) to more than 80% by some IAs (Döker, et. al., 2003). The current fee assessment and collection system brings more autocontrol and effectiveness when compared with the preceding system in which fees collected in a given year may relate to expenditures of even two years previous.

Conflict Management: Prior to transfer, DSI O&M staff was the focus of complaints and resolution of conflicts related to the irrigation system operation. Farmers' main complaints include dissatisfaction with the quantity and timing of water delivery, unhappiness with bills resulting in refusal to pay fees (particularly when it is claimed that water came from a private well rather than from DSI system), demands for repairs to system structures, and dissatisfaction regarding the location of irrigation canals. Complaints were made in face-to-face meetings with DSI staff or local politicians and through letters to DSI. Farmer-to-farmer disputes, e.g. disputes regarding taking water out of turn or head-tail problems, which cannot be resolved by the disputants are taken up by the muhtar and the council of elders or through courts. After transfer, complaints regarding system operation are usually directed to the IA chairman and staff, and sometimes to the village representative on the General Assembly. This has reduced the demands on DSI staff to deal with farmers' complaints. Moreover, electing an IA assembly and having a chance to be a member of an assembly encourage the people to participate and cooperate. Transfer has also had a great effect in developing a democratic system.

Irrigation Efficiency: Overall, the area of irrigated land has increased for the same volume of water, a consequence of better operation and maintenance of the facilities provided by the local O&M staff of the WUO. However, the better outcomes cannot be explained by only better operation and maintenance but drought experienced in the year 2001. It has been experienced that on the whole transferred areas are subject to higher irrigation efficiency (43.6% for 1999-2001) than DSI managed schemes (34% for the same period).

Irrigation Ratios: Irrigation ratios vary by years based on precipitation in the spring and the available water in storage reservoirs. Irrigation ratios are considerably higher in transferred irrigation schemes (68% for 1995-2001) comparing to DSI managed projects (45.8% for the same period). However this is not the only consequence of the transfer because those transferred projects were already yielding higher irrigation ratios before the transfer. Presently, the remainder that DSI manages is not expected to be transferred due to lower irrigation ratios as well as some other minor problems they have.

Energy Consumption: Energy consumption of pump irrigation decreased after the transfer; paying bills leads to less water use and good care of the facilities; reduction in energy use is estimated approximately 25% to 45%.

Employment: After the transfer, O&M staff of DSI decreased from over 9000 personnel in 1992 to below 6000 in 2002. However, the pace of decrease is not at such a rate as it should be. It will reach a well-balanced point in time with retirement. Some retired O&M staff find jobs at the IAs. Both retired persons and IAs are happy with this because of the well-experienced and lower wage for IAs and being employed after the retirement for the person. WUOs employ 5 240 at a minimum wage. Because of the high unemployment in the country a lot of people are willing to accept this minimum wage.

Technical Advice&Training: So far DSI has given technical assistance to WUOs that consist of repair and maintenance of water structures with equipment, training support and guidance on technical and administrative issues. This support is still continuing but is declining over the years as

they gain experience in time. Unless the WUOs are strengthened institutionally and technically, they will need to be supported by the central government. The transfer experience has shown that the transferred schemes cannot keep on performing satisfactorily and contributing to an increased production in irrigated land without a sound assistance program by the government, particularly during the initial years of the transfer. This is a crucial issue since especially the small organizations may face difficulties and fail to fulfill their task properly in which case the sustainability of the participatory irrigation management concept would be put in doubt for replication. And as the IAs gain experience in operational and maintenance topics, less assistance will be demanded and less employment at DSI would take place. DSI also organizes and ensures on-the-job training of accountants and general secretaries of WUOs. It is deemed necessary to provide this support for a while.

It should also be mentioned that the water user organizations have better applications with regard to debt service and labor law and better financial discretion than the central institutions. For example, under the legal framework DSI has no right to cut water supplies, whereas the WUOs does; WUOs have more flexible employment regulations whereas DSI does not. Economic deterrence is applied for non-payment by WUOs whereas DSI does not have this possibility.

Problems Encountered and Relevant Recommendations

However, despite the successes, urgent legal reforms are required with the main objective that the IAs should operate within a well-defined institutional and legal framework enabling sustainability of the PIM. In line with this statement, DSI technical and advisory staff has drafted a law with the IAs representatives submitted to the Ministry of Energy and Natural Resources in 1997. This version was amended and submitted to the Cabinet in Autumn 2001. The unclear legal position of the IAs has important implications for their financial autonomy and even their sustainability. For instance, the IAs have difficulties in obtaining loans from banks. This is due both to the uncertainties in their legal status and the fact that banks are not well informed about their existence and legal basis. This is the main obstacle toward the direct procurement of machinery by WUOs.

