The Role of Economics in Integrated River Basin Management

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Abstract

Insight into the full range of values of water is essential to analyse the implications of water allocation among users in a river basin on the basis of trade-off analysis that have financial, economic, and/or environmental implications for those directly concerned, as well as for society in general. It does not only support policy decisions with respect to water allocation, but also shows to what extent water allocation can be guided by market forces or requires extra management to serve social objectives. As well as economic value, the social, environmental and cultural values of water should also be taken into account, requiring that institutions be in place that are open to Integrated Water Resource Management and improved water management for society as a whole, taking account of multiple objectives.

Key words: *Water valuation, Economic/livelihood benefits, River basin management, Africa.*

Introduction

Economic literature has extensively discussed the meaning of treating water as an economic good (Briscoe, 1996, Perry *et al.,* 1997 and Rogers *et al.,* 2002). At the operational and even the policy level, however, there is still confusion about the potential role of economics in improving water management in a river basin. There is a lack of insight into the strengths and limitations of economics to improve water management in a river basin.

As the use of water by one user in a shared river basin can influence other users, it is important that water use should be carefully managed to avoid conflicts. When water in a river basin is scarce, choices have to be made on the use and allocation of water resources and the ways to achieve such allocation (i.e. the extent to which water allocation and use can be guided by market forces or requires some extra management to serve social objectives). These choices should take account of the benefits (i.e. values of water) for each user, and the costs of service provision and foregone benefits to users who do not have access to water. It is important to note in this respect that water is not only an economic good, but also a social good whose availability will serve the greater benefit of society as a whole.

Economics provides us with two contributions: a) analytical tools like cost-benefit and cost-effectiveness analyses, which require insight into the benefits (i.e. value) of using water and b) market-based instruments/mechanisms, like market-clearing prices and tradable water rights, which allow reallocation of water from lower-value uses to higher-value uses.

The objective of this paper is to study the current and potential role of both contributions to Integrated River Basin Management in Africa. Special attention will be paid to the relevance of insight into the value of water in a river basin and to values of water that go well beyond the economic domain, such as social and environmental values of water.

Methods for water valuation

In allocating and managing water resources, judgments must be made about the full range of values for all its uses. Water management decisions should be based on the economic, social and environmental values of water with a given quality and of a given quantity, available in a certain place and at a certain time. For this, it is important to reveal the hidden social and environmental costs and benefits. The values of water go well beyond the economic domain and include social and environmental dimensions (Hermans and Hellegers, 2005).

Economic values relate to the economic efficiency of water use. Several techniques are available to assess economic water values, and applications of these techniques abound (FAO, 2004). Economic valuation techniques reflect the extent to which the goods and services provided by water resources affect the welfare of society, either as direct determinants of individuals' well-being (e.g. as consumer goods) or via production processes (e.g. as intermediate goods). They are grouped here according to whether the techniques rely on observed market behaviour to infer users' value of water resource functions (indirect techniques), or on whether they use survey methods to obtain valuation information directly from households (direct techniques). Indirect approaches rely on observed market behaviour to deduce values. They include: observations based on market transactions; derived demand functions; the travel cost method; hedonic pricing approach; averting behaviour method; residual imputation approaches; replacement cost/cost savings methods; the income multiplier approach; and the dose-response technique. As it is seldom the case that such market mechanisms are in place (especially not among sectors), the value of water must usually be estimated. Historically, western water was allocated primarily in accordance with the doctrine of prior appropriation, and not by market mechanisms. There were no market prices from which to determine its 'value'. Direct valuation techniques seek to elicit preferences directly through the questioning of individuals on their willingness to pay for a good or a service. These techniques include the contingent valuation method, contingent ranking and conjoint analysis.

Although several techniques are available, some important challenges remain to be solved for empirical valuation, such as the need for improved knowledge about the relations between different water uses, especially in river basins. Estimates of water values are influenced by various factors, such as the measurement techniques employed, the nature of the data used and the assumptions made in the estimation, for instance assumptions about individual/social discount rates. Spatial and temporal aspects of water use also affect its value estimate (NRC, 2004). Irrigation water's value is a derived demand that depends on the demand for (value of) the crop being sold. The marginal value of water depends not only on the value of the crop, but also on the quantity of water used and the nature of crop yield and water response relationships. As more water is applied, the effect on yield generally begins to decline. Farmers will also be less likely to plant high value crops when there is unreliable supply, which means that values also depend on certainty of delivery.

