SOUTHEASTERN ANATOLIA PROJECT (GAP) OF TURKEY: WATER RESOURCES DEVELOPMENT WITHIN THE CONTEXT OF INTEGRATED REGIONAL SOCIOECONOMIC DEVELOPMENT

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Abstract:

Water resources on a regional scale are mobilized to serve the integrated socioeconomic development of a 75,000 km^2 area in southeast Turkey. The 31 billion-dollar project comprises not only of water resources projects, but also of investments in all development-related sectors such as agriculture, energy, transportation, telecommunications, healthcare, education, urban and rural infrastructure, in an integrated manner. The project is one of the largest of its kind in the world. The water resources development program includes 22 dams, 19 hydropower plants and the irrigation network for 1.7 million hectares of land. This paper, after establishing the general development framework, deals with the water resources development aspect of the project. Approaches, studies, projects and implementations in the water resources planning-to-management spectrum are described from a sustainable-development perspective.

1. Project Area:

.GAP project area lies in southeast Turkey, covering eight provinces, corresponding to approximately 10 percent of Turkey's total population and surface area. The project area includes watersheds of the lower Euphrates and Tigris Rivers and the upper Mesopotamian plains. The total surface area is 75,000 km^2, of which 42.2% is cultivated (36% rain-fed farmland), 33.3% pastures, 20.5% forest and bush. Average gradient over 94% of the total surface area is less than 12%, which is generally accepted as the threshold for cultivability. Salinity and alkalinity problems are minimal, and soils with insufficient drainage do not constitute any major proportion. While wind erosion is minor, water erosion of moderate to strong levels are observed to a somewhat larger extent.

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The split of population between urban and rural areas are respectively 56 % and 44%, as compared to 59% and 41% at the national level. The rate of population growth in the project area is 3.4% per annum, a point higher than the national average.

Basic infrastructure in the project area is generally adequate, with 98% of all villages and rural units linked to the road network, and 95% of all villages electrified. Over 70% of rural settlements possess water supply, whereas school enrollment rates and healthcare facility use remain below the respective national averages. Urban centers, with better living standards and services attract rural population in substantial proportions and are therefore threatened by an increasingly inadequate infrastructure.

2. GAP as a Socioeconomic Development Project:

Project GAP aims at removing a socioeconomic "gap" between the project area and more developed regions in Turkey. The region's economy is dominated by the agricultural sector and agriculture is largely practiced under rain-fed conditions. The region's contribution to Turkey's gross domestic product (GDP) is a low 4%, and to the national value-added in the industrial sector is an-even lower 2%.

The region, on the other hand, is rich in soil and water resources. The Tigris and Euphrates Rivers together provide about 28% of all national water supply by rivers; the economically irrigable land area in the region amounts to 20% of that for the whole country.

In order to improve the economy of the region, mobilization of the water and soil resources on a regional scale has been planned, within the framework of integrated, multi-sectoral regional development. As such, the 31 billion-dollar project comprises not only of water resources projects, but also of investments in all development-related sectors such as agriculture, energy, transportation, telecommunications, healthcare, education, urban and rural infrastructure, in an integrated manner. The project is one of the largest of its kind in the world. The water resources development program aims at producing 27 billion kilowatt-hours of hydroelectric energy and irrigating 1.7 million hectares of land. A total of 22 dams, including the sixth largest-volume dam in the world (Atatürk Dam), 19 hydropower plants, the Şanlıurfa Irrigation Tunnel System -the largest of its kind, numerous irrigation networks, canal systems constitute the physical groundwork in water resources (Table 1).

Water resources development of this size and scale is bound to have effects and implications that go far beyond irrigation-related activities, touching every facet of life and involving all social and economic sectors. On-farm development, farmer training and extension programs, agricultural input provision, credit and marketing arrangements, agro-processing, related rural infrastructure, operation and maintenance of the extensive irrigation system, environmental protection, preservation of historical and cultural heritage,

social attitudes and expectations are some of the issues that need to be addressed in water sector.

Project planning and implementation are done based on a *Master Plan* and on an *Action Plan*. Macro-level planning and management, coordination, monitoring-evaluation and implementation in selected areas are carried out by the *Regional Development Administration*.

A comprehensive investment program is under implementation: Out of the total public sector finance requirement of 31 billion U.S. dollars, 10 billion has already been invested, one billion dollar is being spent this year.

The project will double the nation's hydroelectric production, increase the irrigated areas by 50%, more than quadruple the gross regional product, and more than double the per-capita income in the region.

