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Developing economic arrangements for water resources management – the potential of stakeholder-oriented water valuation

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Developing economic arrangements for water resources management – the potential of stakeholder-oriented water valuation

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Abstract

As water is increasingly recognized as a scarce resource, the use of economic arrangements for water resources management seems increasingly promising. Experiences show that economic arrangements can contribute to a more efficient use of water resources but only if specific conditions are met, related to a well-functioning institutional framework and regulations that ensure that the use of economic arrangements is balanced with broader societal objectives. One of the remaining questions is how to replicate the existing cases where economic arrangements are successfully used in water resources management in other areas where the conditions seem promising. Therefore, this paper reviews three cases in the USA, Ecuador and Australia where economic arrangements have been successfully applied, focusing on the processes that have characterized their evolution. Based on these cases, it is concluded that stakeholder-oriented valuation can offer useful support for the development of economic arrangements for water resources management and an approach for such stakeholder-oriented water valuation is briefly outlined and illustrated.

Keywords: economic arrangements, water markets, water valuation, stakeholder processes, stakeholder-oriented valuation

Introduction

Water is increasingly recognized as a scarce resource in a growing number of regions. Numerous countries are expected to experience structural water stress, whereas numerous others are facing problems in securing sufficient water resources during occasional periods of drought. Also polluting activities and deteriorating water quality threaten the reliability of water supplies and contribute to the scarcity of freshwater resources of sufficient quality. Water scarcity may be related to physical scarcity of water resources, it may be due to scarcity in financial means to develop infrastructure to access and distribute water resources, it may be induced by poor management of existing infrastructure or it may be caused by inadequate (enforcement of) institutional arrangements for the allocation of access rights to water resources and inadequate arrangements for pollution control.

The increasing awareness of the scarcity of water resources has led to the adoption of the principle that ‘water is an economic good’ as one of the four Dublin principles in 1992, which are widely accepted as the basis for integrated water resources management (IWRM). Economics deals with the allocation of scarce goods over various competing demands and therefore this view of (scarce) water resources as economic goods seems to make good sense. The focus of various OECD studies on ‘making markets work for water management’ and on the use of water pricing is in line with this (OECD, 1999, 2002, 2003), as well as the

focus of the FAO/Netherlands Conference on Water for Food and Ecosystems on the 'new economy' as one of its main themes (FAO/Netherlands, 2005).

Using economic arrangements for water resources management seems promising but is by no means easy. Experiences show that economic arrangements need to be embedded within an appropriate institutional framework and that the objective of economic efficiency needs to be balanced with broader societal objectives. As the interest in market instruments has grown, more insight has been gained in the conditions within which they may or may not be successfully applied for water resources management. However, the question remains how to replicate the existing cases where economic arrangements are successfully used in water resources management in other areas where the conditions seem promising. Therefore, this paper sets out to review some of existing cases where economic arrangements have been successfully applied, focusing on the processes that have characterized their evolution.

Economic arrangements for water resources management

Water as an economic good

Water is a valuable resource, but its value is rarely reflected in monetary terms. Using economic arrangements in water management can be useful as a means to capture certain important values in cash flows and to allow economic exchange mechanisms to support the allocation of water resources and the associated costs and benefits among stakeholders. Examples of such economic arrangements are for instance payment schemes for environmental services (FAO, 2002, 2004c), water quality trading schemes (EPA, 2004), green water credits (Dent, 2005) and water markets for the trading of water rights or entitlements (Kloezen, 1998; World Bank, 1999). The use of such economic arrangements and market approaches is expected to lead to a more economically efficient allocation of water resources as compared to more administrative allocation mechanisms. Especially market arrangements are believed to provide a more flexible allocation mechanism that also provides economic incentives to water users to use water resources in an economically efficient way (Briscoe, 1996; Kloezen, 1998; World Bank, 1999; Bjornlund and McKay, 2002).

Although the available examples show that economic arrangements can be successfully applied to deal with scarcity issues in water resources management, various authors have convincingly argued that water is not an ordinary economic good (Perry *et al.*, 1997; Savenije, 2001). One should recognize that property and user rights may be complex, that physical characteristics often hinder transfers of large water volumes from one place to another and that water is a non-substitutable resource. Although these complexities may be less present in certain parts of the drinking water industry, they certainly do apply to agricultural water uses (Savenije, 2001). In economic terms, water resources are neither purely public nor purely private goods and they are mostly non-excludable but rivalrous in consumption; in principle, everyone is able to withdraw water resources from a shared base, or everyone is able to degrade the resource base through polluting activities, and when one person has used or degraded a given quantity of water, this water is no longer available in this quality for other users. This means that water resources are more appropriately classified as common pool resources (Kaul *et al.*, 1999).

Balancing economy and institutions

The fact that water is a common pool resource implies that market failures are likely to occur when using economic arrangements for water management, which means that these arrangements might lead to outcomes that are undesirable from a societal perspective (Hellegers and Perry, 2004). Broader societal interests require that other values be taken into account beyond mere market values, such as food security, conservation of ecosystems, employment, balanced rural-urban development, protection of vulnerable groups, etcetera. Thus, the successful application of economic arrangements for agricultural water

management is not straightforward but needs to be balanced with the use of institutional arrangements to safeguard broader societal interests and to reduce or mitigate the negative impacts of market failures (Bjornlund and McKay, 2002; Hellegers and Perry, 2004). In other words, water markets are by default *regulated* markets.

