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Setting-up a National Water Policy through Integrated Water Resources Management Strategy: Turkish Case

by

Özden Bilen

Table of Contents

1. Introduction

The size and other ***sui generis*** characteristics of water resources development projects augment the overall importance of water resources management. However, a comprehensive water resources management concept in general, is a much wider assignment than water resources planning of the basin. The view that, a plan designed for a basin or a water use should be sufficiently fitted into national plans and policies. This is a step forward from the "project oriented" water resources planning for specific needs towards broader perspectives of national development.

In most countries, water sector planning involves ad-hoc decisions and political interventions. But resource scarcity and dependence on water makes it costly to deviate from a comprehensive and rational planning process. This issue is especially important for the developing countries.

The approach on water resources management has generally being carried out from river basin to basin or in some cases from project to project on suboptimation basis. This approach may not be applicable to overall and synchronized optimization of several sectors. To assist in the decision making regarding water allocation, water utilization, quality control and other issues, more comprehensive approach is needed. Therefore, a methodology from sectoral planning to inter-sectoral planning should be introduced. This process requires identification of development objectives, integration of several aspects into water resources management and formalizing a national water policy.

2. Background

Turkey is located in the semi-arid zone of the northern hemisphere and is subject to continental climate characterized by cold rainy winters and dry summers.

The amount of precipitation in any particular region usually varies from one year to another, but over a long period the average remains relatively constant. Taken as a whole, Turkey averages about 643 mm of precipitation annually. Distribution of precipitation is quite uneven. The average annual precipitation ranges from less than 400 mm in the inland areas of central Anatolia to over 2500 mm in parts of eastern Black Sea coast.

Turkey, at a first glance, may look like a water rich country, however, water is not always in the right place, at the right time to meet present and anticipated needs. Hydrogeographically, the country is divided into 26 drainage basins. The rivers in Turkey have generally irregular regimes and their natural flows can not be taken directly as usable resources. Average annual precipitation, evaporation and surface runoff vary greatly with respect to geographical setting.

The average annual runoff of the country is 186 billion cubic meters and the total safe yield of groundwater resources was determined to be 10 billion cubic meters by means of extensive hydrogeological investigations carried out in Turkey.

It is estimated that 95 billion cubic meters of surface runoff and 9 billion cubic meters of groundwater could be technically developed for consumptive purposes.

The total surface area of Turkey is about 78 million hectares. Of this total, almost one thirds (27.7 million ha) can be classified as cultivable land and according to the recent available studies, an estimated 8.5 million ha can be potentially irrigated under present technology. This amount would likely decrease depending on water availability and economic viability.

Presently, about 3 million hectares of irrigation infrastructure has been developed by public sector and about 1 million hectares are provided supplementary water by small scale privately owned irrigation schemes.

The total area under irrigation is about 4 million hectares which includes private irrigation schemes and public schemes.

3. Institutional and Legislative Aspects of Water Management

To achieve a successful integration with water sector and other sectoral policies, changes in legislation and organization is a prerequisite.

Legislation and organization are two components of institutional framework and these two components are very much interrelated. Organizations can only be successful if they are properly empowered by legislation while legislation can only be effective if it is properly administered.

In order to apprehend the legislative arrangements in Turkey, we must look at the status of ownership of water and water rights.

3.1 Ownership of Water and Water Rights

In Turkey, development of water resources is considered within the responsibilities and authority of State. This is not only an economic necessity but also an obligation required by constitution. By Constitution enacted in 1982, all groundwater and surface waters except some privately owned small springs and waters are vested in the government in Turkey.

Although the Turkish Constitution provides for natural wealth and resources to vest in the state, the ownership regime of water resources is rather complex.

The basic principle governing surface water use rights provides that water is a public good to use of which everyone is entitled, subject to the rights of prior uses. It follows that surface water use rights are normally free of any prior authorization. If any conflict arises among users in this respect, the various customary rules and regulations which were locally developed may apply. Should this not help in resolving the matter, rights are settled by court decision.

