VALUATION OF WATER: OPTIONS FOR SUSTAINABLE DEVELOPMENT IN DEVELOPING COUNTRIES

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Summary

While it is universally accepted that water is essential to human existence, it is also argued that it has not been correctly valued. This is because the actual value of water cannot be fully captured in commercial markets or adequately quantified in terms comparable with economic services and manufactured capital. The result is increased exploitation of water resources given the low price of water and the increasing demand due to economic and population growth. It has therefore been realized that one of the main challenges in the coming years will be sustainable water management. Given that water is an essential requirement for survival, the developing countries are facing high demand supply gap due to the scarce availability of water. It is therefore essential that appropriate water management reforms are initiated in these countries that will enable a smooth transition to a sustainable resource utilization pattern.

Environment economists are arguing that for sustainable and efficient water utilization, water has to be treated like an economic good. Proper valuation of water, reflecting its growing scarcity, and an appropriate institutional mechanism that would support the implementation of water sector reforms should be initiated especially in developing countries.

This article aims to highlight the importance of treating water as an economic good in the context of efficient management of water resources in developing countries. It attempts to explain the need for valuing water, highlights the methodology for its valuation, and provides some case studies which illustrate water valuation. It concludes that valuation of water should not only be a policy objective but needs to be implemented judiciously. Price reforms in the water sector and new institutional

structures need to be set in place especially in the developing countries so as to enable efficient water resource management.

1. Introduction

As mankind steps into the twenty-first century, the viability of the existing trend of development, industrialization, and pattern of resource use is being increasingly questioned. The existing pattern of economic growth and development has led to problems of environmental damage and degradation of natural resources. Rising population growth coupled with unsustainable economic development imposes high demands on natural resources, both in terms of quantity and quality.

Since the 1970s there has been an increased focus on the economic implications of environmental depletion and degradation. Environmental economists all over the world have developed approaches and methodologies for costing the environment and placing an economic value on it so as to reflect the scarcity of the resources. However, the most inhibiting obstacle to valuation of natural resources lies in the fact that there is not any established market for environmental assets. Therefore environmental services do tend to be undervalued, and in some cases not valued at all. The inefficiency arising out of this asymmetric valuation leads to unsustainable economic development. For example, estimating net social benefits *(of projects)* becomes difficult if environmental impacts *(such as clean water)* are not valued properly. At a national level, the GNP, which reflects a country's well-being does not actually convey the true income status of the country since the environmental depletion and degradation that accompanies economic growth is not accounted for in its accounting structure.

One of the emerging challenges in almost all the countries of the world is to achieve sustainable development of water resources in the face of continued expansion of population and economic activity. The situation of water depletion is more of a threat in the Asian countries, where large tracts of cropland are irrigated and produce food for larger populations. Public efforts to close the demand-supply gaps require large water resource development projects. While these projects provide economic and social benefits, they can also have adverse social and environmental impacts. To overcome the problem of resource constraints, small irrigation projects, which do not require huge investments, have been encouraged. However, the problem of overuse of resources has emerged, and this has resulted in problems of water quality as well as water quantity.

Theoretically, market forces are supposed to balance the demand for and supply of resources through the instrument of prices. Further, the market conditions and the prevailing market prices influence the allocation of a resource from lower to higher valued activities. Unfortunately, water in developing countries is considered more as a free common resource having almost zero economic value. This inhibits the ability of market forces to tackle the phenomenon of water scarcity.

This article aims to highlight the importance of treating water as an economic good in the context of efficient management of water resources in developing countries. It attempts to explain the need for valuing water, highlights the methodology for its valuation, and cites some case studies to illustrate water valuation. It concludes that valuation of water should not only be a policy objective but needs to be implemented

judiciously. Price reforms in the water sector as well as new institutional structures need to be set in place, especially in developing countries, so as to enable efficient water resource management.