Some of the larger project components are ready or near completion, such as the Atatürk Dam, which has produced over 7 billion kilowatt-hours of hydroelectric energy since it began production in mid-1992. Irrigation on a large-scale basis will start when 26.5 km-long twin Urfa-tunnel system becomes operational in 1994. A major new University has been established, a transregional highway and railroad line are being designed, and studies for an international airport are underway. Construction work continues in sectors such as agriculture, urban and rural infrastructure, telecommunications, industrial zones, healthcare and education on a regional scale.

3. Integrated Regional Development

The strategy adopted for the region's development has the following four basic components:

(i) to develop and manage the region's soil and water resources for irrigation, industrial and urban uses in an optimal manner,

(ii) to improve the land use through optimal cropping patterns and agricultural practices,

(iii) to promote agro-industries and those based on indigenous resources, and

(iv) to provide better social services, education and employment opportunities in order to keep local people where they live as well as to attract qualified personnel to the project area.

The GAP Master Plan's basic development scenario is to make the region an agro-related export base.

The project is socially justified as it is intended to significantly improve the living standards of the local people, increase the per-capita income, and

provide employment opportunities. It is also economically justified as it will fundamentally alter the economic structure from an agriculture-dominated one to a contemporary one. As a result of large-scale irrigation, agricultural production, productivity, and crop variety will increase substantially. Agricultural production estimates are given in Figures 1a and 1b, for primary and secondary products, respectively. This change, in turn, will create a chain reaction, boosting agro-related industries and services. The expected structural change as a result of project implementation is shown in Figure 2. The expected changes in the gross regional product and value added in economic sectors are shown in Figure 3.

The basic development principles in the Southeastern Anatolia Project are:

(i) Integrated, regional development as opposed to project-specific development and sectoral planning, and

(ii) Sustainable development.

GAP is considered to be one of the biggest projects in the world today. Recently, it has been rated as one of the wonders of the modern world by international media.

4. Water Resources Development

The history of efforts to mobilize water for human welfare could provide a relatively comprehensive history of civilization itself, be it irrigation, water power, navigation or flood control. Irrigation is still the major use of water and will continue to be so, in the foreseeable future. Although the principal nature of the issue remains unchanged throughout eras, the situation is much more complex in today's world. The relatively easy or manageable world of water resources development is a thing of past; our natural resources are less abundant; additional uses and a much bigger population compete for the available resources. The challenge to satisfy the need for the basic uses such as drinking, food production, and hygiene has been aggravated by new needs as a result of the sophistication of the society, high urbanization and industrialization. These are no less valid in GAP's water resources development than in any other project. On the other hand, the scale and nature of integrated development in GAP makes it essential, from planning to operation, to properly take into account all elements connected to optimality in resource use and sustainability in development, especially in water resources development.

5. Sustainability

Sustainability is not a new concept, its components and underlying ideas have been around for a long time. Once largely limited to academia and intellectia, it has now evolved into a concept that makes wonderfully good

environmental sense, but quite good economic, social, and engineering sense, as well.

5.1. Irrigation Sustainability

Sustainability in irrigation is probably one with more engineering inputs, compared to the others addressed in this paper. It involves prerequisites such as the quality of design and construction as well as proper system operation and maintenance, effective monitoring and evaluation and a commitment to improve system performance when the need is detected. Some of the external factors involved in irrigation sustainability are the quality of the upper drainage basins and implications from agricultural, environmental and spatial development policies and practices.

Some of the major problems plaguing irrigation sustainability are water losses (due to inappropriate method or technology, lack of education and training and improper infrastructure), water logging/salinity (due to excessive watering and insufficient drainage), and erosion. A major general problem is a preoccupation with "instant gratification", that is, using the available resource for water supply for quick benefits, ignoring proper infrastructure, skipping drainage, neglecting education and training. Very typical to less-developed countries, money saved from proper drainage and canal lining is spent to extend water supply, thus aggravating the problem. Other reasons are the lack of incentives for water conservation, lack of legislative or institutional arrangements, enforcement difficulties and inadequate education. We now know that, regardless of the reason, this leads to problems that are eventually a lot more expensive to solve.

5. 2. Sustainability: Agricultural System and Components

Influenced by the irrigation system performance, sustainability in producing crops that produce value added is also affected by a number of more complex and broader issues such as:

(i) markets: existence, prices and accessibility,

(ii) economics: ability to produce value added,

(iii) production system: soil quality, land-use patterns and competing alternatives, cropping intensity, and

(iv) engineering and supply system: proper infrastructure, knowledge and services (agricultural research and development, proper provision and use of agri-inputs and credit, extension and training, physical infrastructure-road networks, communication facilities, storage and transport.