Where prospective users intend to divert water from larger streams, the corresponding interference with existing rights is however diffused within a much larger area with a result that no user may be able to determine his claim. Such a practice is severely affecting downstream users and today, a stage is rapidly being approached where not only private but government irrigation schemes are confronting this type of difficulty in some river basins. Court adjucation in this case is rendered almost impossible because of the difficulty of identifying prior existing rights within basins overlying several provincial and district jurisdictions, to that, different interpretations of the law by different courts add substantial complexities to the problem.

As to the uses of surface waters for hydropower production and thermal waters, special legislation has been enacted which subjects such uses to the prior authorization regime. It is interesting to note that whereas private consumptive uses of surface water are not subject to any prior authorization or even to prior notice requirements non-consumptive uses such as hydropower production and fishing are subject to the concession regime.

In regards to underground water resources, a prior authorization is required for their use from the General Directorate of State Hydraulic Works. Private permits are issued annually for ground water use. There are only water use rights, and conditions are imposed regarding extraction rates and purpose of utilization. The water use rights can neither be sold nor transferred.

Ground water resources are thus better covered by law than surface water resources.

3.2 Order of Priorities

In the absence of general order priorities in Turkish Laws, these are established on a case to case basis in the right of public interest and beneficial use criteria, as well as within the general frameworks of national planning. Special legal and economic provisions therefore regulate particular orders of priority between different uses and between different existing rights.

Considering the uses of waters are regulated by the provisions of the Civil Code which does not establish priorities nor provides for the registration of water rights, priorities concerning the uses of waters are subject to special legislation and rational planning. General Directorate of State Hydraulic Works establishes priorities for the investigation development and implementation of irrigation, power generation, flood control, and river training. These priorities are based on economic and emergency factors decided by the Council of Ministers.

No general legislation to regulate the right to use public waters has yet been promulgated in accordance with the corresponding provision of the Civil Code. Special laws have however been issued for sectoral uses introducing the prior authorization system in which priorities are regulated on a case to case basis.

3.3 Laws in the Water Sector

In relation to water resources management, there are several codes in the Turkish Legislation. The list given below states the significant ones ;

6200 Coded Establishment Law of General Directorate of the State Hydraulic Works (DSI)

6200 Coded Law entered into force in 1954. This law defines duties and authorities of the State Hydraulic Works and determines its organizations.

Water resources management and nation-wide responsibility for water-sector planning is centralized within the General Directorate of State Hydraulic Works (DSI) under the Ministry of Public Works and Settlement.

According to its specific law, this organization acts as the water sector's integration to some extent, although this is not systematically established in the legislation.

167 Coded Ground Water Law

The Ground Water Law came into force in 1968, and according to this law the ground water is the sole property of the State and DSI is the only legal authority responsible for investigation, use and allocation of ground waters.

1053 Coded Drinking Waters Supply Law

Law entered into force 1968 and authorized DSI to provide drinking water to the cities having population more than 100,000 provided that the Government authorizes DSI and the concerned city council approves.

4759 Coded the Bank of Provinces Law

The Bank of Provinces was established with a mandate to assist all municipalities, irrespective of size, in the financing and construction of the most of their infrastructure works including water supply and sewerage. Law came into force in 1975.

7428 Coded Rural Area Water Supply Law

According to this law, the responsibility for supplying drinking water to the villages was given to the "State Hydraulic Works". Later on, this responsibility was transferred from State Hydraulic Works to the General Directorate of Rural Affairs.

2872 Coded the Law of Environment

This law came into force in 1983, starts from the principle of "the polluter pays" and handles the issue of environment on a very broad scope. The aim of the law, which considers the environment as a whole, is not only to prevent and eliminate environmental pollution but also to allow for the management of natural and historical values and land in such a way as to utilize and preserve such richness with concern for future generations as well.

Although there are separate enactment dealing respectively with such matters as rural and urban water supply, underground waters, irrigation hydropower,

At the national level, DSI co-ordinates water use, other agencies which either need for a potential development project or itself invest in water-sector should cooperate with DSI and must obtain for each project prior approval of DSI, concerning source of water and volume to be used.

