

EVALUATION OF WATER RESOURCES MANAGEMENT IN TURKEY

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Abstract

Integrated Water Resources Management is defined as a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. Water should be utilized in an equitable, reasonable and optimal manner in the interest of all users. Conflicting issues should be solved through cooperation among riparians in transboundary river basins. Any activity should abstain from causing any significant harm to other beneficiaries while utilizing water. Natural meteorological and hydrological conditions should be considered in developing water policy and allocating waters. Turkey lies in a semi-arid region. Precipitation is limited 5-6 months per year. Turkey is not a water rich country. Per capita water availability is 1550 m³/cap/year in 2010. 98% of the population reaches safe drinking water. Turkey is expected to be a water stressed country by 2030. 87% of the population utilizes sewerage network. Approximately 74% of water is used in agriculture for irrigation. Turkey's target is to reduce this rate down to 64% by 2030. In this study, water resources management in Turkey and problems were discussed along with EU compliance process and recommendations were provided.

Key words: water resources, management, Turkey, irrigation, environment

INTRODUCTION

In many respects Turkey has been fortunate in both her endowment of water resources and in her organizational structure to handle water. In particular, in State Hydraulic Works (DSI) the country has a major organizational asset for the development of most surface and groundwater irrigation, drainage, flood control, dams, and even the main structures of domestic water supply for all towns and cities of more than 100,000 people. This is a great potential critical mass of both responsibility and expertise, and should provide a good base for integrated water resource management in the country. In addition, Turkey is one of the world leaders in the development of Water User Associations (WUA), and in the transfer of irrigation schemes to these farmer groups for operation and maintenance (O&M). Yet,

there are several major institutional, financial, technical, and legal problems that require urgent solution for sustainable water resources management in general, and irrigation and drainage in particular. Unsolved, this will lead to deterioration of the water resource supply-demand balance, and eventually damage the welfare of large groups of people or limit their progress. Available surface water resources in Turkey have been estimated at 112 km³. Water use data (2012) show that irrigation is the main user with an estimated 29.6 km³ (74 percent of the total use), domestic uses are about 6.2 km³ (15 percent), and industry, environmental flow, and other uses account for about 4.3 km³ (11 percent) [1, 2]. Although not directly clear from this data, there are issues related to water scarcity in Turkey which will force major changes in institutional responsibilities, practices, and culture. This onset will not happen across the board in Turkey's 26 river basins (in Turkey there is also reference to 25 basins, with the

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Euphrates and Tigris considered as one), but rather river basin by river basin.

MATERIAL AND METHOD

WATER MANAGEMENT IN TURKEY *Surface Water*, the territory of

Turkey comprises 26 river basins, with a total surface area of about 780,000 km² (Figure 1). There are six river basins in the large category (>30,000 km²), 16 in the medium (10-30,000 km²), and four in the small category (<10,000 km²).

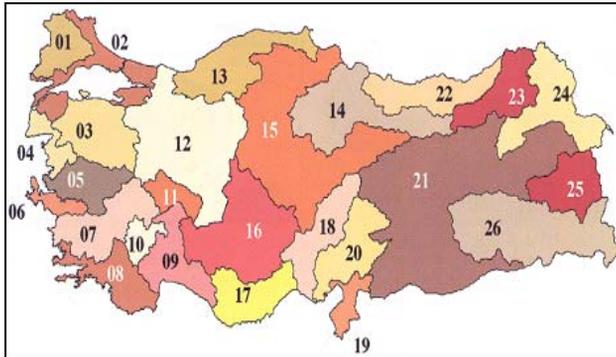


Fig. 1 Turkey's 26 Basins

Annual surface run-off is estimated at 193 km³, with nearly a quarter of the run-off from the Euphrates and the Tigris Rivers, followed by Sakarya and Yesilirmak Rivers. Including 12 km³ of groundwater and inflows from neighboring countries, about 110 km³ of water is available annually for consumption, which means about 1,700 m³ per capita. This is only one-fifth of that of countries in Western Europe, lower than the world average. The water availability is estimated to fall below 1,000 m³ per capita by 2025. Water demand is growing rapidly, with the irrigation sector presently consuming about 30 km³, or 74 percent of current total consumption, and 27 percent of annually available resources. Domestic uses are about 6.2 billion m³ (15 percent), and industry and other uses account for about 4.3 billion m³ (11 percent). If irrigation expansion continues towards the 8.5 million ha target, water demand for irrigation could increase to 71.5 km³, or 65 percent of annually available resources by 2030 (Table 1).