A review of institutional frameworks in successful water markets confirm the need to combine economic, and institutional arrangements and indicates some of the institutional factors that are likely to support successful and sustainable application of economic arrangements in water resources management. These include factors that are equally important for both the introduction of market arrangements as for other administrative allocation systems, such as active water user participation, with structures that provide transparency and accountability among users, an administrative system that registers and enforces timely water deliveries and a well-maintained water delivery infrastructure (WorldBank, 1999). This implies that the lack of well-functioning institutions cannot simply be bypassed by the introduction of market arrangement, but also, that the lack of well-functioning institutions should not necessarily be a reason to refrain from the use of economic instruments altogether. When functioning institutions are absent, institutional strengthening is anyhow needed for improved water resources management.

Nevertheless, there are some additional requirements when one prefers an economic over a more administrative approach. These include the need for transferable water property rights and water allocations (in the case of water markets), for information and transaction mechanisms to facilitate economic transfers and for a mechanism to deal with externalities, to negate the effect of third party interests or to mitigate negative impacts which might occur (Perry et al., 1997; WorldBank, 1999; Bjornlund and McKay, 2002; Hellegers and Perry, 2004).

The process leading up to the successful introduction of economic arrangements in water management.

Although some knowledge is now available on the institutional requirements for the use of economic arrangements in water management, still little seems to be known about the processes that precede the successful introduction of such economic arrangements – successful here meaning that the introduced arrangements promote a more economically efficient allocation of water resources, in a sustainable way, and without compromising important social, cultural and ecological values. A better understanding of the processes behind the success stories will help to draw some lessons on what is needed to improve the development of successful and sustainable economic arrangements in other places. What is the process that leads towards the successful introduction of such arrangements and how can it be supported?

Without pretending to be exhaustive, three fairly recent cases are discussed where economic arrangements have been introduced for water resources management: the New York City Watershed Agreement in the USA, the ‘fondo ambiental del agua’ in Quito, Ecuador and water rights trading in the Murray-Darling Basin in Australia. These cases are generally considered to be successful, as illustrated by their inclusion in the recent Millennium Ecosystem Assessment Water report (MA, 2005) and by citations in various other international publications as good examples, as the coming sections will illustrate. They show that economic arrangements can be successfully applied to water resources management, linking the provision of good quality water resources to financial flows between beneficiaries and providers. In all three cases economic arrangement were introduced fairly recently, which is likely to increase the relevance of insights into the processes that lead to their adoption for future replications.

The processes behind the introduction of economic arrangements in water management in cases in the US, Ecuador and Australia

The New York City Watershed Agreement

Description of the NYC Watershed Agreement
New York City (NYC) relies on the provision of clean water from upstate watersheds for the water supply of about nine million people. In order to protect the source and to maintain the quality of its drinking water, the city has reached an agreement with the upstream watershed communities to finance the implementation of measures that will help control pollution from agricultural and domestic sources. Under this agreement, New York City makes funds available to the watershed residents for the implementation of best management practices on farms, the upgrade of wastewater treatment facilities, the rehabilitation of septic systems, the improvement of storm water runoff systems and the acquisition of land from upstate landowners on a voluntary basis (NRC, 2000; Platt et al., 2000). This agreement costs New York City approximately US$1.5 billion over ten years (NRC, 2000).

The funds are administered by the Catskill Watershed Corporation, which is a non-for-profit corporation established under the agreement to administer programs for the watersheds. It includes members from the watershed communities, as well as representatives of state and city government. A Watershed Agricultural Program has been incorporated into the agreement, administered by a council composed of farm, agribusiness and environmental leaders, to review, approve and support efforts on individual farms to improve the water quality of surface and groundwater resources (Platt et al., 2000).

This New York City Watershed Agreement has received considerable attention as an 'innovative set of economic alternatives for protecting water quality for one of the world's largest public water systems' (WWAP, 2003), a 'turning point' for valuing ecosystems services (Economist, 2005), and 'a prototype of the utmost importance to all water supply managers' (NRC, 2000). It can be regarded as one of the first payment schemes for environmental services (PES) and thus is of considerable importance. Currently, there is much interest in the use of such PES schemes to support water resources management. PES schemes are flexible compensation mechanisms by which the providers of environmental services are compensated by users that benefit from these services. PES schemes in watersheds usually involve the implementation of financial mechanisms to compensate upstream communities for activities that are expected to maintain or improve the availability and/or quality of water resources for downstream uses (Kiersch et al., 2005).

Process leading to the Watershed Agreement
The process leading to the New York City Watershed Agreement was triggered by the Surface Water Treatment Rules that were issued by the federal Environmental Protection Agency (EPA) in 1989. These rules were meant to ensure the safety of drinking water by requiring filtration of water from surface water sources, unless it could be proven and guaranteed that the surface water sources met very high water quality standards. As New York City was relying on surface water reservoirs for its drinking water, which was currently not filtered before distribution, the new federal rules implied that the city would possibly have to build a filtration plant for its drinking water in order to safeguard public health. This would costs some US$ 6-8 billion, as well as some US$ 300 million operating costs annually according to 1993 New York City estimates (Platt *et al.*, 2000; NRC, 2000).

In order to avoid filtration, New York City had to show that the high quality of the water from the watersheds could also be guaranteed for the year to come. Therefore, New York City started cooperative efforts to protect its watershed together with the local governments and farmers. In 1992 the Watershed Agricultural Program started as a cooperative program between the City's Department of Environmental

Protection and farmers in the watershed. Also in 1992, Whole Community Planning was started as a platform for negotiations between NYC and the communities on maintenance of water quality standards.