Presently most of the IAs is leasing machinery from DSI as well as from the free market. One alternative of overcoming the financial problems encountered in the procurement of machinery and equipment is joint ownership of the needed equipment among nearby IAs. Furthermore, WUOs can collaborate and purchase the machinery and equipment on a joint ownership basis. The joint ownership agreement must clearly determine the principles of utilization and operation and of the machinery or equipment. Despite its economic advantages, the option of joint ownership may however; cause problems in accounting principles (e.g. amortization) and some conflicts may arise between the joint owners.

Another option is the procurement of machinery and equipment by a financially capable WUO for lease to smaller WUOs. This option is likely to reduce potential problems that would arise from the use of the machinery and equipment. Moreover, it may be considered that the current irrigation associations should be organized for higher-level organizations, e.g. federations in long run to achieve economies of scale in equipment purchase and operation, equipment maintenance.

A provision for the required O&M equipment and machinery should be made to the WUOs and this should be done on a cost-sharing basis. The IAs need different types of machinery and equipment in order to fulfill their O&M responsibilities. On the other hand, the most significant O&M related machinery inventory in Turkey is owned by DSI. However, the present legal mechanism allows only transfer of old (scrap) or surplus machinery to other institutions or entities. The transfer of newly acquired equipment by DSI is complicated due to Article 38/e of its establishment law No: 6200.

Flexibility in structural changes in order to choose the most suitable model should be allowed. If the regulations are not appropriate to meet the water user organizations'needs, some unexpected incidents such as low yield, inadequate water distribution, violation of rules and social turmoil may result.

CASE STUDIES: PERFORMANCE OF SELECTED IRRIGATION ASSOCIATIONS

The performance of some selected Irrigation Associations (IA) is examined in this part. Irrigation associations are selected according to their size of net irrigation area. The selected IAs are as follows: Söke from Aegean Region, Plain of Çumra from Central Anatolia, Tektek from the Southeast, and Kösreli from the Cukurova Region. They all have relatively large net irrigation areas compared to other transferred schemes.

IA of Söke is in Region XXI of DSI, and it is the only IA in the region that covers 26,000 ha. It was transferred on 24.06.1998. IA of Plain of Çumra is one of the two IAs in Region IV. The net irrigation area of IA of Plain of Çumra (24,922 ha) constitutes about 42% of the region. It was transferred on 24.05.1995. IA of Tektek takes place in Region XV that has in total 15 irrigation associations. IA of Tektek (15,841 ha) constitutes about 13,4% of total region. IA of Tektek was transferred on 25.12.1997. Lastly, IA of Kösreli takes place in Region VI. Its commanded area 18,300 ha which is about 20,6% of the total area in the region. It was transferred on 28.6.1995.

Irrigation Indicators

Definitions: Net irrigation area or the commanded area occupies the area excluding the area occupied by roads, houses, cemeteries, etc. *Irrigated area* is the area actually supplied with water in a given season. *Area of first crop* denotes the total area on which crops are firstly planted and irrigated in a season. *Area of second crop* denotes the area on which the second crops are planted and irrigated after the first crops on the same area are gathered. *Irrigation ratio*[13] is calculated by dividing the irrigated area (area of first crop) to the net irrigation area. *Total irrigation ratio* is equal to the sum of irrigated area (area of first crop plus area of second crop) and irrigated area out of commanded area divided by the net irrigation area. It is observed that irrigation associations also contribute to the irrigation of land in the neighborhood that is not included in the commanded area.

A warning about the changes in irrigation ratios is necessary. It must be reminded that high irrigation ratios are not solely a consequence of the transfer because transferred irrigation associations were the ones, which were already performing high irrigation ratios before the transfer (Döker, et. al, 2003).

IA of Söke shows slightly better performance with an average irrigation ratio of 92.5% after 1998 compared to the maximum irrigation ratio of 90% before the transfer. Total irrigation ratios follow similar high percentages before and after the transfer, being on average 104,4% and 103,4%, respectively.

Excluding 2001, *IA of Plain of Çumra* displays similar performance like Söke, with an average irrigation ratio of 94%. 2001 was an exceptional year with only 48,2% irrigation ratio. If 2001 is included; the average irrigation ratio decreases to 84.8% in the considered period. Low irrigation ratio 2001 is due to an exogenous factor. Indeed, it was recorded a long-lasting drought from 1999 to 2001, and the amount of water in the reservoirs was effected negatively. This decline was felt severely by the end of the drought. In addition, the rainfall was enough and timely for the cropping pattern in 2001. This may have restrained farmers' demand for water from the irrigation association since the cereal production constituted 85% of the total area.