Considering the other competing demands for water this high use of water for irrigation may result in overuse of available water resources unless efforts are made to substantially improve the overall irrigation efficiency [3].

RESULTS AND DISCUSSIONS

The fact that Turkey is presently using only about 38 percent of its available water resources may give a false impression.

Water use varies widely by river basin, and in some basins indications are that annual abstractions are already exceeding available resources. Based on the increasing demands from all sectors, some estimates predict that available water resources may be approaching full exploitation within 25 years. It is not clear how accurate these projections are that assume continued substantial irrigation and domestic water expansion, which seems rather high. Other upper middle income countries have not seen such rapid increases as demand management measures come in.

Table 1 Water Consumption in Turkey

Year	Irrigation		Domestic		Industry		Total Demand (hm ³)
	Demand (hm ³)	% of total	Demand (hm ³)	% of total	Demand (hm ³)	% of total	
1990	22,016	72	5,141	17	3,443	11	30,600
1997	26,415	74	5,520	15	3,710	10	35,645
2000	31,500	75	6,400	15	4,100	10	42,000
2030	71,500	65	25,300	23	13,200	12	110,000

There has been a continuous expansion of irrigation over the past 26 years during which the area under irrigation more than doubled. The area developed for irrigation to date is 5.8 million ha, of which 3.5 million ha in 1,930 systems (46 percent) were developed by DSI, 1.3 million ha (31 percent) by GDRS, and the balance 1.0 million ha (23 percent) by private farmers. *Irrigation Management Transfer* Towards the end of the 1980s, concern was expressed about the relatively high investment and operational costs of irrigation development, the inadequate performance of some parts of the irrigation sector, and the relatively low irrigation ratios achieved on many schemes. This led to the development of an Irrigation Master Plan that recommended improvements in the overall approach to the development of the sector in general and in the selection of irrigation projects for future support in particular. One of the key recommendations was that DSI transfer operation and maintenance (O&M) of large-scale irrigation schemes to water users, especially in light of: (i) rapidly escalating labor costs; (ii) a hiring freeze on government agencies; and (iii) national budgetary crisis that led to a squeeze on financial allocations to DSI in general and to the O&M Department in particular. There continue to be major irrigation developments in the country, but with limits to the annual capital investment budget, completion of irrigation and drainage schemes is in general taking a long time, as too many constructions are ongoing at a given time. The chapter provides several examples of the impact on the benefits and the economics of delays in completion of construction works. The case studies show that slow implementation, with the time lag from

the main investment to the start of significant benefits stretching by many years, reduces the economic merit of packages dramatically.

The end result is that public money spent in the early years of a package's slow construction is not producing benefits until many years later. So, at any one time, the country has fewer irrigable hectares in service than it would have had if packages and their components had been constructed at the technically appropriate speed, with the same historical set of investment budgets [4].

The drip-feed way of funding irrigation development does thus not use the nation's resources in an optimum way. Operation and maintenance of irrigation and drainage systems is not sufficient for long-term sustainable use of the systems. Although O&M budgets are quite substantial, only a relatively small portion is used for maintenance of the systems. Lack of O&M and the subsequent reduction in area that can receive water is not the only reason for DSI's estimates that average cropping intensities on all irrigation schemes are 66 percent for gravity irrigation and 48 percent for pumped irrigation. Farmers opt out for other reasons as well, including sufficient rain and socio-economic reasons.

Institutional Most of the issues discussed above are caused, in part, by certain institutional deficiencies in the water and irrigation sectors that will require changes in institutional responsibilities and practices for their rectification. DSI was established in 1953 as the primary agency for irrigation development. It was mandated and therefore concentrated on developing dams and irrigation water delivery systems in Turkey. DSI's response to the growing threat of water scarcity in some river basins and the under-use

of installed systems in other areas has been to try to deliver more water through building more infrastructures rather than to identify and assess the underlying root causes. The current water situation demonstrates an orientation towards supply management rather than demand management by DSI. Currently, there is no single agency responsible for integrated water resources management in Turkey. The responsibilities for water resources management are divided among a number of government agencies, including DSI, MOEF, and local government. Under Law No. 6200 DSI is not explicitly given the responsibility for basin-wide integrated water resources management [5]. This law, which was passed in 1953, established DSI as an agency to develop the water resource, which was the priority at that time when water resources were undeveloped and in abundance relative to the population and water demands. However, while this mandate was for surface waters, it was not for groundwater where DSI by Law No. 167 has a specific responsibility for management of the groundwater resource. However, it has not been able to completely fulfill this responsibility and groundwater extraction is increasing rapidly in response to especially domestic and industrial demands in areas with shortage of surface water resources [6]. In certain areas, the groundwater level is gradually falling with little consideration as to how the ground water might be recharged from surface water supplies, or supplemented by groundwater supplies. Integration of management of surface and groundwater resources, two resources are intimately connected should be strengthened, first of all in river basins that are approaching or exceeding available renewable water resources. Surface and groundwater continue unregulated to a certain extent and there is no comprehensive system of determination and allocation of supplies. A shift to an increased focus to integrated water resources management is therefore needed. This follows developments in many other countries where integrated water resources management rather than construction of new hydraulic works has become central to economic development.