General Directorate of State Hydraulic (DSI) is the main executive agency of the Government for overall water resources planning, execution and operation. At user level, distribution of drinking water supply and distribution of hydropower through inter-connected system are being undertaken by municipal water administrations and Turkish Electricity Distribution Authority (TEDAŞ), respectively.

3.4 Organizations in Water Sector

In Turkey, there are several governmental and municipal institutions in water-sector operating under specific laws and regulations.

The State Hydraulic Works (DSI)

This organization was established in 1954 as a legal entity and brought under the aegis of the Ministry of Public Works. Its duties are to plan, design and construct works for flood protection , irrigation, drainage, water supply and treatment. It is also empowered to plan, design and construct hydroelectric schemes. Further responsibilities of DSI include performing basic investigation (streamflow gauging, soil classification, etc.), preparation of river basin development plans, and formulation of proposals for construction, financing and subsequent operation of the works flood control and quality management, the organizational structure of water resources in Turkey is not so complex, because of the restricted number of authorities involved.

In this context, administration and nation-wide responsibility for water resources planning is to a greater extent centralized within the General Directorate of State Hydraulic Works (DSI) under the Ministry of Public Works and Resettlement.

Generally speaking it is worth noticing that perfect coordination between all activities in the water resources development required establishment of a single institution to embrace all functions. Such a management approach or mode may be practicable at relatively early stage of water resources development of a country. However, as development proceeds, excessively large and overburdened institution has become less practicable and problem arises how the functions should be subdivided in between existing and possible new institutions.

The process of redistribution of old functions, apportionment of new functions should be undertaken in such a way that minimum overlaps occur and yet providing adequate procedures for co-ordination.

In I954, State Hydraulic Works (DSI) were established to deal with almost all matters related to the water resources development but later on planning and implementation of some small scale irrigation projects which do not interfere with the large scale schemes and rural area drinking water supply projects were to be excluded from the activities undertaken by DSI and necessary amendments in legislation were made. DSI has undergone progressive changes and concentrates its human and financial resources on those areas where there is a major interest.

In this respect, experience points continuing need to review legal and organizational arrangements constantly to ensure that those arrangements keep pace with changing conditions.

Other organizations in water sector are the **General Directorate of Rural Services (GDRS)**, to carry out on-farm development works and to develop small water resources (up to 500 liters per second) for irrigation purposes and to supply drinking water to the settlements in rural areas. **The Bank of Provinces (İller Bankası)** is an executing agency for physical infrastructure and an organization for financing municipal infrastructure. **General Directorate of Electrical Power Survey (EIE)** has the responsibility for carrying out hydrological studies to evaluate the national hydroelectric potential. **Turkish Electricity Distribution Authority (TEDAŞ)** has the responsibility of generation, transmission and distribution of electricity in Turkey.

4. Integration Tools for Comprehensive Water Resources Management

4.1 Environmental Considerations

Sustainable natural resource management plays a key role in the long-term economic development of Turkey. To ensure sustainable growth, the development policies of Turkey should include environmental concerns and provide for appropriate actions. As apart of policy formulation, the Government is preparing to develop a National Environmental Action Plan (NEAP) to establish baseline environmental conditions, determine an action plan that can be integrated into the overall development program, and identify environmental investment priorities.

The Ministry of Environment (MOA) is the most significant institutional organization for environmental management as the main coordinating body. MOA coordinates all national and international activities pertaining to environment in addition to its tasks of forming an environmental policy and making legal arrangements.

With the 2872 Coded Environment Law, the MOA is charged with determining which actions will require environmental reporting, how the reports will be organized, reviewed and approved, and who will prepare the environmental reports.

In 1993, a regulation was issued concerning Environmental Impact Assessment (EIA) which states the purpose of the EIA process as follows:

1) identify and evaluate the environmental impacts of proposed public and private activities which may cause environmental problems;
2) prevent or mitigate adverse impacts; and
3) assess alternatives to the activities.

DSI has been placing great emphasis on the realization of environmentally sound projects. Environmentallv sensitive areas are being preserved and mitigation effort has been spent to reclaim those areas . A department of environment is being established within DSI to better concentrate on the issue.