It seems that besides Çumra, Söke was also affected by the drought in 2001. Irrigation ratios, which do not fall below 90%, decrease sharply to 83% in year 2001.

IA of Tektek performs a relatively low irrigation ratio (69.7%) at its first year of transfer in 1998, when compared with following years with an average irrigation ratio of 91.9%. Tektek also seems to have suffered from the drought. The irrigation ratio declined from 100% in 1999 to about 87% in 2000 and 2001, and it rises back to 93.6% in 2002. The fact that the region XV displays 6% of inadequacy

[13] In the data files of IAs, irrigated area is often equal to the area of the first crop. Even if that's not the case irrigated area is used to calculate the irrigation ratio. Similarly, if irrigated area is not equal to the area of first crop, total irrigated area is calculated as irrigated area plus area of second crop plus irrigated area out of commanded area.

of water resources and the rest, 94% of other reasons; marketing, urbanization, etc. as the reason for non-irrigation supports the probable negative effect of the drought on the IA of Tektek.

IA of Kösreli displays a stable trend in irrigation ratio ranging from 95.2% to 92.2% in the last five years. Total irrigation ratio did not exceed 97.7% and it is not less than 94.7%, either.

Cropping Patterns

In the Söke Region, the share of cotton production seems to be gradually declining from 96% to 93% prior to the transfer. However, on the year of transfer (1988), cotton production jumped back to 97%, and it declined sharply to 72% in 2000. In the same year, sunflower production rises rapidly to 27%, implying a considerable substitution of sunflower for cotton. It should also be noted that before 1998 sunflower production did not exist. This substitution did not last long. In the following year, sunflower is not produced, and in 2002 it takes only a share of 5%. Cotton production seems to continue its average share of being over 90% in the following years. Moreover, corn production starts after the transfer at a moderate level of only 1% share. In year 2002, sugar beet is observed for the first time.

The irrigation O&M *in Çumra* are transferred to two irrigation associations in 1995. Hence, examining the region as a whole may give important clues about the Plain of Çumra, which is about 42% of the total region. After the transfer, cereal production displayed a fluctuating downward trend. The Plain of Çumra followed this trend with higher ratios. Cereal production in the Plain of Çumra declines from 85% to 68%, while in the region it declines from 70% to 48% from 2001 to 2002. After the transfer, the share of sugar beet area in the region increased from 10% up to 26% in 2002. Although the share of sugar beet in the region fluctuates in the last 4 years, the Plain of Çumra produces the crop at a very stable pattern of 12% share in total. In the whole region, pulses have increased its share roughly from 8% to 18%. In Plain of Çumra, in last two years, the importance of beans and vegetables and feed crop seems to increase. In year 2002, beans and vegetables are produced even more than sugar beet (16% of share) and feed crop production has taken place at about 3 % share. It can also be concluded that in year 2002 farmers substituted beans and vegetables for cereals. Lastly, after the transfer, farmers in the region do tend to decrease cereal production to produce more sugar beet and pulses, giving priority to sugar beet.

In Region XV, it is quite difficult to make comments on changes in the cropping pattern since the irrigation in the region, and hence the net irrigated area of the associations' increases over time. For instance, the area of irrigation of Kısas was 1696 ha at the beginning, but its commanded area was enlarged to 4219 ha in 2002. However, it can be said that as irrigation expands, while cereal production loses its importance, cotton increases its share. IA of Tektek follows the same trend. In addition, corn and soybean production slightly brings variety to production pattern in the irrigation area of Tektek in last two years.

In Region VI, over 90% of the total area is transferred during the last months of 1994 and in the first eight months of 1995. In the region, it is observed that the share of cotton area increased from 18% in 1994 to 42% in 1996, while the share of pulses falls over 15% in the same period. In the first year of transfer, farmers seemed to prefer cotton to corn. Share of corn fell down to 19% in 1995. However, in the subsequent years corn was preferred to both cotton and pulses. In last two years, 2001 and 2002, pulses seemed to be preferred to corn and cotton. Following the transfers in the region, cereal was not produced at all. *In IA of Kösreli*, for the period 2000-2002, cotton, vegetable garden, peanuts and corn lose their shares, however, soybean becomes the dominant crop with a share of 56%.

Sources of Income

The sources of income of the irrigation associations can be classified as: (1) Irrigation fees, (2) Membership fees, (3) Revenues from the supply of goods and services, i.e. renting out machinery and

equipment, (4) Interest income received from bank accounts, and (5) Fines especially due to the late payments.