However, by the end of 1993 the cooperation between New York City and the watershed communities ended abruptly when New York City presented its proposal for meeting the filtration avoidance requirements. These plans consisted of new watershed rules and regulations[1] and the large-scale purchase of lands to prevent further degradation of water resources in the watershed. These plans were considered unacceptable by the watershed communities, who feared the plans would impair economic development and reduce property values. In December 1993 the Coalition of Watershed Towns filed a lawsuit against New York City to prevent it from executing its plans. This led to an impasse in efforts to reach an agreement about a watershed management plan which lasted for over a year, until the Governor of New York State intervened in April 1995 (Platt et al., 2000). The negotiations that started in 1995 resulted in an agreement in principle later that year: "There were more than 200 meetings, many of them bitter and unproductive. But in the end – the last details were worked out at 4:20 yesterday morning – the combatants agreed on a plan." (NYTimes, 1995). In January 1997 the final Memorandum of Agreement (MOA) was signed and formally executed.

Conclusions from the case

In the case of the New York City Watershed Agreement, the establishment of an economic payment scheme was the result of a difficult negotiation process, which eventually led to an agreement on specific types of activities to be included in the payment scheme. New York City was a key player in this process, combining significant economic and political weight in the region with a clear motivation to avoid an enormous investment in a filtration plant for its drinking water.

Fondo ambiental del agua (FONAG) in Quito

Description of the FONAG

The Quito valley is one of the most densely populated areas in Ecuador, including the Quito metropolis with more than 2 million inhabitants. It faces large water related problems because of the high water demands combined with contamination of limited water resources. In Quito, a water protection fund, 'fondo ambiental del agua' (FONAG), has been established to collect money from the downstream beneficiaries of water related services in the Quito metropolis to provide donations to the national park administrations and to support local programmes of interest to FONAG in the watersheds that supply water to Quito. These activities include reforestation, environmental education, surveillance and monitoring of water quality, investigation of sustainable community production alternatives. Although at this point it remains difficult to quantify the impacts of these projects, some conditions have been laid out to ensure that funds are spent wisely, including limits in the amounts of money that can be spent on the management of the fund and on studies (Lloret, 2005). The FONAG should help to safeguard downstream interests, consisting of water supply for the city of Quito, including drinking water for households and water for industry, and power generation in a hydropower reservoir.

Membership to FONAG is on a voluntary basis and consists of both public and private organizations, who entered into a long-term agreement. The diversity of members and their long-term commitment is considered to be one of the strong features of the fund. It means that FONAG is not constrained by the many rules and regulations that apply to public agencies, making it for instance easier to attract foreign donor investments, while the fund's (semi) public members and its constitution provide safeguards that the fund's activities are beneficial to public interest.

[1] Based on the State Public Health Law, NYC has the authorization to make watershed rules and regulations to protect its drinking water supply from contamination, although these rules are subject to the approval of the State of New York.

FONAG is, just as the New York City Watershed Agreement, another example of a PES scheme and during recent years, many similar payment schemes for environmental services have been implemented in the Latin American region (FAO, 2004c; Kiersch et al., 2005). The FONAG features in many of the recent overviews of payment schemes for environmental services, from an article in the Economist (2005), to the Millennium Ecosystem Assessment (MA, 2005), the Katoomba Marketplace (Katoomba, 2005), recent work by FAO (2002, 2004c) and the FAO/Netherlands Conference on Water for Food and Ecosystems (Lloret, 2005).

Process leading to the establishment of FONAG

The water supply of the city of Quito originates mainly from two watersheds located in the Cayama-Coca (4 000 km²) and Antisana Ecological Reserve (1 200 km²) in the Andean mountains. Although both areas are under environmental protection, the watersheds are threatened through several land uses such as agricultural production, extensive livestock grazing with impacts on both water quality and quantity for drinking and irrigation water use, power generation, and recreation. Destruction of forests and grassland (*páramo*) which contributes to the degradation of the high plateau is assumed to affect the stream flow causing floods in winter and drought in summer (Kiersch et al., 2005).

To ensure the conservation of the water resources in the watersheds for the drinking water supply of Quito, the Nature Conservancy (TNC) and the Fundación Antisana, a local NGO, launched the idea in 1997 to establish a fund that would make an explicit link between the use of water and the conservation of the watershed (Katoomba, 2005). With the support of USAID and the Quito Metropolitan Area Sewage and Potable Water Agency (EMAAP-Q), this lead to the creation of the FONAG water protection fund in January 2000. In May 2001, also the Quito power company (Empresa Eléctrica Quito) entered as a constituent, as did the private company Cervecería Andina in March 2003. Recently, also the Swiss Development Cooperation has joint the Fund, as well as the Ministry of Environment, which has an observer status. The constituents contribute to the Fund, varying from 1 percent of drinking water revenues by EMAAP-Q to an annual fixed amount by others, with written agreements for the 80 years of the Fund's constitution. At the start of 2005, the Fund had close to 2 million dollars and investment bonds for the year 2005 were estimated at close to 500,000 dollars (Lloret, 2005).

Although this may appear to have been a straightforward process, in fact 'the process has been slow and painstaking' (Katoomba, 2005). Initially, the city mayor and the boards of directors of the water utility and the power company had to be convinced of the potential benefits of the fund (Katoomba, 2005). Once established, field activities financed by FONAG did not start until 2004, years after the establishment of the fund, because FONAG works with the interest, not the capital, on the money in the fund (Katoomba, 2005; Lloret, 2005). In fact, the fund still has to prove that it is really contributing to improved availability of water resources. The lack of understanding of linkages between specific watershed protection activities and water flow and quality makes it difficult to assess how much of the desired service actually reaches the users. As of yet, statements concerning outcomes in terms of environmental improvement or hydrological returns are not available (Kiersch et al., 2005).

Conclusion from the case

The case of FONAG indicates that the payment scheme is based largely on a 'virtual' market for activities that are expected, but not yet proven, to contribute to the sustained availability of good quality water resources. It is the result of a process initiated by non-governmental organizations that lasted several years and that gradually gained more momentum, after its participants were sufficiently convinced of the value of the services and activities supported by the Fund.