CONCLUSION

Current legal framework relevant to water resources management in Turkey is not sufficient for an integrated management. That is why, a legal regulation is needed. Standards should be established based on both qualitative and quantitative utilization purposes of water resources and all the gathered data should be collected at a single center. Currently available laws and regulations should be gathered under a single framework and a “water law” should be issued. The principle of “user pays” should be adopted, and this principle should be involved in proposed water law.

Sustainable use of water resources requires maintaining the integrity of the hydrologic whole. It is thus evident that isolated treatment of any component of the water resource system results in suboptimal, if not unsatisfactory, solutions. For this reason, an integrated approach is inevitable for the rational management of water resources. In Turkey, there is a great deal of effort in adopting and exercising an integrated approach to water resources management. However, individual elements of the water resources system could not yet be defined explicitly. To better assess and develop the water resources of the country, integrated water resources management should be adopted.

Turkey, like many countries today, faces challenges in efficiently developing and managing its water resources while working to maintain water quality and protect the environment. To add to the challenge, Turkey will need to continue to develop its water resources in order for its economic and social development to keep pace with its growing and modernizing population.

Unlike the industrialized countries, Turkey was not able to develop its water resources until a few decades ago. Consequently, water development is urgently needed in order to catch up to existing demands, and to prepare for future demands. Infrastructure such as dams, reservoirs, hydroelectric power plants, irrigation, drinking water and sanitation systems are crucial for satisfying basic human needs, the eradication of poverty, and for economic growth.

Considering the economic and social benefits to be enjoyed from water resources development and since hydropower is

renewable, non-polluting and inexpensive, its wider use should be encouraged in accordance with the implementation plan of the Johannesburg Summit. International organizations should be able to assist in financing such infrastructure in developing countries, and in arid and semi-arid regions in particular.

It is recommended that government sets up a new National Water Authority (NWA) that will focus on integrated water resources management. Two options are described: (i) the integrated model where the main water resources agency will not only deal with water resources management, but also with major tasks related to water resources and irrigation & drainage planning and development, as well as O&M. In the case of Turkey, this would mean that DSI would become the NWA; (ii) the segregated model, whereby water resources management functions are separated from design and operational functions, in part to maintain objectivity of the delicate trade-off decisions that will increasingly have to be made in allocating water use. The decision of the location of the NWA will have to be made by government.

To implement the Water Framework Directive (WFD) as well as related Directives of the EU, the government of Turkey, as mentioned earlier, needs to enact a new comprehensive water law that incorporates the requirements of these Directives. The transposition of the WFD and related directives into Turkish legislation would require the adaptation or repeal of several existing Turkish legal instruments. It is strongly recommended that each EU directive is transposed as a separate regulation as all provisions of the directives need to be fully implemented. Also, communiqués and standards should be incorporated into the regulations, as they may otherwise have insufficient legal force.

A current weakness of the Turkish system is the separation of water quality and quantity management. If the two tasks cannot be combined into one institution it is important to establish adequate mechanisms for the coordination of these two functions. This should be addressed as part of the review of the legislation. Agreement on the approach to be used for the harmonization of the Turkish water legislation with the EU legislation (e.g. a new Turkish Water Law and individual regulations

for each EU directive or amendment to existing Turkish legislation) is of high priority.

To finance the large investments required to comply with EU water legislation the participation of the private sector in the provision of the required infrastructure should be encouraged.

Agricultural sector has the greatest share among the water user sectors of Turkey. So, the utilization of tools and technologies providing effective water utilization in agriculture in well compliance with environmental regulations should be among the prior objectives of the country. Re-use opportunities of drainage and waste waters should be developed and works toward this objective should be carried out.

Selection, design and implementation of best proper irrigation methods based on land characteristics and implementation of proper irrigation programs will provide an effective water resource utilization and preservation. With the implementation of pressurized irrigation systems water loses and excessive water use and consequent negative effects on environment will be prevented. Water pricing should be based on volumetric consumption instead of crop-area basis.

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