2. Scarcity of Water Resources: An Increasing Concern

Water, said Pindar, the eminent Greek philosopher, is the best of all the things. Extensive and prolonged droughts in many parts of Asia, Africa, and the United States, have categorically demonstrated the unique position and importance of water for mankind's social and economic development. Water has become a center of controversy, as the gap between supply and demand is increasingly widening in all parts of the world, especially in the developing countries. Physical scarcity of water, arising due to the increased demand of the rising population and increasing economic growth is only one aspect of the problems associated with water. Another rising concern is the issue of economic scarcity prevailing at present. Though there may be enough water to meet society's needs, there are few incentives for wise and conservative use of the resources or for effecting efficient utilization among competing demands. It has been estimated that between 2000 and 2030, the demand for water could grow by over 650 percent. Even modest estimates project a fourfold increase. However, the extent of the problem varies between countries. It was estimated that in the late 1980s, the global average water utilization level was only eight percent. Some countries in North Africa are in the 20-50 percent utilization range. According to an index prepared by Population Action International in 1997, the basic requirement of water for domestic purposes (assumed to be only 50 liters (or 20 cubic meters) per person per day) was not available to a large proportion of the world's population in 1990.

A World Bank study in 1989 estimated the "Water Availability Index" for 22 countries. The index is calculated by dividing available water resources in a country (assumed to be constant over time) by the population. This method takes into account the level of water regulation in a county. The Water Availability Index was prepared for 1955, 1990, 2025 and 2050. Two interesting facts emerged from the study. First, three countries in the Middle East and North Africa (Algeria, Tunisia, and Israel) had much less water available per capita in 2025 than the other countries in the study, and the water available per person is also declining rapidly. These countries had between 2750-1000 cubic meters of water available per person in 1995, but by 2050 they will only have 100-500 cubic meters of water per person. Second, the other countries in the survey either had relatively abundant water supply in 1955 and high rates of population growth or moderate water supplies with little or negative population growth.

During the 1990s water shortages had reached critical magnitudes in many areas of developing countries. For example, in two metropolitan cities in India, the per capita water availability was recorded to be much lower than the 70 liters per capita per day norm as recommended for urban areas in India (without a sewerage system). (See Table 1.)

City	Availability	Demand
1.1 Bombay	13.7	180.0
Delhi	237.0	363.0
Hyderabad	65.0	130.0
Madras	47.0	200.0

Source: Individual water boards and municipalities cited in Sankar U. and Mathur O. P. (1998)

Table 1. Per Capita Water Availability and Demand in Metropolitan Cities in India (liters/capita)

Under pressure to supply adequate water, cities in developing countries are exploring sources hundreds of kilometers away and are over-exploiting groundwater, compounding the problems caused by the agricultural sector. Groundwater is now the source of four fifths of domestic water supply in rural areas in India and of about half of urban and industrial uses. The consequence, for example, is that in the city of Ahmedabad in India increased withdrawal has pushed down the water table in the centre of the city from an average of 100 feet in 1965 to a level of 300 feet in 1990. It also needs to be pointed out that water scarcity is a function not only of volumetric supply but also of quality sufficient to meet the demand. A 1998 sample survey of some of India's major rivers showed that while most could support aquatic life, they were totally unfit for drinking or even bathing. The prevailing water quality of the river Yamuna in India has been officially classified unfit even for animal drinking and agriculture use. Further, the levels of chemicals like boron and fluoride in Delhi's groundwater were found to be exceeding the stipulated standards set by the Indian Centre of Pollution Control Board.

The situation of a falling water table over a longer period of time has strong implications for agriculturally advanced regions and where crop production contributes significantly to the central revenue. Increased demand for food by the ever-increasing population has put pressure on land and water resources in particular. In India for example, states like Punjab, Haryana, Tamil Nadu, and parts of Gujarat, heavily depend on subsurface sources, especially for irrigation purposes, because of limited surface water supply. These states have documented more than 60 percent level of groundwater development The development process in these regions is marked by an over use of resources, thereby resulting in an increase in environmental costs and conflicts.