In IA of Söke, irrigation fees gain so much importance in time that in last two years (2001 and 2002) all income consists of only irrigation fees. The total revenues from the irrigation fees seemed to decline in real terms in the period of 1998 and 2002. While the IA collected USD1,065 thousand in 1998, in 2002 only USD883 thousand is collected from irrigation fees. The irrigation association was not able to recover from the decrease in total income in 2001. The revenue in 2002 (USD883.3 thousand) was still lower than the pre-crisis level of USD1,339.8 thousand in 2000. However, it should also be added that the decline in real income in 2001 was probably as a result of previously mentioned long-lasting drought besides the economic crisis in 2001. In addition, the decline in the average irrigation fee in real terms was another factor for the decline of the revenues. While the average irrigation fee was USD3.58/decare in 1999, per decare fee in 2002 was only USD2.23. Lastly, it is nice to observe that the share of fines in total revenue was very low. Compared to other regions, it seems that, the Aegean farmers respect the payment schedules more than the rest of the country.

In IA of Plain of Çumra, besides irrigation fees, interest income and fines take a considerable share. For instance, fines were about 20% of total income in 2001. Interest income also constitutes on average 5% of total income. In year 2000, total income increased up to USD777 thousand. The total revenue declined to USD417 thousand in 2001, possibly because of the effective rain by the end of drought period, increasing rainfed cropping, and lastly, economic crisis which made average fee of water decline from USD0.99 per decare down to USD0.77. However, the recovery was quick. The total income is more than its pre-crisis level (USD797 thousand) in 2002. This recovery was mainly due to increase in total irrigated land (from 12,005 ha in year 2001 to 35,052 ha in year 2002) and increased average fee of water (from USD0.77/decare to USD1.84/decare).

In the income budget of *IA of Tektek*, interest income kept its place over the years with a minimum share of 4.92% and a maximum of 12.71% in total income. IA of Tektek also experienced a similar fast recovery like Plain of Çumra after year 2001. This was possibly related to the increase in irrigation fee of water (from USD2.56/decare in 1999 to USD3.65/decare in 2002), as well.

In IA of Kösreli, interest income lost its importance over the period. The share of interest income in 1998 was 4.13%; no interest income was gained in 2002. In the region, fines were always the second important source of income after the irrigation fees. While in 1999, the total revenue from the irrigation fees was USD1,349 thousand, it declined drastically to USD762 thousand in 2000, despite with no significant change in the irrigated area. Although, there exists no data about average fee of water in year 1999, it can be strongly claimed that average fee of water was much higher in 1999 in real terms. The irrigation association does not seem to be affected much from the economic crisis of year 2001 since its income increased from USD818 thousand in 2000 to USD850 thousand in 2001. However, the total income decreased to USD506.5 thousand in the following year, despite the increase of the average irrigation fee per decare (from USD1.82 to USD2.46) with no change in the total irrigated area.

Operation and Maintenance Expenditures

In IA of Söke, it is observed that total O&M costs increase continuously in US Dollar terms until 2002, despite an abrupt depreciation of TL in 2001. The O&M costs have increased almost seven times in 5 years' period in real terms (being USD101,830 in 1998 and USD705313 in 2002). The share of operation costs in total O&M costs decreased from 86% to 37%, while the share of maintenance costs increased from 13% to 63%. The reversal of the shares did not show a regular trend, implying a restructuring period after the transfer process. It should be pointed that while the share of operation costs in total decline during the considered period, the operation costs increased to USD258,381 in 2002, from USD88,151 in 1998.

The rise in share of maintenance costs may be considered as a normal process for the IA towards taking over full responsibility of maintenance and repair that requires higher use of labor, machinery and equipment of the IA. IA of Söke experienced an expansion in machinery and equipment

availability. Hence, the rise in maintenance costs in amount and share in total O&M costs, is signaling the fact that the transfer process is proceeding properly. Yet, it would be desirable to have the expansion of the maintenance costs coupled with no significant increase in operation costs to achieve a higher level of cost effectiveness in the transfer process.

On the other hand, the increase in the revenue of the IA was not at par with the increase in the costs. The total income of the IA was about 10 times of the costs of O&M in 1998, but this figure declined to 1.25 times of O&M costs in 2002. Similar trend was observed in income over total expenses, however, at a less severe rate. For instance, in 2002 income over total expenses is only 103%, meaning that income and total expenses were almost equal. However, this is still an improvement for case of Söke since in 1999 and 2000, these ratios were significantly lower than 100%, for instance it was 72% in 2001.