Water rights trading in the Murray-Darling Basin

Introduction to the case

The Murray-Darling river basin spans several states in the south-east of Australia and some three million people inside and outside the basin heavily depend on its water resources. The development of the basin's water resources has enabled the expansion of agricultural activity and currently the agricultural produce in the basin exceeds AU$ 10 billion (MDBC, 2004). Since the 1950s, the growing water demands have caused declining water quality, rising water tables and increased salinity. To help prevent further degradation of the water resources a cap has been put on diversion, limiting annual diversions, effective from July 1997.

Within the cap, water entitlements may be traded and prices are determined by the market. The trading arrangements that are in place for the Murray-Darling river basin in Australia are an often cited example for river basin management and well-functioning water markets (e.g. Tarlock, 2001; Bjornlund and McKay, 2002; Moss et al., 2003, FAO, 2004b). Trading arrangements have first been put in place on state level and, although a pilot has been started on interstate water trading, the state level experiences are more advanced. The specific trading arrangements are illustrated here for the state of New South Wales.

Water trading arrangements in New South Wales

Water trading in New South Wales (NSW) is based on the trade of water rights, which are separated from land titles. Individual water rights are vested in water licences that define a share in the available water resources, expressed as a unit share rather than as a fixed volume per year. The actual volume that a licence-holder is entitled to differs per year, based on water availability, and is called the annual water allocation. Water licences as well as annual water allocations can be traded and water licences can be split and consolidated (DIPNR, 2005).

Generally, at the start of the water year government officials make an available water determination (AWD), specifying the water volumes per unit (e.g. 0.8 megalitres per unit), taking into account aspects such as climate, storage, flow levels and historic usage. This provides the basis for the annual water allocations to individual licence holders, which is calculated as *units in the licence * water volume per unit*. This annual water allocation is credited to the water allocation account of the licence holder, which, similar to a bank account, specifies how much units of water a licence holder is entitled to. For some licence categories, AWDs may be made throughout the year if more water becomes available (DIPNR, 2005).

The system of tradable water licences and water allocations deals mainly with water diversions for commercial purposes, such as irrigation of crops. The overall extraction limits for the source, specific environmental water rules and the rules under which the available water determinations are made available are determined in the water sharing plans, which are mandatory for all water sources in NSW. Rural landholders are entitled to basic rights to water without a licence and there also is a provision that recognizes the cultural and spiritual importance of water to Aboriginal people in NSW (DIPNR, 2005). In dry periods, priority is given to the environment, urban water supply, rural drinking water supply and finally irrigation (Huckell, 2005). This means that in dry years, the volumes of water needed for the environment and for drinking water supply (priority allocations) are first abstracted from the total available volume, before calculating the water volumes per unit for commercial water licences.

Process leading to the establishment of water trading arrangements in New South Wales

The serious problems related to overexploitation of the water resources in the Murray-Darling river basin triggered the involved states' ministers to limit annual water diversions in each of the basins states to the volume of water that would have been diverted under 1993/94 levels of development (MDBC, 2004). In New South Wales, enforcing this cap proved especially difficult, as in 1996 and 1997 three major sub-basins in this State exceeded the cap (Tarlock, 2001). The Government of New South Wales announced a

comprehensive water reform package in 1997, initiating a participatory stakeholder process through the establishment of community based Water Management Committees (WMCs). The outcomes of this process was consolidated in the 2000 Water Management Act, which consolidated previous legislation.

The Water Management Act required the development of water sharing plans for all water sources in NSW by local water management committees, which should give directions for water allocations between competing users, including between the environment and extractive users (ACIL, 2002). Furthermore, the Water Management Act provided a framework for these water sharing plans, determining the conditions for water rights and the duration of the water sharing plans. However, the duration of the water sharing plans and of the water rights proved an important source of disagreement. Initially, the state government of NSW announced plans for water sharing plans to have five year tenure (NFA, 2005) and to confirm existing rights for only ten years (Moran, 2003). For farmers, a longer tenure for water sharing and perpetuity of water rights was important to allow security for their investments. If water sharing arrangements could change regularly and if water rights could be lost, risks of investment would become too high and obtaining credits from financing institutions would be almost impossible (Huckell, 2005).

Eventually, the framework for most water management provisions in New South Wales evolved largely from agreements on water made between the Commonwealth and the states in the Council of Australian Governments, which resulted in the National Water Initiative, signed on 25 June 2004 (Hamstead & Gill, 2004; DIPNR, 2005). The 2004 NSW Water Management Amendment Act gave effect to aspects of the National Water Initiative, including the creation of perpetual water rights and the provision for the term of a water sharing plan to be extended beyond its ten years. This development was in parallel to the agreement reached in NSW that existing rights were to be converted into *perpetual* water access licenses, in return for agreed cuts on agricultural water use of a further 3%, in addition to the basin cap, over period of 10 years, from 2004 to 2014 (Huckell, 2005). In the agreed trading scheme, there is a phased transition towards full trading to protect farmers in existing irrigation systems. To ensure that not of all of sudden tail-end farmers within an irrigation system find themselves alone within a system, facing much higher burden of operation and maintenance costs for irrigation infrastructure, only 4% of water licence can be traded annually. This will eventually be phased out (Huckell, 2005).

Conclusions from the case

The water trading schemes in place in New South Wales in the Murray-Darling river basin resulted from a long process of political negotiations and legislative reform, triggered by increasing water scarcity and influenced by external pressures from the interstate basin level and the national level. Water trading is embedded in a complex system of rules and regulation that has been established through this political process and that include various safety guards such as the rules for the establishment of water availability determinations and a phased transition towards full trading. Within this legislative framework, further conditions for water allocations are determined by the local water managements committees, through the development of water sharing plans.