In 1994, an EIA guidelines was prepared under an agreement (TCP/TUR #2252) between the Turkish Government (was represented by DSI) , FAO and United States Bureau of Reclamation (USBR) for water development projects in Turkey. The guidelines complies with Turkey's legal requirements and is also generally consistent with the EIA requirements of the World Bank, FAO, the Asian Development Bank, and the United States, Dutch and Finnish development agencies.

The said guidelines were designed to identify environmental impacts and set forth mitigation measures. The following list partially gives the likely impacts to be studied: expropriation, resettlement, land use, climate, air quality, water quality, soils, geology, mineral resources, noise, topography, hydrology, vegetation, fish and wildlife, endangered or threatened species. recreation, aesthetics, history, cultural resources, social well-being, economy, energy requirements, hazardous or toxic wastes. The impacts are classified as: (i) direct impacts, (ii) indirect impacts, (iii) cumulative impacts.

In 1993, the team responsible for the preparation of guidelines identified 5 DSI projects for pilot studies. And a workshop was organized to train DSI staff.

4.2 Financial Aspects of Water Management

4.2.1 Preparation of a Rational Financing Plan

Financial management of water sector is a fundamental part of total management structure. Financial policies could have an important influence in achieving social and resource allocation objectives. In addition to the efforts to upgrade water resources planning skills and development of policies reflecting the growth of water sector over long term, there has been a growing recognition of need to implement an investment program supported by a rational financing plan. Given the constraints on financial resources, for a rational financing plan the following points are being considered:

(i) "Core programs" of high priority investments should be developed in each water subsector (or for each agency) for which resources should be ensured especially for those dependent on local finance from the consolidated budget. The core program should be based on a "low case" or "most conservative" projection of financial resources with standby or advanceable projects identified in case resources turn out larger. Core investment program must be defended against any budgetary cuts.

(ii) Price contingency funds should be used to handle divergence between targeted and actual rates of inflation.

(iii) Investments should be programmed on a multi-year basis. This would permit more realistic phasing of project expenditures, and by giving agencies more assurance on funding availability over several years.

4.2.2 Appropriate Pricing and Cost Recovery Policies

At the United Nations Mar del Plata Water conference of March 1977, it was declared that "pricing and other economic incentives be used to promote efficient and equitable use of water" This statement underlines the importance of pricing policies to encourage efficiency in water-sector.

With respect to pricing, approaches selected will have effects on both the distribution of income and allocation of resources. Higher prices for water would induce consumers to use less water, since price will influence total usage and will affect the appropriate level of investment.

-Cost recovery of irrigation

Irrigation capital costs and operation and maintenance expenditure inquired by State Hydraulic Works (DSI) are subject to repayment in accordance with its establishment law. According to this law, a payment schedule is prepared by DSI.

Water charges include the actual cost of operating and maintaining irrigation facilities and the amount required for recovery of capital costs of such facilities, amortized over a period not exceeding fifty years. Although, certain amount of interest rate (subject to approval of Government) could be applied, in practice, no interest is charged. Furthermore, amortization charges, once they have been established, are not adopted to inflation. Only when the charges become very low, some adjustments are made, the latest in 1985.

Regarding the amortization, the areas concerned are classified in groups considering the payment capacity of farmer, geographical location, and the amount of investment.

In principle, O&M charges are set by DSI to recover 100 % of actual O&M costs of previous year and water rates are being charged on cropped-area base with different rates for different crops. However, the low rate of collection has forced the Government to accelerate the transfer of O&M responsibility (this transfer, for the time being is confined with the O&M transfer and ownership of the system remains under the government responsibility) of irrigation systems to private users (Water Users Organizations), as discussed in the 4.2.2 section of this paper. Present practices have shown that under private management, farmers' collection rate has substantially increased over 90%. And the collected fees are being used by the users to operate and maintain the system without government intervention except for close monitoring for guidance and support for the sustainability of the systems.

In the meantime, within the scope of the amendments of some items of DSI's Establishment Law, the item related with the collection and late payment of water charges has also been proposed for necessary adjustments including late payment penalty clause.