Social values involve issues such as social equity, livelihoods, food security, affordable consumer prices, poverty alleviation, rural development, and counter-urbanization, as well as the closely related concept of cultural values. Although economic valuation approaches sometimes include a social component to analyse equity concerns related to economically efficient allocations, there is only a small body of literature that specifically discusses social valuation as a component of its own. Methods that are mentioned as possible candidates to assess social values range from stakeholder analysis and participatory problem appraisal risk assessments to multi-criteria analysis (cf. FAO, 2004). The value of water can also be derived from the opportunity cost of actual policy decisions, which reflect implicit preference values of society to allocate water according to politically defined priorities.

Environmental values focus on the value of water as an essential requirement for sustainable ecosystems. Just as with social values, the environmental component has not been explored in the same detail as the economic component in the field of water valuation. Methods are available to assign economic values to environmental goods, such as contingent valuation, travel cost methods etc. (see FAO 2004), but intrinsic environmental values are rarely assessed directly.

Values of water are often high for industrial and municipal use (\$0.3-1.0/m^3) compared to the value of water for agriculture (\$0.05-0.15/m^3), recreation and navigation. Such differences show potential benefits of transferring water between uses. The actual benefits from transfers will depend on the quantities of water transferred and transaction costs of such transfers. Transfer of a rather small amount of water out of agriculture to industry would, however, rapidly bring values of water down to agricultural opportunity costs levels.

Incorporating water values into IRBM

Integrated River Basin Management (IRBM) is Integrated Water Resources Management (IWRM) applied at basin level. Integrated Water Resources Management is a collection of management practices by water managers to improve water management for society as a whole. It requires a view of water managers that is wider and broader than the immediate objectives and goals that they are managing river basin water for. It requires coordination of the use of multiple water resources (rivers, canals, groundwater) by multiple users (agriculture industry, municipality and nature) for multiple purposes (irrigation, drainage, drinking water and flood protection). Why is IWRM needed? When water management is too focused on only one goal, problems may arise with other water users.

Water managers exist at all levels in the organizational structure. Farmers are water managers, usually with the main objectives of using water to optimize production and farm income. A farmer is managing for only one goal, which is not “integrated”. Water Users Associations are water managers at a higher level than field level, usually with the main objective of distributing water equally over farms and villages within a defined area of an irrigation system. Water Boards, River Basin Committees or Catchment Managing Agencies are water managers over a large region, and usually have the objective of distributing water equally/equitably over different sectors (urban, industry, agriculture and nature). They are by design already more reflective of the principles of IWRM. The variety of stakeholders with different objectives for water use is usually larger when considering a larger geographical area. On the other hand, when a water board is designed around an irrigation system, the danger exists that the focus of a board is oriented towards the functioning of the system for agricultural production (the reason that the irrigation system was designed in the first place) and loses its “integrating” function for the many aspects of water management.

Insight into the value of water is essential to support policy decisions with respect to the allocation of water among different sectors in a river basin, which is generally a political decision as allocation has so many implications that the uncertainties of a ‘free market’ solution are often unacceptable as judged by society. The government may attach values to allocations that contribute to the livelihoods of household and equitable income distribution and poverty alleviation, or that encourage rural development, reduce food costs, or contribute to food security. It is therefore essential to go beyond the economic domain of water valuation and to include social, environmental and cultural dimensions as well.

Insight into the various values of water also shows to what extent water allocation and use can be guided by market forces or requires extra management to serve social objectives. When there are multiple objectives or third-party effects, public intervention is often required, as markets often fail in the presence of the social objectives described above or externalities.

Payment schemes for environmental services (PES) offer a mechanism that can be applied to a river basin to translate water values into financial flows. It means that upstream farmers in a river basin are financially compensated by downstream users to maintain or modify a particular land use that affects the availability and/or quality of downstream water resources. PES schemes can help to promote the adoption of good agricultural practices through financially rewarding their positive environmental externalities. This can simultaneously safeguard water resources and food security. PES schemes can benefit poor people, contributing to food security and rural development, by generating direct payment to people in rural areas in return for water management activities that are unrecognized and unrewarded. There are different ways to organize PES schemes, for instance using land ownership or specific activities as a basis for compensation (Hermans and Hellegers, 2005).