5.3. Environmental Sustainability

A better understanding of the rapid deterioration of natural resources in the world and the dramatic (negative) consequences of massive development in 1950's have made the preservation and enhancement of the water-soil-air ecosystem a very high priority consideration in development.

Two important implications of environmental sustainability are water quality degradation and irrigation related diseases (crop, animal, human).

Other development-related environmental issues include air, water and noise pollution due to industrial development, urbanization, and inadequate infrastructure. Creation of large reservoir lakes and extensive irrigation schemes calls for special attention.

5.4. Societal Sustainability

The beneficiaries and users in irrigation development are people. Sustainability in this sense would require that the needs, wants, and "don't wants" of people be incorporated in the whole spectrum -from planning to operation- in an appropriate manner. The main issue here is, in broad terms, to properly understand the

- impact of development on social attitudes, and

- impact of societal expectations and needs on development

and act accordingly. Development should not bring about such easy compromises as implementing "primitive" systems to escape potential resistance or imposing values on people.

Societal sustainability concept is typically taken for granted in western countries, and is yet to be recognized in many developing countries. Nevertheless, earlier with the progress in telecommunications and information technology and now with the large-scale democratization in the world, this is bound to gain greater importance in development in near future.

5.5. Concluding Remarks

Sustainability has definitely imposed a new condition for all facets of development. It has also made it essential to adopt an integrated approach to development, as opposed to the fragmented, project-specific (or sector-specific at best) approach of the past. An immediate implication of this has been the need for interdisciplinary collaboration and for a thorough understanding of the system dynamics. Regardless of the issue or the individual situation at hand, we have to deal with or take into account a new set of concepts including environmental considerations, institutional arrangements, legislation, user participation, interagency cooperation,

education and training, research and development, use of technology not only in the design or in physical structures and equipment, but also in operation, management, monitoring, and data acquisition.

We know that sustainable water resources development can be achieved. Mistakes made in the past, in the developing and the developed world alike, provide us valuable information as to the possible consequences. To re-cite some of these mistakes:

- fragmented or project-specific approach as opposed to integrated development,
- lack of concern, legislation, institution or enforcement for water-related issues,
- insufficient or misallocated funds,
- improper, inadequate or non-existent physical infrastructure,
- lack of proper drainage,
- upper watershed degradation,
- improper maintenance, operation and management practices,
- non-use or mis-use of technology,
- lack of user participation,
- neglecting societal needs and expectations.

6. Development Approach in Southeastern Anatolia Project:

GAP is planned and implemented as an integrated multi-sectoral regional development project in which water and soil resources provide the basis for development. The project covers the development-related social and economic sectors such as agriculture, forestry, industry, transportation, health care, education and tourism together with interactions among them.

In developing the region's soil and water resources integrated planning, optimality and sustainability concepts are taken into account in the respective plans and projects as well as through a number of studies/principles:

- Canals and flumes are always lined,

- Drainage is always provided,

- Use of urban wastewater after treatment in irrigation and watering is under consideration,

- Modern technology is adopted where appropriate: pressurized irrigation, modern canal regulation with downstream control and remote supervision,

- Major model development project for management, operation and maintenance of irrigation systems under way: institutional issues, water charges, farmer participation aspects included,

- On-farm development, leveling and land consolidation to improve economic viability and to prevent salinity and water logging,

- A large-scale agrarian reform implementation is under way,

- Further water savings are aimed when appropriate such as conjunctive use, and re-use of irrigation return water,

- Major watershed rehabilitation in upper basins (World Bank funding),

- Farmer training and extension programs on large-scale basis (World Bank funding),

- Major agricultural research and development project in implementation,

- Optimal crop pattern and agricultural marketing project completed, taking into account, domestic, regional and international markets,

- Mechanization, input, storage and credit requirements are estimated and provision planned,

- All related physical infrastructure needs are estimated and construction programmed,

- Impacts on crop, animal and human health studied (GAP Health Sector Master Plan),

- Formal and vocational educational needs to serve development objectives and requirements estimated, implementation program prepared (GAP Human Resources, Education and Training Master Plan),

- Environmental effects taken into account, environmental impact assessment is under way,