In IA of Çumra, operation costs decreased regularly both in real terms and in share of total O&M expenditures until 2001. Whereas, maintenance costs increased regularly both in real terms and share in total expenditures until 2001. On the other hand, in year 2002 share and amount of operation costs rose 12 percentile and 75%, respectively.

The share of the total O&M costs in total expenses also increased. Income figures displayed a better performance compared to IA of Söke. The ratio of income over total O&M costs showed an increasing trend in the considered period, indicating that income can compensate more of the total O&M costs over time (155% in 1997 and 361% in 2002). Similar observations can be made for the ratio of income over total expenses. The share of total expenses in income was 97% in 1997, and in the year 2002 it reached up to 353%. What distinguishes the IA of Plain of Çumra from IA of Söke at the first glance is the decreasing amount of operation costs during the period.

In IA of Tektek, the share of operation costs in total O&M costs (68,8%) was still at a considerable level in 2002 (USD332 thousand) and it was much higher than the 1998 level, when operation costs (USD75 thousand) were only 46% of the O&M costs. It seems that Tektek diverged from Söke and Plain of Çumra in these indicators. Share of maintenance costs in total O&M costs has declined from 53% in year 1998 to 31% in year 2002. As a result, the ability of income to satisfy total O&M cost and total expenses have fallen down in five years' time. In addition, the association did not show a significant expansion of the machinery and equipment. It can also be added that in years 1998, 1999 and 2000, average percentage increase in permanent personnel (112.4%) was greater than average percentage fall in real wages (32.5%).

Although *the IA of Kösreli* was transferred in 1995, maintenance costs item is still only 22% of total O&M costs. The IA still spends more on operational costs. This is probably due to lack of ownership of vehicles and other equipment. The IA does not seem to expand much in equipment items although it seems to be able to generate sufficient funds to acquire more equipment of its own. The IA has on average the best rate of income over total expenses and income over total O&M costs ratios being 316% and 375%, respectively. It did not increase the total personnel expenditures, as well. Permanent personnel increased at rate of 39% and real wages declined at about 37%.

Change in Fee Collection Rates

Collection rate is defined as fees collected in a given year (excluding fees paid for the previous years' assessments) divided by fees assessed in the same calendar year. However, *total collection rate* is defined as the fees collected in a given year (including fees paid for the previous years' assessments) divided by the fees assessed in the same year.

IA of Söke was able to collect on average 52.91% of the assessed fees in the same year during the period. However, excluding the first year following the transfer (1999 with a collection rate of 37.8%) the average climbs up to 75,3%.

In fact, fee collection rates may be misleading to check the performance of irrigation associations. For instance, the payments in all selected associations are mostly due by October, November or December, i.e. in one installment towards the end of the accounting year. A delay of even a couple of weeks would shift the fee payment to the new accounting year. For instance, the payment is due by

the end of December in IA of Kösreli and it is due by the end of November in Plain of Çumra. In Söke, the payment is due by November or December. Payment dates may be more flexible depending on the prevailing cropping pattern in the IA area. In addition, there exist also irrigation associations that receive fee payments in advance. It is necessary to consider the issues above in evaluating the fee collection figures.

Table 8 draws a better picture in fee collection performance for IA of Söke with 89%. Total collection rate is still relatively lower than the other irrigation associations. According to DSI staff, the IA of Plain of Çumra was already a very good performing unit in fee collection rates even before the transfer. However, yearly fee collection rates are in conflict with this fact, and it is obvious that yearly collection rates are misleading. Indeed, total collection rates display an average rate of 129.2%. Further, low total collection rates in years 1999 and 2000 may be related with long-lasting drought that ended in 2001. The region has been already experiencing a significant change in the cropping pattern after the transfers. Such an effort of farmers to change the cropping pattern may be supported via providing some flexibility in collecting irrigation fees, as well.

IA of Tektek displays a good performance having on average a rate of 72.11%. Minimum collection rate was 55.6% and the recorded maximum was 82% in the last five years. Total fee collection rate is also very stable with an average of 100,6%. However, it must be noted that Tektek has an important difference in fee payments schedule. Fee payments are done in two installments; one in between June and August and the other by November.

Table 8. Total Fee Collection Rates [in percentages] (Source: Irrigation Associations, 1998-2002)

Irrigation Associations	YEARS				
	1999	2000	2001	2002	Average total collection rate (4years)
	Total Collection Rate				
Söke	61,1	110	96,7	88,1	88,98
Plain of Çumra	53,1	36,2	344,01	83,4	129,18
Tektek	100	100	100,1	102,1	100,55
Kösreli	185,5	194,8	219,5	35,5	158,83

Note: No significant delay in fee payments is assumed for 1998.