Many of the existing schemes rely on external financial resources, which raises questions as to their ability to operate independently in the long run. Schemes that do not rely on external financial resources are usually those that are created by companies or other large users linked to or located in urban areas, such as breweries, large municipal drinking water providers or hydropower producers. In these schemes there is usually a clear link between downstream benefits and upstream management practices. Downstream beneficiaries are often willing to pay upstream farmers for the provision of water-related services. Downstream beneficiaries' willingness to pay is likely explained by the fact that the PES schemes generate private benefits, like improved water quality for downstream users or water availability for hydropower generation, that are relatively easy to translate into monetary terms. When it concerns social or environmental benefits, or when downstream beneficiaries do not have the means to pay, external funds are more likely to be needed to compensate upstream land users. The quantification of water-related benefits is needed in order to increase the transparency and consequently the feasibility of payment schemes for water-related environmental services. This should enable participants in the scheme to verify what value they get for their money.

If one regards private markets and public regulation as two ends of a spectrum for the allocation of water and water-related services, then PES systems are somewhere in the middle of this spectrum; they use a market mechanism within a clearly-defined legal framework as a fair, efficient and sustainable way for the sharing of costs and benefits of water resources management. Further down to the public end of the spectrum, one can find right-based approaches. These approaches use legal agreements, laws or treaties to ensure that water allocations within river basins meet public standards.

Water valuation as a means to support local IWRM should be stakeholder-driven, connecting water problems and solutions to stakeholder values. However, water problems are easily framed too narrowly by focusing predominantly on water, which excludes important solutions from the picture. Taking stakeholder values as a starting point, it becomes clear that problems may manifest themselves in water resources management, but that their underlying causes may lie elsewhere. Value-focused thinking leads to the identification of additional solutions that are not water-centered but value-centered (Hermans *et al.,* 2004).

The underlying dynamics of cooperation in the river basin are located in the need to balance trade-offs between the distribution of the resource, demands for it and the benefits that can accrue from its use. There is a need to shift those forces on addressing future demand scenarios from an era of supply management to policy responses.

Water allocation in African River Basins

Most of Africa, with the exception of northern and South Africa, is characterized by a limited development of water infrastructures. The number of large dams in a continent that makes up 20% of the world amounts to only 1,192 out of a total of 24,864 large dams worldwide. Likewise, the irrigated area makes up only 6% of the total cropping area (Molle, 2003). In many areas, rainfed agriculture is the sensible technology – e.g. in Uganda and Rwanda. There are various explanations why irrigated area is limited in Africa. First of all, the costs of investments are high, as all infrastructure has to be imported. Costs seem to be three times higher in Africa than in Asia. Secondly, operation costs are high, as there is often a rather large distance between the water source and the irrigated area. Thirdly, irrigation is often not economically viable, due to the decline in crop prices in recent years. Finally, nobody is able to pay for investments and there is limited capacity to manage. These factors have constrained large-scale development of water resources. Generally the basic allocation of water among sectors and countries is a political decision, since allocation has so many implications that it can often not be left to the free market. The way water is currently allocated in the Nile and Okavango River Basin is described below.

Nile River Basin

The Nile Water resources are a principal factor in the livelihoods of present and future Nile basin generations, generating public discussion on management and development scenarios. The Nile Basin Initiative (NBI) was established in February 1999, after intensive dialogue and consultation among all the countries within the Nile river basin. The countries made this decision after realizing that only cooperation could unlock development potential and establish an environment of development seeking win-win benefits. Since the formation of the present NBI there has been growing interest in public discussion, with divergent views necessitating regular clarification
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The objectives at the heart of the NBI processes are: i) to develop the water resources of the Nile basin in a sustainable and equitable way to ensure prosperity, security and peace for all its peoples; ii) to ensure efficient water management and optimal use of the resources; iii) to ensure cooperation and joint action between the riparian countries, seeking win-win gains; iv) to target poverty eradication and promote economic integration; and v) to ensure that the program results in a move from planning to action.

With the commitments the NBI is getting from all the participating countries and donor partners, it is believed that the Nile Basin countries are on the right track to achieve these objectives. Basin countries have agreed on a common vision that seeks to “achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources”. Within the same five years since the establishment of NBI as a transitional institutional arrangement, the Nile basin countries have also been steering another track which is the searching of an appropriate Nile Basin Cooperative Framework. This is a legal-institutional framework under which the joint developmental programs put in place by the NBI will operate.