Irrigation cost recovery system, however, could be evaluated in terms of increasing the government revenues. improving the efficiency of irrigation schemes and providing more equitable income distribution.

Tariffs related to the O&M costs, are calculated and charged on the basis of area irrigated, adjusted for the crop grown for reflecting the differences in water requirement. Cropped area base charges do not lead more efficient use of water, farmers are not charged in proportional with the actual consumption. No motivation for conservative use can be achieved by this system.

The government irrigation schemes implemented and operated by DSI are financed from the national budget. This is a transfer of income from the taxpayers to beneficiaries in order to redistribute income from the urban population to the farmer. Irrigation schemes in less developed areas are charged lower rates, this provision for transfer of income from the "richer" regions to "poorer" does not help much for more equitable income distribution, since flat rates at scheme level apply all farmers without considering farm size.

-Cost recovery in Water Supply and Sewerage

Within municipalities, water charges constitute part of budgetary incomes. Tariffs for water is determined by the municipal assemblies taking into account operation, maintenance, replacement costs and amortization of capital costs over 30 years. Drinking water charges are composed of fixed term independent of consumption and variable term corresponding to water volumes consumed. Additions to the water supply tariff are made by Municipal Water and Sewerage Authorities of big cities such as Istanbul, Ankara and İzmir in order to cover sewerage and sewerage disposal costs. For example Ankara Water and Sewerage Authority charges 100 percent of the drinking and utility water tariff as sewerage costs.

4.2.3 Resource Mobilization through Private Sector Participation for Hydropower Development and User Participation in Irrigation Systems Management

(i) Private Sector Participation Models

Particular emphasis is now being placed on the mobilization of private resources for energy development which includes hydro-power generation. Policy in this regard is supported by law 3096 and 3996 issued in 1984 and 1994, respectively and these laws are supported by a series of regulations issued by a decree which define the principles of the law and provide guidelines for implementation.

Out of several potential models two emerged as most viable at present:

"Build, Operate and Turnover" (BOT)

Under this model, private investors would arrange financing, build and then operate a given facility for a certain period, after which is would be transferred to the Government. This period is expected to be about 15 years coinciding with the completion of all debt service obligations. Private investors would be responsible for putting the financing package together without a Government guarantee of loan repayment. The Government, would, however, enter into a take-or-pay agreement for the output at agreed levels of plant availability and prices based on a cost plus formula to cover operational cost and debt servicing obligations as well as provide a real return to the equity shareholders.

"Concession Agreement" (CA)

Exemplified by the present arrangements between Government and the ÇUKUROVA (ÇEAS) and Antalya (KEPEZ) utilities which are permitted, within concession areas to construct power plants and sell directly to high or medium voltage consumers.

(ii) User participation in Irrigation Systems Management

Major progress has been made on institutional and management improvement in the field of irrigation in Turkey, especially with respect to participatory irrigation management and transfer of irrigation systems full management to users (water users organizations) on a gradual and accelerated basis.

The main underlying reason for transfer program has been the O&M financial burden for DSI and the Government, which was getting unbearable and unsustainable. The O&M cost recovery, largely due to political reasons, has been unsatisfactory (about %30). Considerable increase in the cost of O&M due to the role of unionized labor further aggravated the situation. The present Government's general policy of promoting privatization was also a contributing factor.

Transfer of operation and maintenance responsibility of irrigation systems to users in DSI has started in early 50s and continued at a slow pace until mid-1993. The total area of fully transferred schemes had merely reached 62,000 ha by mid-1993. In July 1993, the World Bank's cooperation in promoting the transfer program was initiated. The progress was remarkable after that. An area of around 10,000 ha has been immediately transferred until the end of 1993 and additional area of 158,000 ha were transferred successfully by mid-November, 1994. By the end of 1994, an additional 42,000 ha is expected to be transferred. Therefore, the cumulative total will reach 272,000 ha (including large schemes covering areas of 15,000, 11,000, 8,000 hectares). According to the transfer plan, DSI is planning to turn over nearly 1,000,000 ha to user farmers by the year 2000. This figure constitutes more than half of the DSI-developed irrigated area in Turkey.