In a study undertaken by Tata Energy Research Institute, New Delhi, entitled "Green India 2047," it was estimated that the future annual incremental costs of extraction of replenishable groundwater in two districts in Haryana—Kurukshetra and Mahendragarh—are likely to be 66 and 69 million Rupees respectively. Different scenarios of future incremental costs of extraction of replenishable groundwater in overexploited areas in India yield estimates ranging from 4.9 billion Rupees to 9.8 billion Rupees a year.

The case discussed above is representative of what is actually happening in many parts

of the developing world. The increasing costs of groundwater extraction are likely to be particularly severe for small and marginal farmers. Falling water tables require greater expenditure on extraction equipment that such farmers may find difficult to afford. Apart from the economic implications of a falling water table, an unsustainable pattern of resource use may have a number of other social implications in terms of equity in availability of resources and in terms of food security to poorer farmers. Within the agricultural sector, conflicts relating to the use of water and its distribution between upstream and downstream users have been documented in various parts of the developing world. Besides this, there are concerns that an emerging water scarcity will result in other problems like loss in yields and environmental constraints like intrusion of seawater into the groundwater (aquifer) and thereby lead to several waterborne diseases.

Table 2 below shows the water supply and sanitation coverage for developing regions in 1980 and 1990. In Africa in 1990 the coverage of rural sanitation was only 26 percent while rural water supply was accessible to only 42 percent of the population. In the Asian and the Pacific regions, sanitation was accessible to only 54 percent of the total rural population compared to 65 percent of the population in the urban areas. During the ten years (1980–1990), the entire developing region's urban water availability improved by only five percent, rural water availability improved by 33 percent, while sanitation access improved by three percent in the urban sector and 12 percent in the rural sector. Therefore, it is evident that the major fundamental problems associated with water management are:

- An increasing gap between demand and supply of water.
- Decreasing usability of available water (due to pollution of surface and groundwater).
- Growing competition for water between rural and urban users.
- Competing demands between sectors.

Region/ Sector	1980				1990			
	Population 10^6	Percent coverage	Number served 10^6	Number unserved 10^6	Population 10^6	Percent coverage	Number served 10^6	Number unserved 10^6
Africa								
Urban water	119.77	83	99.41	20.36	202.54	87	176.21	26.33
Rural water	332.83	33	109.83	223.00	409.64	42	172.06	237.59
Urban sanitation	119.77	65	77.85	41.92	202.54	78	160.01	42.53
Rural sanitation	332.83	18	59.91	272.92	409.64	26	106.51	303.13
Latin America and the Caribbean								
Urban water	236.72	82	194.11	42.61	324.08	87	281.95	42.13
Rural water	124.91	47	58.71	66.20	123.87	62	76.80	47.07
Urban	236.72	78	184.64	52.08	324.08	79	256.02	68.06

sanitation								
Rural sanitation	124.91	22	27.48	97.43	123.87	37	45.83	78.04
Asia and the Pacific								
Urban water	549.44	73	401.09	148.35	761.18	77	586.11	175.07
Rural water	1823.30	28	510.52	1312.78	2099.40	67	1406.60	692.80
Urban sanitation	549.44	65	357.14	192.30	761.18	65	494.77	266.41
Rural sanitation	1823.30	42	765.79	1057.51	2099.40	54	1133.68	965.72
Western Asia (Middle East)								
Urban water	27.54	95	2616	1.38	44.42	100	44.25	0.17
Rural water	21.95	51	11.19	10.76	25.60	56	14.34	11.26
Urban sanitation	27.54	79	21.76	5.78	44.42	100	44.42	0.00
Rural sanitation	21.95	34	7.46	14.49	25.60	34	8.70	16.90
Totals for these regions								
Urban water	933.47	77	720.77	212.70	1332.22	82	1088.52	243.70
Rural water	2302.99	30	690.25	1612.74	2658.51	63	1669.79	988.72
Urban sanitation	933.47	69	641.39	292.08	1332.23	72	955.22	377.00
Rural sanitation	2302.99	37	860.64	1442.35	2658.51	49	1294.72	1363.79

Source. Gleick (1993) (from: Young L. (1996), *Water Resource Handbook*, Mc Graw Hill.)