Irrigation Association of Kösreli does not have stable collection rates either. It is also known that fines are the second important income item after the irrigation fees. However, average total collection rate in last four years is the highest with 158.8%.

Vehicles and Other Equipment

Each selected irrigation association had at least one computer and it seems that over years they added new ones to their office equipment. Computers are used for a number of functions. The most common application observed is that budgeting and accounting. A related application of tracking irrigation fee payments is also common together with managing the employee payroll.

All selected IAs have two-way radio systems based on small hand-held units and an unmanned repeater station. These are usually linked with local DSI networks, at least on the unit used by the chairman, and may be linked with the radio nets of neighboring associations as well.

The vehicles in the annual reports included automobiles for the use of the chairman and possibly of the general secretary, and motorcycles for the use of the field staff. However, it is also observed in one association in İzmir that purchase of motorcycles is avoided by requiring applicants for jobs as field technicians who already own a motorcycle, and the IA simply provides the fuel (Svendsen and Nott, 1999).

IA of Söke and IA of Plain of Çumra have been expanding in the ownership of heavy vehicles to be able to cope with lifting, transport, etc. in the irrigated area. IA of Kösreli and Tektek seem to be relatively stable in the number of vehicles and other equipment.

Personnel

All selected irrigation associations, except the IA of Söke, increased the number of permanent staff. In addition to expanding in vehicles and other equipment, IA of Plain of Çumra did also expand the number of its permanent staff from 2 to 21 people. However, average net salary in the IA has decreased considerably, from USD518/month to USD229/month.

IA of Söke follows just the opposite path in personnel policy from other IAs. It decreases the number of permanent personnel (57 persons in 1999 and 28 in 2002), however, increases the average net salary (USD306 in 1999 and USD325 in 2002). The rest of IAs increases the number of personnel, however, decreases the average net salary in US Dollar terms at the same time. Moreover, except IA of Söke, all irrigation associations do hire temporary workers for about 7-8 months to manage water distribution during the irrigation season.

CULTURAL HERITAGE IN ANATOLIA

The fight of mankind to improve his living conditions has given rise to many civilizations. The traces of ancient civilizations in Anatolia can be found either in caves or in sheltering rocks. Instruments made out of flint stone enabled men to make use of nature and live with it. The process starting with life in caves and primitive manual instruments then shifted to areas around larger water resources where cities and first states were established. Despite the advantages of settling along rivers, early communities also had their concerns about defense and this led them to settle also in hardly accessible areas where they could more easily defend themselves. Wells and cisterns were the simplest was of providing water to such strongholds.

It can be said that water and water culture carried mankind a significant step forward on the way of civilization. Settled living and farming were the outcomes of water and its utilization. Throughout history, cisterns and other types of storages were made to collect and keep rainwater; canals were constructed and tunnels were dug to take water from one place to the other; aqueducts were made to convey water over hilly areas; water scales were used to distribute water in settled areas. All these further enriched Anatolia as an *open-air museum*.

In the period 10000-4000 BC, there was the process of desertification upon the cessation of tropical rains in the Mediterranean area and people moved to the banks of the Euphrates, Tigris and the Nile to provide for their drinking and irrigation water needs. Communities settling along these waterways reached a rather high level of technology in the storage, conveyance and allocation of water. They were even good in infrastructure planning in the sense that they built facilities for wastewater collection and discharge that can be regarded as first step in sanitation.

The earliest of all known water facilities is the Java Dam in Mafrak (in present Jordan) built around 2600 BC to provide drinking water. A clay tablet unearthed in Nippur, in Mesopotamia, dates back to 1300 BC and shows the plan of a large-scale irrigation system (Özis, 1994). The “milometer” developed in Memphis around 3000 to measure water flow in the Nile can be found also in other places along the course of this river. In Timulat (Egypt), the first canal opened to connect the Nile to the Red Sea dates back to the reign of Zeostris the III and this canal was widened several times after. Then we see in Ninova, the capital city of the Assyrian Kingdom, a water conveyance system built in three stages to connect different regions of the kingdom. This facility dates back to BC 795-681 to the reign of Sunharib.

The oldest dam in Anatolia is Karakuyu, which was built by the Hittites during the late 2nd century BC The Hittites enjoyed a rather sophisticated environment of arts and culture mainly under the influence of Mesopotamian civilizations The remains of this dam suggest that the facility was used to irrigate Uzunyayla area. Other water facilities dating back to the Hittite era include those that can be found in Boğazköy and Gölpınar.