As main results: a) transfer of each ha of irrigated land to users reduces the need for the government O&M expenditures and the related cost recovery by about USD 100/year. This means that the government will save each year about USD 10-16 million until year 2000, when the cumulative annual savings will reach about USD 90 million per year; b) Water User Organizations (WUOs) have generally demonstrated the ability to operate and maintain the systems satisfactorily and assessing and collecting water fees less than that incurred by DSI.

Despite the need for improvements, considering its relatively long and generally successful experience with participatory management of irrigation and transfer of full management responsibility to users, both in gradual and accelerated manner, Turkey can be considered as a model for transfer in the region and in Asia. Some of the important features of transfer in Turkey are:

(i) transfer is not restricted to a single type of user organization. Based on the users' preference and size of the related scheme, irrigation systems have been transferred to Water Users Associations (WUAs), Municipality Water User Organizations, Village Water User Organizations and cooperatives and all these

organizations are found to be generally successful. In addition to above cited models, another participation model called participation through joint O&M and as irrigation groups is considered to be highly appropriate transitional (intermediate) organizations for gradual establishment of successful WUAs.

(ii) to avoid duplication of efforts and weakening users responsibility for managing the systems, transfer of systems is not restricted to the tertiary units or only the lower and canals. Already schemes with all related irrigation primary, secondary and tertiary networks, covering area as large as 15,000 ha have been transferred.

(iii) DSI managed to carry out the above accelerated transfer without expanding its organization and;

(iv) to contribute to promotion of participatory management of irrigation systems and transfer of full irrigation management to various types of water user organizations, in their countries the above developments in Turkey can be reviewed by the experts and policy makers of those countries who wish to promote such practices.. There are several WUOs in the country that can be visited by such persons. Turkey will be prepared such visitors by mid-1995. Initially Antalya then Adana (where large or umbrella WUOs or Federation of WUAs are expected to be formed), İzmir and Konya Regions (the four Pilot Regions for Transfer), will also be suitable sites for such visits.

4.3 Water Resources Allocation

When discussing water resources allocation, several modes could be distinguished, including respectively: **(i) intersectoral allocation and optimum utilization** which calls for allocation and reallocation and water among different uses such as irrigation, hydropower, urban water supply, in-stream recreational use, **(ii) the interbasin transfer of water** which includes allocation among places of use, involving particularly long interbasin transfers of water.

4.3.1 Intersectoral Allocation and Optimum Utilization

i) Allocation among different uses;

It is quite obvious that, water resources allocation can not be separated from economic considerations. One of the results of a transfer of water from one use to another or from one area to another is a change in economic activity, causing adjustments in different sectors of economy. For example, transfer of water from hydropower into irrigation infrastructure increases income in agriculture sector and the highest growth of regional economy might be attained. On the other hand, contribution to the national economy could be the largest, as the hydropower generation will be maximized through allocation of water from agricultural use to energy sector.

Economic analyses of water allocation for developed supplies help several alternatives emerge:

a) maximum irrigation area expansion,
b) maximum power generation subject to the implementation of only priority irrigation schemes,
c) only priority irrigation and hydropower schemes will be implemented (slower development).

These alternatives defined above could be compared by several macro indices such as incremental capital output ratio, growth rate, total public investment requirement.

Performance of the above alternatives is summarized as follow:

Alternative A

-Irrigation area will be maximized and so will be the production of most crops.

- Sustainable population will be the highest so that a large number of migrants are expected into the region, absorbing surplus labor in other regions.

-Public investment requirement will be the highest, and the investment efficiency will be relatively low..

- Growth of per capita GRP will be the lowest.

-The highest growth of the region's economy can be attained.

Alternative B

-Contribution of the national economy will be the largest, as the hydropower generation will be maximized.

-Relatively small magnitude of in-migration will occur so that the population pressure on the urban areas within the region may be more manageable

- Efficiency of public investment will be high.

Alternative C

-Public investment requirement will be the smallest, and the investment efficiency will be higher.

-Sustainable population will be the smallest, and there will be only small magnitude of in-migration.