Key conclusions from the cases

Although the three cases covered two very different types of economic arrangements, namely water protection funds or payment for environmental service schemes in New York City and Quito and water markets in New South Wales, one key aspect clearly emerges from the descriptions of the processes that preceded the described arrangements: economic arrangements are the result of a (long) negotiation process among stakeholders. The arrangements were put in place only when the stakeholders agreed on the adoption of trading mechanisms or payment schemes. This was the result of a stakeholder process which had its own pace and rationale and that was not imposed by an external (government) actor, but that was initiated after years of profound problems causing stakeholders to unite for action. Conflict and distrust

among stakeholders was often part of this process, but also a joint realization that sound water management required a cooperative approach and a joint recognition of the value of water.

A negotiated agreement among stakeholders is key, because the successful economic arrangements in the described cases operate within well-defined boundaries. They are part of a larger package of economic, administrative and institutional arrangements to ensure that a broad range of societal values are included. Particularly the rules and regulations that shaped the administrative and institutional arrangements were the subject of negotiations among stakeholders, before they trusted the 'invisible hand' of the market to play its role. The agreements for the New York City Watershed and for the FONAG in Quito are basically agreements on the way in which the economic funds are regulated: how much funds are to be made available or how funds are to be collected, and what guidelines and procedures apply for financing projects and activities with these funds. Although much closer to a free market, also the trade in water rights in the Murray-Darling basin is constrained by various licenses and trading rules and is embedded in an institutional and regulatory system that safeguards environmental baseflows as well as social fairness. The importance of the regulatory arrangements in the last case is further underlined by the facts that existing laws were changed to enable the use of market mechanisms.

Although previous studies on existing economic and market mechanisms in water management did not focus on the process leading up to those mechanisms, the findings here are very much in line with the findings from previous studies. As was mentioned in an earlier section, those studies point out the need to balance economic arrangements with institutional, regulatory and administrative arrangements, but they also point out the importance of active stakeholder participation for the proper functioning of the resulting hybrid economic/administrative/regulatory systems (Briscoe, 1996; World Bank, 1999). Thus, stakeholder processes are important throughout the lifecycle of these hybrid systems, from their early conception to their sustained use.

Stakeholder-oriented water valuation to support the development of economic arrangements

The potential of water valuation to support the development of economic arrangements

Stakeholder processes determine the success of economic arrangements in water resources management. As transparency and accountability are known success factors for existing economic arrangements (World Bank, 1999), they are also likely to be important for the stakeholder processes leading up to those arrangements. Offering stakeholders a mechanism for the transparent assessment of important water values is potentially very useful to help them reach an agreement on those values and on the ways to manage them through the use of regulated economic arrangements.

So far, an explicit and transparent assessment of water values and the way they are impacted is often absent in the process leading up to economic arrangements. In the case of New York City, the costs of building a filtration plant were very clear and high enough to trigger action, but even here, the agreed package of US$ 1.5 billion does not offer a guarantee that the activities under the agreement will be sufficient to meet official water quality standards within the time frame of the filtration avoidance granted by the EPA (NRC, 2000; Hermans et al. 2003). In Quito, the contributions to the fund by the constituents are set rather arbitrarily, based on their individual willingness and ability to pay, and the eventual impacts of projects funded by the FONAG on water availability downstream remain as of yet largely unknown.

Nevertheless, a certain common understanding on the value of water resources is necessary to reach an agreement on the design of economic arrangements. Eventually, an accurate valuation is important to ensure sustainability of these economic arrangements. In the case of New York City and Quito, those who

pay for the activities in watersheds want to ensure that the money they spend is actually contributing to the provision of water resources. In the Murray-Darling basin, direct costs of purchasing a certain volume of water is set in the market place, but the societal transaction costs to enable this market to function should also be taken into account. Registration of licences, water accounts and trade, and monitoring of water diversions are all required for a well-functioning market. The costs for maintaining this institutional and administrative support infrastructure should be reasonable in relation to the contribution of the markets to improved water resources management.

In general, valuation is a prerequisite to address the question whether or not economic arrangements contribute to the sustainability of agricultural water use and quality. Limits in technical knowledge limit the extent to which the costs and benefits associated with economic arrangements can be assessed, but nevertheless, some sort of assessment or valuation needs to be done, both in deciding about new arrangements and in monitoring progress in using existing ones. But then how does one help stakeholders to decide on the appropriate rules and regulations for well-functioning economic arrangements?

The need for a new approach to water valuation

Economic valuation methods such as market-based approaches, contingent valuation, hedonic pricing and the travel-cost method help to express environmental values into monetary terms, incorporating externalities in a total or full economic value of water resources (FAO, 2004a). This offers a logical starting point to translate water values into financial flows through market arrangements and to 'internalize the externalities'. Nevertheless, the three cases have shown that in the success stories, calculations of full economic values have not played a decisive role in the development of economic arrangements. Several explanations for this can be found:

1. Specific costs and benefits associated with watershed protection and water uses are difficult to quantify and to capture in monetary terms, not only in developing countries, but also for instance in the case of New York City and Australia. The limited accuracy reduces the usefulness of economic valuation methods in practice.
2. Stakeholders may value other things in addition to narrowly defined economic values expressed in dollars, such as social stability and environmental sustainability. Of course these values can somehow be translated into monetary values, but, apart from the methodological constraints involved in conducting such translations, this ignores the fact that trade-offs between such values are within the realm of politics rather than economics (cf. Hellegers and Perry, 2004).
3. Economic valuation is a tool for researchers and analysts and as such it is disconnected from stakeholder processes. The pace of stakeholder negotiations may not fit the timeframes needed for proper analytic valuation exercises, or, when external experts are consulted by one or more stakeholders, their advice may simply be overruled by the client, as was the case for an expert panel consulted by EPA in the New York City case (Okun et al., 1997).