The Urartu giving life to Van and its vicinity with many dams, reservoirs and irrigation canals deserves being referred to as the "Hydraulic Civilization" of western Asia. These facilities dating back to the 1000 BC played important role in transition from transhumance to settled farming in Eastern Anatolia. Some of these 2800 years old facilities are being used even in our day. The Semiramid/Şamran canal, bringing fertility to Gürpınar plain through an aqueduct over Hoşap stream, as well as the Ferhat canal to the south of Lake Balık testify to the high level of water technology developed by the Urartu.

Moving to west from the Hittite and Urartu civilizations of the east, civilizations in this part of Anatolia too played a pioneering role in the development of science and culture including their water related engineering. It is safe to say that these civilizations of the western Anatolia, during Hellenistic, Roman and Byzantine periods, further contributed to the emergence of a "water culture" in Anatolia with their engineering skills. During these periods, water springs in mountains paved the way for water conveyance systems adapting to topographic features of the area and the replacement of canals by aqueducts to bring water to settlement areas. Water pooled in storages was then conveyed to settlement areas by pipes.

The antic city of Bergama in Western Anatolia was provided water by 8 water conveying systems belonging to the Hellenistic era and to the times of the Romans and Ottomans. The water conveyance system around Mount Madra, dated as 200 BC bears special significance in terms of water engineering. Another interesting facility dating back to 130 BC comprises two tunnels through which Bergama stream flows under the Serapis Temple.

The antic city of Ephesus had its water from a waterway extending 10 km long. It is also known that the area around the Arthemis Temple had its water through a reverse siphoning system. The antic city of Perge is also significant for its success in water storing and conveyance systems. The antic city used to have its water from two short cut but high capacity conveyance lines dating back to the 1st and 2nd centuries BC. 5 discrete water collection points, cisterns and canals for wastewater discharge constitute other antic water facilities of this city.

Remaining from the 2nd century BC the water conveying system in the antic city of Aspendos deserves to be called as one of the engineering marvels of antic times. The antic city of Side on the Mediterranean coast used Manavgat stream to solve its water problem. Water from this stream reached the antic city through a 30 km long canal (2nd century BC). Monumental fountains in the city helped dwellers provide easily for their water needs. Among other antic dams in Anatolia, the first one of three dams constructed in Dara near Mardin during the reign of Justinianus (527-565) is known as the oldest arch-type dam in the world. As to the Löptüğün landfilled dam near Amasya, date is given as the Byzantine era.

There is not much detailed information on many water facilities dating back to the time of the Seljuk Turks. One interesting example, however, is a bridge on the Haburman tributary of the Euphrates near Çermik dating back to 1179. The bridge also has a waterway feeding a watermill nearby. Old records on foundations testify that there used to be water facilities dating back to the same period now submerged by Altınapa and Sille dams.

In Ottoman architecture merited for its mastery of reaching fine shape and function by getting rid of trivial details, water facilities have their special place. In this context, Sinan, a celebrated architect surviving to our times with his monumental works, contributed much to the solution of water problems in İstanbul with his neatly designed waterways.

Kırkçeşme water conveyance system constructed by the Roman Emperor Theodosius (379-395 AD) is one of the three significant waterways serving to the European part of İstanbul. After

restorations introduced in Cebeciköy during the reign of Fatih Sultan Mehmet, a part of water was diverted to fountains under Bozdoğan Aqueduct. “Kırkçeşme” (“multitude of fountains”) derives from these fountains. During the reign of Süleyman the Magnificent, 33 aqueducts were constructed to mitigate then existing water shortage in the city.

In Üsküdar (Scutari) many civilian, military and religious premises were provided water through 16 independent conveyance systems built during various periods. These water facilities are fed by springs existing on the slope of Çamlıca hills. Facilities named Mihrimah, Solak Sinan, Atik Valide, Hüdai, Çinili, Aslan Ağa, Selami Ali Efendi and Cedit fed more than 150 fountains, religious lodges and palaces in this part of İstanbul.

Water storage and conveyance has always been a problem in İstanbul. The Taksim water system dating back to the 18th century is one facility mitigating this problem. This 23 km long facility has 3 water reservoirs (Topuzlu, Valide and Sultan Mahmut). During the 18th century, the facility was supplemented by what was called “Hamidiye water way” that was used mainly for drinking water supply. In the period 1554- 63, the facility was further extended by Sinan with the construction of Kağıthane water facility in Belgrad Forests.