The growth rate of GRP will be lower out only slightly, and relatively high per capita GRP can be attained.

On the basis of above mentioned case for water allocation-benefit relation, the most general approach dealing with alternative uses requires the identification of objectives of all interested parties the exploration of all alternatives which might meet these objectives, an enumeration of gains and losses to each of parties in pursuing each alternative and weighing of these gains and losses both economic and non-economic to arrive choice or course of action.

(ii) Changes in Water Allocation;

Changes in water allocation can also be brought about by new demands arising during the operation of a project.

Turkey has so far developed roughly 30 percent of its economically usable surface and ground water potential, However, the level of water usage and water resources development reached almost to its limits in Gediz and Büyük Menderes river basins, although there are still some suboptimal development possibilities. Hence, water becomes an economically scarce good having an opportunity cost at the source. How this situation came about, needs a brief explanation.

In both river basins a slow shift from dry farming to irrigated agriculture was begun in 1930's. This movement was greatly accelerated after the first half of 1950s with the initiation of General Directorate of State Hydraulic Works which was established in 1954.

Development of rivers for irrigation thereafter proceeded rapidly first through the stage of diverting run-of-the-stream flow, and thence into that of building reservoirs for storage and interseasonal transfer.

In general, State Hydraulic Works concentrated its efforts on the most attractive river-land combinations available in the downstream parts of these two rivers were generally first developed and water rights were tied up putting severe barriers in the way or new developments in the upstream reach of the rivers and in the domestic water supply of growing urban centers. Water was over allocated to irrigation uses at the expense of its use elsewhere such as urban water supply and recreational in-stream uses.

Municipalities, which were running out of ground water and urgent of domestic water supply, had been left short of surface waters in terms of quality as well as quantity.

Therefore the problem of growing municipal areas, faced with a need to increase their water supply, can be viewed as one of choosing between two alternatives such as irrigation and municipal use.. In Turkey, however, there is no any transfer of water rights from agriculture to municipal use or to higher economic uses. Moreover, water rights are acquired simply by putting water to beneficial use and are still not defined in any official or reliable way such as a permit which does define the right to some extent. At present, almost 95 percent or more of the water rights are not adjudicated.

In consequence, State Hydraulic Works were led not only to exploit marginal or submarginal opportunities as available but also generally to exploit the few better opportunities with projects of excessive and uneconomic scale.

On-going and planned water supply systems of İzmir (the third largest city of Turkey) which is located in Gediz river basin, will be much more expensive than existing facilities.

4.3.2 Interbasin Transfer of Water

Transfer of water from surplus areas to areas of water deficiency is being planned on a very large scale and becoming more common within countries and regions. Transfer of water can have large equalizing effects on the value of water and the social and economic benefits of transfers may exceed total costs.

The technological means at our disposal for large scale transfers have increased and improved considerably. However, the implementation of these projects may also change the social and economic conditions of the population in regions that supply water as well as in those that receive it. It is therefore of vital importance to study and assess all the economic, social and ecological consequences of such diversions.

With regard to the water transfer over long distances, out of several cases in Turkey, Great Melen Dam and Transmission System of İstanbul Water Supply Project is of special interest. This system will meet the medium and long term municipal water demands of a population over 10 million people until the year 2020.

4.4 Technical Integration Tools

(i) Water Sector Data Base

Hydrometric and meteorological information are, at present, stored in the DSİ files and archive. Many users, including other agencies and universities, benefit from reports, data and records dealing with hydrology. The classical data storage systems failed to meet these requirements and in response to this, State Hydraulic Works (DSI) inaugurated a modern, computer oriented data processing system for meteorological data and streamflow measurements. Coordination with other establishments collecting water resources inventory data is urged so as to make the formats compatible with data bank systems that are being used in different organizations.

Large water data processing system is undoubtedly very complex and complicated task. At a later stage a national data processing system may be established as an autonomous institution for collecting, storing and processing all information from the entire field of natural resources.

(ii) Analytical Instruments for Quantitative and Qualitative Evaluation

Mathematical modelling of water systems, as one of the advance methods of quantitative evaluation of water resources, is becoming a routine practice in water sector. These methods permit a more comprehensive examination and evaluation of management alternatives.