Table 2. Water Supply and Sanitation Coverage for Developing Regions, 1980 and 1990

Because of the specific characteristics of water (see Figure 1), governments have played an active role in its management and ownership. However, all over the world, certain common problems are associated with government involvement, including fragmented public sector management, neglect of water quality (with serious health and environment impacts), and under valuation of water resources. What is essentially required is the development of a mechanism that reflects the scarcity of the resource and enables a sustainable water resource policy.

- Large, lumpy capital requirements and economies of scale in water infrastructure tend to create natural monopolies, warranting regulations to prevent over pricing, many water investments produce joint products, such as recreation, electric, power, flood control, and irrigation, making pricing and allocation decision more difficult.
- Large size and extremely long time horizons of some investments, given underdeveloped capital markets and the potential for political interference's in many water infrastructure investments, reduce the incentives for private investments in the sector.
- The various uses of water within a river basin or from a common acquirer are interdependent, withdrawals in one part of the basin reduce the availability of water for other users.
- Certain types of water activities, such as control of floods, and water-borne diseases are local public goods, which cannot easily be charged on the basis of individual use.
- Water resources are often developed because of their strategic importance for national security and regional development.
- Some regions are subject to periodic droughts, because water is essential to sustaining life, government may take control of water.

Source: World Bank, Policy on Water Resource Management, p 28

Figure 1. Special characteristics of water

3. Rationale for Valuation of Water: The Need for Price Reforms

Water was involved in one of the most famous intellectual conundrums in the history of economic thought: the water-diamond paradox. This problem was resolved in the eighteenth century with the concept of a distinction between value in-use and value in-exchange. Although its price is low, water has an enormous value in-use to humans since it is a necessity to survive, while diamonds have a high value in exchange.

Historically, water was available in ample supply and therefore was treated as a free good, and continued to remain so even with increases in population and economic growth. As a consequence, many rivers and groundwater sources have become polluted and water is now a scarce resource. Water has been traditionally provided to meet demand. However, it is becoming prohibitively expensive to resort to large-scale infrastructural solutions for providing water to meet ever increasing demands.

Effective water resource management requires that water be treated as an economic good. The 1992 Dublin statement [United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992] stipulates that, "water has an economic value in all its competing uses and should be recognized as an economic good". There is however still a debate on the theoretical and operational implications of this concept and the economic impact on the poor. Price signals have successfully helped in achieving the social and economic equilibrium for most goods. However in the case of water resources, this is completely lacking since water is perceived as too

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Glossary

Environmental Services:	Services provided by the environment like water, fresh air, etc.
Externalities:	Factors/events that occur outside the realm of the project.
GDP:	Gross domestic product of a country
GNP:	Gross national product
Opportunity Cost:	The alternative cost incurred to access the resource.
Water Availability :	Calculated by dividing available water resources in a country (assumed to be constant over time) by population.
Water Table:	Depth of groundwater level.
Water Utilization Level:	

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Biographical Sketch

Mamta Borgoyary, a programme officer in the forestry network group of the Natural Resource Management Unit. The network has been set up with the support of the Ford Foundation to provide all technical and administrative assistance to the Joint Forest Management cell of the Ministry of Environment and Forests. Her special interests include food security evaluation, environment economics (natural resource accounting, green budget, and environment taxes), natural resource management, poverty reduction strategy, economic and financial analysis, socio- economic survey/analysis, project planning and coordination, project management and evaluation (including economic and financial analysis), quantitative and qualitative research analyses.