Thus, although in principle the existing methods for economic water valuation can offer useful support for the design of economic arrangements for water resources management, their application in practice is limited. There is a need to complement the existing suite of economic valuation methods with an approach that is specifically oriented towards the stakeholders and their negotiation processes that determine the design and implementation of economic schemes. Rather than regarding valuation as an external input, it is to be recognized as an intrinsic part of the stakeholder process – throughout their negotiation process, stakeholders are making various choices, which implies that they value one thing over another. Valuation should help stakeholders to gain more insight into the values affecting their choices, so as to take them more consciously into account when making their choices. However, these values are not always strictly economic. This means that the established economic valuation tools and methods can be part of a stakeholder-oriented approach, but they are not the sole focus and they are only to be used if they can usefully contribute to clarifying values and reaching agreements among stakeholders.

A general process for stakeholder-oriented water valuation

Stakeholder-oriented valuation approaches have been explored in several cases for local water resources management, for instance in Tanzania (FAO, 2005), Sri Lanka and Lao PDR (Nguyen et al., 2005a,b) and Cambodia (IUCN, 2005). A forthcoming publication by FAO, IWMI, IUCN and Imperial College capitalizes on the experiences and insights gained so far with this new approach by these organizations. From this, a generic process for stakeholder-oriented water valuation is emerging to more firmly link water valuation to stakeholder processes. This stakeholder-oriented valuation process is based on the IWRM process as conceptualized by GWP (2004), but focusing specifically on the implications of linking valuation to stakeholders as part of water management processes. Essentially, the process consists of seven elements that are linked to one another as a logical sequence of activities:

1. Identify the main triggers for the process, problems to be addressed and stakeholders involved
2. Identify and structure the objectives that are at stake, covering each involved stakeholder, to ensure that the full range of values is considered
3. Value the existing situation, using indicators that are linked to the identified objectives
4. Identify possible measures that can help improve the situation, including economic instruments
5. Assess the expected impacts of possible measures, covering the full range of identified objectives
6. Evaluate, refine and chose a set of measures / economic arrangements to implement
7. Implement, monitor and evaluate the impacts of the implemented (economic) arrangements

The structure of the seven elements outlined above suggests a linear process, but often reality is different; this is the case for IWRM processes generally (GWP, 2004) and also for stakeholder-oriented valuation. Water management processes may move from problem to solutions, from solutions to other solutions or even from one problem to the next. Also, the group of stakeholders involved is likely to change over the course of the process, as some stakeholders may disengage themselves and new stakeholders may enter the process in a later stage, changing the range and priority of the values, problems and solutions that are considered in the process. Whatever the exact sequence of activities in a stakeholder process, the role of stakeholder-oriented water valuation should be to support stakeholders by explicating the problems and the values involved, sharing the different perspectives and positions, and through this process, identifying solutions that can form an agreeable basis for action. The seven elements outlined above are considered essential for a sound stakeholder-oriented valuation process, be it as a direct sequence or in a more haphazard way.

Illustrating the stakeholder-oriented valuation process for the case of New York City

The use of the stakeholder-oriented valuation process is illustrated for one of the cases discussed before: the New York City Watershed Agreement. Table 1 shows how the process in the NYC watershed can be described in terms of the procedure for stakeholder-oriented water valuation. It illustrates that the seven elements in the stakeholder-oriented water valuation process should be used in an iterative way and that sometimes certain steps need to be repeated whereas others can be skipped.

Although it is a hypothetical example, Table 1 illustrates the general thinking behind stakeholder-oriented water valuation and demonstrates how a stakeholder-oriented valuation approach fits the (negotiation) processes by which economic instruments for water resources management are developed. Stakeholder-oriented valuation features a pragmatic use of analytic tools, including some ‘straightforward’ economic analyses, which are relatively easy to incorporate in a participatory process. For instance, the main value driving the process in New York was the financial costs of filtration. This was relatively easy to estimate and, although the estimate had a considerable margin of uncertainty, it effectively triggered New York City to search for alternative solutions.

Table 1 Illustration of the stakeholder-oriented water valuation process for the NYC Watershed Agreement