An actual case study, for the Sakarya River Basin in northwest Anatolia was conducted by Istanbul Technical University (ITU), with the participation of State Hydraulic Works (DSI). The main objective of this project was to demonstrate the application of modern water resource systems planning techniques that have been well developed in theory, to a real water resources planning study in Turkey in such a way that the decision makers are assisted in choosing among alternative development plans for the basin. These type of projects have largely stimulated institutional cooperation in the country. However, training in the field of systems analysis is needed.

(iii) Technological Improvements and Technology Transfer

Transfer of experience and technology and feedback among scientists and technicians and between countries to remain a major constraint in most developing countries. On the basis of past experiences, it is evident that the success of a project on water development for the planning, design, construction and operation is strongly influenced by the level of technology. Some technological requirements of water sector in Turkey could be listed as follow:

- In some flood prone basins such an Seyhan and Ceyhan river basin, development of flood forecasting and advanced warning systems for all watershed area will help to mitigate flood hazards. A study financed by Japanese Government has been started in Seyhan basin.

-A full scale research projects on 3000 hectares of land in GAP project area concerning improved irrigation techniques has already been proceeded. This pilot project aims at creating conditions for the introduction of new techniques.

-The need exists for modernization of the hydrometric network introducing remote controlled gauging stations.

-Establishment of remote sensing facilities could provide an important input to the management of water resources. In Turkey, utilization of this technology in water-sector is rather limited and needs to be developed.

- The introduction of automatic control in some existing and planned irrigation schemes can have a significant impact on reducing the losses of water improving the operation of water distribution and, in the end raising the efficiency of systems. Especially on long canals where regulation is critical, electronic or hydraulic control could help a lot for achieving optimum utilization of water. In this respect, a study on Harran main canal in Southeastern Anatolia Project (GAP) has already been initiated by State Hydraulic works. Technical support is provided by a consultant firm.

5. International Cooperation on Transboundary Water Courses

International cooperation on transboundary water courses should be handled apart from political distortions and a true scientific approach should be incorporated.

It would be useful to define water resources management as "the art of matching the supply of water with the demand while controlling the quality". In order to realize this process, we depend on two types of complementary policies (i) **supply-augmenting policies**; which include making use of storage facilities, water transfer among rivers and non-conventional water supply methods, (ii) **demand management policies**; which include making more efficient use of existing supplies through structural, operational and economic means. These two policies can be treated inseparably while setting up project alternatives and searching for optimum solutions.

Large annual and seasonal variations observed in the runoff of most large basins may make it necessary (as in Euphrates-Tigris case) to store adequate water in the upper catchments in order to allow regulated flows throughout the year and over the years. Thus, optimal runoff regulation in the basin in most cases is a prerequisite for sound cooperation. The Turkish transboundary water management policy

which calls for upstream regulation of Euphrates-Tigris basin stems from the apprehension that unregulated waters of Euphrates and Tigris would have devastating potential to riparian countries.

The possibility of supply-augmenting policies such as water transfer between basins can be sought for the promotion of regional cooperation. A good example to this idea is the prospective water transfer from Tigris to Euphrates.

With reference to the problems of transboundary rivers among riparian countries, the concept of integrated planning is merely presented in the context of resource allocation. However, the agreement on proper water allocation should be based on findings derived from a basin-wide planning process and any discussion should emphasize basin wide planning as a goal. Such a plan depends on the collection, interpretation and evaluation of basic data relating to hydrology, climate, soils and other physical and socio economic factors.

Based on the above considerations, a three-stage plan can be proposed as follows: (i) inventory studies for water resources, (ii) inventory studies for land resources, (iii) integration of the first two stages into a master plan, combining the riparian countries' resource management plans and including water transfer projects. Having mentioned stages implemented, the two extreme points of view, absolute territorial sovereignty and absolute territorial integrity must be moderated by the concept of "equitable and reasonable utilization" of a transboundary water-course with the obligation of a riparian country "not to cause appreciable harm to other water-course states.