Okavango River Basin

Water allocation in the Okavango River Basin is currently not guided by market forces, but by an integrated initiative OKACOM (Permanent Okavango River Basin Commission). The classic elements of a water allocation struggle are in place in the Okavango River Basin (ORB); competing demands set against the backdrop of a valuable ecosystem. Socio-economic pressures on the basin in the riparian countries Angola, Botswana and Namibia may result in irretrievable environmental damage. The two downstream riparian countries – Namibia and Botswana – are extremely arid. The Okavango river is the only exploitable perennial river that flows thought the territories of both countries and is therefore strategically important. Angola, the upstream riparian country, is relatively water rich. Angola has, however, been at war for almost three decades, first in a war of independence, then a civil war that destroyed much of the country's infrastructure. The recent end of the civil war now enables Angola to address the needs of its citizens.

The three countries are at different levels of social, political and economic development, and each country has different priorities and objectives in terms of its future needs for water. The economic polarity in the basin is clearly evident: Angola has a Gross National Product of $500 per capita, Namibia has $1,960 per capita and Botswana, $3,630 per capita in 2001. The implications of economic differences between states are particularly important for understanding how benefits accrue from water usage – to which sectors and to which states and how the sharing of benefits can best take place. In the Okavango basin, the economy does not rely so much on agriculture, with Namibia having the highest agricultural contribution at 11.3% of Gross Domestic Product in 2001, followed by Angola with 8% and Botswana with 2.4%. The agricultural demand for water can increase, if Angola begins to develop its irrigation potential on key watersheds.

The total volume of water needed within the catchment during 2000 was estimated at 23.3 million m^3/year. Consumptive needs (excluding water needs to maintain ecosystems) of Angola would require 60%, while Botswana and Namibia would need 18% and 22%. The combined water requirement of the three countries in 2020 would be equivalent to 300 million m^3/year. Consumptive needs of Angola would be 40%, while Botswana and Namibia would need 18% and 42%. The growing demand can be ascribed to the expected increase in population, growing industrial activities, development of Angola and demand from the environment. Not only is the ecological integrity of the Okavango delta a major international issue, but tourism development of the resources is an issue of importance for Botswana. For Namibia, the need is mainly for industrial and municipal water, particularly in the central part.

Agreement is required over the sharing of both the benefits and associated liability of the basin's water resources through joint management. In 1994, Angola, Botswana and Namibia established OKACOM to investigate ways to accommodate the legitimate water needs of the three countries in a sustainable manner, and to collaborate in the management of the basin's water resources in general. OKACOM is a proactive initiative and was not imposed on the basin state by any external agency. It is a legitimate intergovernmental agency responsible for the management of the Okavango River Basin. The objective is to act as a technical advisor to the three contracting parties on matters relating to the conservation, development and utilization of the water.

In 1995, OKACOM declared a commitment to the implementation of an integrated management plan (IMP) for the whole basin. The riparian countries are working towards the implementation of the IMP; a comprehensive study of alternative management options and a detailed environmental assessment of each option, to provide essential background for negotiating the equitable and reasonable allocation of water between the Okavango Basin countries. This process will weigh the legitimate water supply needs and opportunities of the countries against the preservation of the unique Okavango Delta. Under OKACOM, all transboundary water issues will be discussed through inter-ministerial representation, including issues of prior notification and other matters. The failure of OKACOM to bring forth a timely agreement between the riparian countries, and one that is endorsed by a broad range of stakeholders, will affect the Basin. OKACOM reduces the conflict potential by institutionalization and procedures, thereby creating confidence and reducing uncertainly.

It becomes clear that the current and potential role of market-based instruments, like market-clearing prices and tradable water rights, in water allocation in African river basins is and will be limited, as society may prefer to allocate water in ways that are inconsistent with the likely outcome of a free market. There are often multiple objectives (an efficient allocation is not always politically acceptable). It may, for instance, trigger socially undesirable changes in income distribution, especially when sectors or downstream and upstream riparian counties in a River Basin are at different levels of development. The Nile Basin Initiative and OKACOM are both initiatives that aim to agree the sharing of the basin's water resources through tradeoffs that take account of the financial, economic, and/or environmental implications for those directly concerned, as well as society in general.

Conclusions

An important conclusion of this paper is therefore that it is hard in practice to solve issues which are essentially political in nature 'by' economics (i.e. by means of economic instruments). Such issues can just be better understood 'through' economics (i.e. though analytical tools), which requires insight into the values of water. Insight into the full range of values of water can support political decisions.

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