Element in the process	Explanation for the NYC Watershed case
Triggers and key stakeholders	EPA Surface Water Treatment Rules issued in 1989 require NYC to protect water sources or build filtration plants for its drinking water. Key stakeholders are NYC, EPA, watershed communities
Main objectives and associated stakeholders	Safe and reliable drinking water supply – EPA and NYC Financial costs within reasonable limits for drinking water supply – NYC Local economic development opportunities – watershed communities
Values current practices (current values here taken as 1996 values)	Current drinking water supply meets health criteria, but fear is that increased human activity in watersheds threatens ability to meet standards in future, especially for pathogens and phosphorus (ref:NRC, 2000) Costs for NYC drinking water supply: US$ 450 mln for water supply and wastewater collection in 2002, so presumably less in the 1990s (ref: NYC, 2002) Economic development in watersheds: local economic indicators score low in comparison to NYC and national averages. For instance, 1996 per capita personal income (PCPI) was US$ 18 743 for the non-metropolitan areas in New York State, which include the NYC Watershed area; PCPI was US$ 29 320 for metropolitan area; for US as a whole it was US$ 24 175 (ref: BEA, 2005).
Possible measures	Build filtration plant (option for NYC) Request filtration avoidance based on unilaterally imposed watershed rules (option for NYC) Request filtration avoidance based on agreement NYC and watershed communities to control pollution on voluntary basis (joint option for NYC & watershed communities)
Impacts of measures	Filtration plant: reliable and safe drinking water supply, investment of US$ 6-8 billion and annual operating costs of US$ 300 million (costs for NYC) (ref: NRC, 2000) Filtration avoidance based on strict watershed rules: impaired economic development (economic impact: local counties to remain at bottom end of state and national lists, affected stakeholders: watershed communities); reliable and safe drinking water supply, with possibly some remaining risk of pathogen outbreaks (impacts relevant for NYC and EPA) Filtration avoidance based on agreement and compensation payments: slightly reduced range of options for economic development but compensation and support for certain types of economic activities (such as best practices for farms) (watershed communities); reliable and safe drinking water supply, with some remaining risk of pathogen outbreaks (impacts relevant for NYC and EPA); investment of US$ 1.5 billion over 10 year period by NYC (ref: NRC, 2000)
Choice	Request filtration avoidance based on strict watershed rules and regulations, together with some voluntary activities with watershed communities (unilateral decision by NYC)
Implementation - Trigger round 2	New watershed rules announced by NYC, appealed by watershed communities in lawsuit. Impasse, need for external intervention by a new stakeholder: the Governor of New York State
Key objectives	As above plus the objective of New York State for healthy regional development, balancing the urban and rural interests in the state
Measures	As above but minus the option of unilateral imposition of stricter rules by NYC
Choice	Filtration avoidance based on agreement among NYC and watershed communities (i.e. payment for environmental service scheme)
Implementation, monitoring and evaluation	Agreement under implementation since 1999, through various watershed programmes. Impacts are improved management practices on farms, upgrading of wastewater treatment plants in watershed towns, rehabilitation of numerous septic tanks (ref: Brown, 2000) A first evaluation of the agreement has been executed by the National Research Council in 2000 upon request of NYC (source: NRC, 2000) Monitoring water quality in reservoirs is done continuously and will determine whether or not additional activities are required to meet the objectives of safe and reliable drinking water supply

Conclusions

The available experiences show that economic arrangements can offer useful tools for efficient, equitable and sustainable water resources management, but that they need to be accompanied by adequate administrative arrangements and embedded in an appropriate institutional framework. Apart from knowledge about the economic, administrative and institutional arrangements, a proper understanding of the mechanisms that determine success of failure of economic arrangements also requires knowledge about the processes through which they are developed. A review of three cases where economic arrangements have been successfully implemented, shows that the economic arrangements have been the result of a negotiation process among multiple stakeholders. The stakeholder process was especially important to reach an agreement about the administrative and regulatory arrangements that set the boundaries within which economic arrangements were confined to ensure that societal goals are not jeopardized. This means that new economic arrangements need to be carefully designed, with the involvement of multiple stakeholders.

More insight is needed in these multi-stakeholder processes, to identify certain commonalities that can help support future negotiations among stakeholders about the regulations and conditions required to put in place sustainable economic arrangements for water resources management. Nevertheless, one thing that is clear already from the three described cases, is that a transparent assessment of the value that water resources represent to the involved stakeholders, as well as to society as a whole, will be helpful to support this process. For this, traditional economic valuation methods need to be complemented by stakeholder-oriented approaches that help to facilitate dialogue among stakeholders and that can effectively incorporate the broader societal concerns related to social equity and environmental sustainability, beyond mere monetary values. Further work in this area is needed, building on the experiences that have already been gained and from which a process for stakeholder-oriented valuation emerges. This needs to be further developed into sound operational methodologies that link water valuation to the stakeholder processes by which economic arrangements are developed. Specific attention is needed for the participatory aspects in such valuation methodologies, as well as for the assessment of the broader societal values associated with water resources management.

References

ACIL Consulting (2002). *Economic Impacts of the Draft Water Sharing Plans. An independent assessment for the NSW Department of Land and Water Conservation*. Canberra: ACIL Consulting.

BEA, 2005. *Regional Economic Accounts*, US Department of Commerce Bureau of Economic Analysis, http://www.bea.doc.gov/bea/regional/reis/default.cfm#a (visited 21 Sep 2005)

Bjornlund, H. and J. McKay (2002). Aspects of water markets for developing countries: experiences from Australia, Chile and the US. *Environment and Development Economics*, **7**, 769-795.

Briscoe, J. (1996). Treating water as an economic good. The idea and what it means in practice. Paper presented at the ICID World Congress in Egypt.

Brown, Jeff L. (2000). Protecting the Source. *Civil Engineering*, **70**(12), 50-55.

Dent, David (2005). *Green water credits*. Case contribution to E-Forum for FAO/Netherlands Conference on Water for Food and Ecosystems (http://www.fao.org/ag/wfe2005/casedb_en.asp).

DIPNR (2005). Water Management in New South Wales. Various info-sheets and website information, Department of Infrastructure, Planning and Natural Resources, www.dipnr.nsw.gov.au, dd. 15-07-05.

Economist (2005). Are you being served? Environmental Economics. *The Economist*, April 21, 78-80.

EPA (2004). *Water quality trading assessment handbook*. US Environmental Protection Agency, Office of Water. November 2004, Washington, D.C.

FAO (2002). *Land-water linkages in rural watersheds*. FAO Land and Water Bulletin 9. Rome: FAO.