Celebrated architect Sinan shaped the cultural topography of İstanbul with his monumental works. Sinan’s architectural contributions can also be found in Edirne, including water facilities. Sinan designed and supervised the construction of Taşlımüsellim waterways providing water to the city of Edirne from water collectors to the northeast. These waterways join near Küçül Düllük village before reaching the city. Facilities dating back to the late Ottoman era include the landfilled dam near Anadoluhisarı and Şamlar Dam in Küçükçekmece.

As a peninsula, Anatolia benevolently provided her natural resources for the inflorescence and social-economic development of many civilizations mentioned above. These civilizations in turn contributed much to the emergence of a universal culture. The task now is to add further to this culture reaching to us from the depths of ancient history.

CONCLUDING REMARKS

Turkey has implemented the irrigation management program successfully. It is obvious that the government has saved a significant amount of financial resources. Besides, water use has become more reliable and equitable. However, it must be reminded that the transfer is only the first step. The second step should be achieving the sustainability of the program. However, it is still too early to claim the sustainability of the system. Some points should be further examined. For instance, it should be questioned whether any kind of subsidy or support should be provided to irrigation associations by the government. If yes, how long and at what level should it be? Another issue could be whether the participatory approach should be applied not only for operation and maintenance, but also for new investment.

Government support is especially essential for technical advice and capacity building of irrigation associations for a certain time after the transfer in order to sustain the system. Subsidy can be provided, however, the level and type of it must be determined very well. Participatory approaches should not be limited only with O&M but also should cover new investment, especially in modernization and rehabilitation of irrigation projects. For instance, Turkey has had a small experience with two rehabilitation projects implemented by irrigation associations with the contribution of a World Bank funded project. This application could be extended (Döker, et. al., 2003).

Moreover, some measures should be taken by the government to reduce the probable negative externalities that may be sourced by high prices of energy, economic crises of the country, interest rates, etc. Environmental Impact Assessment studies for large irrigation projects have to be done and outcomes of these studies must be taken into consideration in decision-making process. Lastly, water saving and protection should be a priority in planning and designing water related projects.

REFERENCES

Belli, O. (1997), Doğu Anadolu'da Urartu Sulama Kanalları, *Arkeoloji Sanat Yayınları*, İstanbul.
Data Files of South East Anatolian Project (GAP).
DSI (1994). *Su ve Toprak Kaynaklarının Geliştirilmesi Konferansı Bildirileri*, C. 1, Ankara.
DSI (2001-2002). *Evaluation reports on irrigation schemes operated or transferred by DSI*, General Directorate of DSI, Ankara.
First National Congress of Irrigation (FNCI) (2001), *Kulturteknik Dernegi*, p: 82-92, Ankara.
General Directore of Rural Services, GDRS (2003). *Soil and Water Resources of Turkey and Erosion*, GDRS, Ankara.
Household Labour Force Survey Results (2002), *State Institute of Statistics*, Ankara.
Irrigation Associations (1998-2002). *Annual Reports,* Irrigation Associations (1998-2002).
İstanbul Büyük Şehir Belediyesi, (1987), Sinan'ın İstanbul'u, İstanbul.
İzmirligil, Ü. (1979), Side Su Yolları, *Türk Tarih Kurumu*, Ankara.
Oğuz, B. (1998), Bizans'tan Günümüze İstanbul Su Yolları, İstanbul.
Önge, Y. (1997), Selçuklu ve Osmanlı Dönemlerinde Su Yapıları, *Türk Tarih Kurumu*,Ankara.
Öziş, Ü. (1994), Su Mühendisliği Açısından Türkiye'deki Eski Su Yapıları, Ankara.
Öziş, Ü. (1995), *Çağlar Boyunca Anadolu'da Su Mühendisliği,* İstanbul.
Söğüt, H. (1996), The Future of Transfer Program in Turkey and Tendencies in Irrigation Policy, *International Seminar on Participatory Irrigation Management*, April 10-17, Antalya.
State Planning Organization, SPO (2001a). 8th Five-Year Development Plan. Report by the Special Commission on Water Basins and Management, State Planing Organization (SPO), Ankara.
State Planning Organization, SPO (2001b). *Population Dynamics and Migration Sub-Commision Report* (2001), State Planning Organization (SPO), Ankara.
Svendsen, M. and Nott, G. (1999), Irrigation Management Transfer in Turkey: Process and Outcomes, *EDI Participatory Irrigation Management Case Studies Series*, June 1999.
Uşkay, S. (1996), Turkey's Program on Irrigation Management Transfer, *International Seminar on Participatory Irrigation Management*, April 10-17, Antalya.