- Watersheds are protected through legislation, development (especially urban and industrial) in drainage basins closely controlled,

- Societal attitudes and expectations are taken into account, extensive research and field work by sociologists conducted,

- Governments completely committed to proper completion of GAP, financing provided, institutional and legislative arrangements are made, e.g. GAP Administration has been established to plan, coordinate, monitor project activities and to control spatial development; monitoring/evaluation is followed by measures,

- Technology and modeling capabilities are vastly utilized, e.g.
  - data acquisition and monitoring,
  - use of geographical information systems in appropriate areas,
  - computer-aided manufacturing in Atatürk Dam,

- roller-compacted concrete technology in Atatürk Dam's cofferdam,
- laser-guided irrigation tunnel construction,
- hydrological and reservoir operation modeling,
- global circulation model under way to improve forecasting capabilities.

7. Conclusion:

Turkey is implementing an integrated development project based on water resources. The project will greatly enhance the living standards and income levels of the people living in a 75,000 km^2 area that corresponds to 10% of the national population and surface area. Project encompasses all sectors in an integrated and coordinated manner.

The project enjoys wide-scale political and popular support. An administration has been established specifically for project-related activities.

Water resources development takes into account sustainability requirements; engineering, environmental, social, institutional, legislative considerations are incorporated, modern technology is utilized.

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Opinions presented in this paper are those of the author and do not necessarily reflect those of the Turkish Government.

Figure 1a. Agricultural Production in GAP (Primary Products)

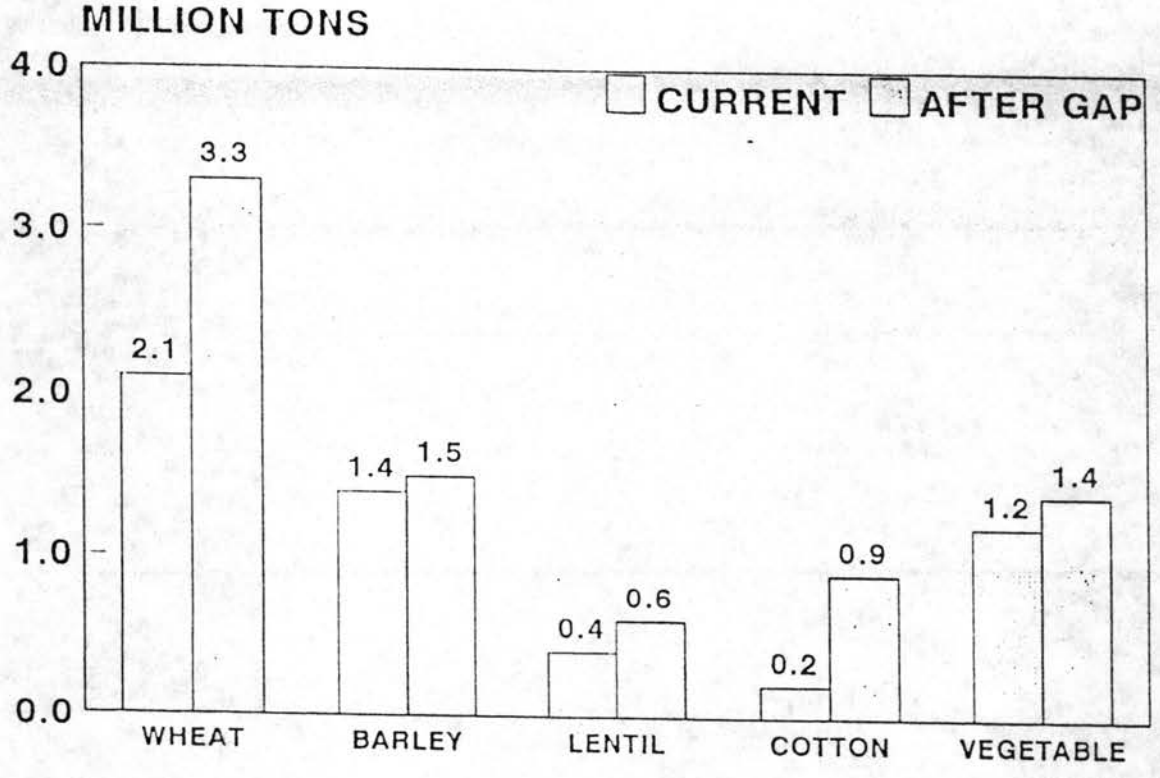

Figure 1b. Agricultural Production in GAP (Secondary Products)