FAO (2004a). *Economic valuation of water resources in agriculture*. FAO Water Report 27, prepared by K. Turner, S. Georgiou, R. Clark, R. Brouwer & J. Burke. Rome: FAO.
FAO (2004b). *Water charging in irrigated agriculture*. FAO Water Report 28, prepared by G. Cornish, B. Bosworth, C. Perry, & J. Burke. Rome: FAO.
FAO (2004c). *Electronic Forum on Payment Schemes for Environmental Services in Watersheds*. Final Report. Santiago, Chile: FAO and Latin American Network for Technical Cooperation in Watershed Management.
FAO (2005). *Water Productivity and Vulnerable Groups in the Mkoji Sub-Catchment*. Project Report. FAO and Sokoine University of Agriculture. Rome: FAO.
Hamstead, M. and J. Gill (2004). *Implementing the Water Management Act 2000*. Sydney, Australia: New South Wales Department of Infrastructure, Planning and Natural Resources.
Hellegers, P.J.G.J. and C.J. Perry (2004). *Treating water as an economic good in irrigated agriculture. Theory and practice*. Report 3.04.12., Agricultural Economics Research Institute (LEI), The Hague.
Hermans, L.M., G.E.G. Beroggi and D.P. Loucks (2003). Managing water quality in a New York City watershed. In: *Journal of Hydroinformatics*, **5**(3), 155-168.
Huckell, A. (2005). *Personal communication Andrew Huckell*, Campaign Manager and Senior Policy Analyst. NSW Farmers' Association, Sydney, Australia. Rome, 11 May 2005.
IUCN (2005). *Veun Sean Village, Stoeng Treng Ramsar site, Cambodia: Rapid participatory assessment for wetland valuation*. Case Studies in Wetland Valuation #11, February 2005.
Katoomba (2005). *Innovating Water Markets in Latin America: A profile of Marta Echavarria*. By Ricardo Bayon for The Katoomba Group's Ecosystem Marketplace. http://ecosystemmarketplace.net/pages/article.people.profile.php?component_id=468&component_version_id=452&language_id=12 (visited 22 September 2005).
Kaul, I., I.Grunberg, M.A. Stern (eds.) (1999). *Global public goods: International cooperation in the 21st century*. New York: Oxford University Press.
Kiersch, B., L. Hermans and G. van Halsema (2005). Payment schemes for water-related environmental services: a financial mechanism for natural resources management. Experiences from Latin America and the Caribbean. Paper for *UNECE Seminar on environmental services and financing for the protection and sustainable use of ecosystems*, 10-11 October 2005, Geneva, Switzerland.
Kloezen, W.H. (1998) Water markets between Mexican water user associations. *Water Policy*, **1**, 437-455.
Lloret, P. (2005). *Un fideicomiso como herramienta financiera para la conservación y el cuidado del agua, el caso del Fondo ambiental del agua en Quito, Ecuador*. Case presented at FAO/Netherlands Conference on Water for Food and Ecosystems, The Hague, 31 January – 4 February, 2005 (see www.fao.org/ag/wfe2005 for case description and presentation)
MA (Millennium Ecosystem Assessment) (2005). *Responses Assessment. Chapter 7: Water*.
MDBC (2004). *The Cap. Providing security of water users and sustainable rivers*. Canberra: Murray-Darling Basin Commission.
Moss, J., G. Wolff, G. Gladden, E. Guttieriez (2003). *Valuing Water for Better Governance*. White Paper for Third World Water Forum, sponsored by the Business and Industry CEO Panel for Water.
National Research Council (2000). *Watershed management for potable water supply: Assessing New York City's approach*. Washington, D.C.: National Academy Press.
New York Times. 1995. At Last, a Watershed Agreement. *New York Times*: Nov 3, 1995, A.28.
NFA (2005). What has the NSW Farmers' Association been doing for farmers about water reforms? NSW Farmers' Association website (http://www.nswfarmers.org.au/rural_issues/water_reforms)
Nguyen-Khoa, S., L. Smith and K. Lorenzen (2005a) *New Perspectives on the Impacts of Irrigation on Fisheries. Results from Lao PDR (Huay Thouat) and Sri Lanka (Kirindi Oya)*. Case presented at FAO/Netherlands Conference on Water for Food and Ecosystems, The Hague, 31 January – 4 February, 2005 (see www.fao.org/ag/wfe2005 for paper and other materials)
Nguyen-Khoa, S., L. Smith and K. Lorenzen (2005b) *Adaptive, participatory and integrated assessment of the impacts of irrigation on fisheries: Evaluation of the approach in Sri Lanka*. Working Paper 89. Colombo, Sri Lanka: International Water Management Institute.

NYC (2002). *Adopted Budget Fiscal Year 2003*. The City of New York. July 2002. (http://www.nyc.gov/html/omb/html/finplan06_02.html)

OECD (1999). *The Price of Water: Trends in OECD Countries*. Paris: OECD Publications.

OECD (2002). *Social Issues in the Provision and Pricing of Water Services*. Paris: OECD.

OECD (2003). *Improving Water Management: Recent OECD Experience*. Paris/London: OECD/IWA Publishing.

Perry, C.J., M. Rock and D. Seckler (1997). *Water as an Economic Good: A Solution, or a Problem?* Research Report 14, Colombo, Sri Lanka: International Irrigation Management Institute.

Pfeffer, M.J. and L.P. Wagenet (1999) Planning for Environmental Responsibility and Equity: A Critical Appraisal of Rural/Urban Relations in the New York City Watershed. In: O.Furuseth and M.B. Lapping (eds.) *Contested Countryside: The Rural Urban Fringe of North America*. Brookfield, Connecticut: Ashgate.

Platt, R.H., P.K. Barten, M.J. Pfeffer (2000). A full, clean glass? Managing New York City's Watersheds. *Environment* **42**(5), 8-20.

Savenije, H.H.G. (2001). *Why water is not an ordinary economic good*. Value of Water Research Report Series No.9. Delft, the Netherlands: IHE.

Tarlock, A. Dan (2001). Water Policy Adrift. *Forum for Applied Research and Public Policy* **16**(1), 63-70.

World Bank (1999). *Institutional Frameworks in Successful Water Markets. Brazil, Spain, and Colorado, USA*. Technical Paper 247. M. Marino & K.E. Kemper (eds.) Washington, D.C.: The World Bank.

WWAP (World Water Assessment Programme) (2003). *Water for People Water for Life. The United Nations World Water Development Report*. UNESCO Publishing and Berghahn Books.