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Economic Valuation in the EU Water Framework Directive

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About AquaMoney

AquaMoney brings together 16 renowned European research institutes with the objective of developing and testing practical guidelines for the assessment of environmental and resource costs and benefits (ERCB) in the context of the European Water Framework Directive (WFD). The concept of environmental and resource costs and benefits plays a central role in the economic analysis of the WFD, in particular in relation to the cost recovery of water services (Article 9 WFD) and exemptions based on disproportionate costs (Article 4 WFD). So far, no practical guidelines exist for their assessment. AquaMoney will address this omission. The project consortium is supported by an Advisory Board of 30 governmental and non-governmental WFD river basin policy and decision-makers.

Economic Valuation: what is it?

Water is a unique resource, and it contributes to human wellbeing in a number of ways. Improvements in water quality or a more efficient use of scarce water resources therefore benefit human uses in different ways. This includes the use of lakes and rivers for recreation, but also services and industries that rely on clean water, such as water supply and food processing. Where water quality improves, industrial users can dispense of costly installations for water treatment and purification.

Yet, besides cases where benefits actually accrue to a firm or an individual as cash gains, there are also other, more diffuse benefits, which all too often go unnoticed. Such intangible benefits improve the quality of life, but by how much, and for how many people, is unknown.

The situation is somewhat different for the costs of water improvement measures. Costs tend to be more manifest, they are often readily expressed in monetary units, and they usually accrue to a small number of affected parties. For these reasons, benefits are easily overlooked in water management decisions. Economic valuation methods can help to make benefits more tangible, also in comparison to the costs, by putting a price tag on them. Over the past decades, a number of economic valuation methods have been developed and used to assess the monetary value of improved water status. Yet their application in the context of the European Water Framework Directive (WFD) creates some specific challenges. These challenges are addressed in the DG Research funded project AquaMoney (www.aquamoney.org).

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Valuation: when is it required by the WFD?

The EU Water Framework Directive, which entered into force in 2000, introduced several innovations into water resource management in Europe. One of these is the application of economic tools, principles and approaches to water management. In the WFD, there are three areas where monetary valuation comes into play.

- **Article 9 WFD** requires Member States to take account of the principle of cost recovery for water services, including environmental and resource costs. Thus, water services should pay for themselves, and should not receive cross-subsidies from other public services or the general budget. The inclusion of environmental and resource costs means that the external costs of water services should be included in the price of water. Economic valuation methods can be used to assess the magnitude of these environmental and resource costs.
- **Article 11 WFD** specifies that "programmes of measures" should be established in all river basins, which should include the "most cost-effective combination of measures" to achieve the WFD objectives. This implies the use of a cost-effectiveness analysis, or a comparable procedure, to make sure that the WFD objectives are reached at the lowest cost. To this end, information on the costs and the effects of different measures is needed. However, it is sufficient to quantify the effects in physical units – assessing the monetary benefits of measures is not required. Still, some EU Member States intend to do so, thereby moving from a cost-effectiveness to a cost-benefit framework.
- **Article 4 WFD** specifies the environmental objectives of the Water Framework Directive. It also specifies conditions under which exemptions from these objectives may be applied. This includes cases where reaching the objective by 2015 would be "disproportionately expensive." In such cases, the 2015 deadline may be extended, or a less stringent objective defined. However, the practical interpretation of the term "disproportionately expensive" remains disputed. One interpretation is that costs are disproportionate if they exceed the benefits of achieving the good status objective. In this case, benefits need to be valued in monetary terms, in order to make them comparable to the costs.

In addition to these three processes, some Member States have started their own efforts to assess the costs and benefits of the WFD implementation. While this is not required by the Directive, such efforts can provide valuable information for decision making, e.g. who benefits from the implementation of the WFD in what way.

Example: costs and benefits of upgrading waste water treatment in Greece

A study carried out at the Thermaikos Gulf, a shallow Bay area south of Thessaloniki, has assessed the costs and benefits of a proposed scheme to extend and upgrade waste water treatment capacities. The bay suffers from pollution from urban sewage and industrial waste as well as agricultural draining. 88% of the population are connected to sewage treatment – which leaves 12.3 million litres of untreated waste water per day. Against this background, respondents were asked which increase in their water bills would be acceptable if the revenue was used to extend and upgrade waste water treatment in the area. On average, respondents were prepared to pay around 46 Euro per person per year. Respondents gave various reasons why they would pay, ranging from practical reasons (concern about smell and restricted recreational uses) to ethical reasons, such as the desire to preserve the environment for future generations. For the entire area, this would yield an annual benefit of around 34.2 million Euro. This compares to a (conservative) cost estimate of 8.7 million Euro, leaving a net welfare gain of 25.6 million Euro. These numbers suggest that the upgrading scheme would enhance welfare of citizens in the region significantly.

Source: Kontogianni, A., et al. (2005). The costs and benefits of implementing the European Urban Waste Water Directive in Greece, in Brouwer, R. and D. Pearce (eds.): Cost-benefit analysis and water resources management. Cheltenham: Edward Elgar.

Valuation: one of several ways of looking at benefits

The implementation of the WFD will benefit Europe's citizens in a number of ways. However, not all of these benefits are equally amenable to monetary valuation. When assessing the monetary benefit in a willingness-to-pay study, the potential users need to understand the good being valued, and need to be familiar with it. This may not be given for goods that have no direct use value. Thus, some specific measures, such as restoration of river banks or the introduction of certain aquatic species, may have a high value for the functioning of an aquatic ecosystem, but produce little or no measurable benefits for the users of a water body. At the same time, there are a number of effects where monetary valuation makes sense and produces robust results – for example, a number of studies have assessed the economic benefits of reduced eutrophication risks. In these cases, valuation can make a useful contribution to decision making.

It is important to underline that economic valuation of costs and benefits has a supportive role in the WFD implementation, not a prescriptive one. While valuation should come in to ensure than efficient and beneficial choices being taken, it is not the role of valuation to test whether the WFD as such stands a cost-benefit test, or whether its objectives have been set in the right way. The good status objective of the WFD has been set as an environmental objective, irrespective of cost-benefit considerations. The role of economics is to show the least-cost way of achieving this objective, and to prevent cost overruns.

Example: integrated assessment of costs and benefits at the Werra

A recent German study has carried out an integrated assessment of different policy options for the Werra, a tributary of the Weser in Central Germany. The study looked at various types of measures directed at morphology, continuity, point and diffuse emissions, and assessed their hydrological and ecological effects as well as their costs, benefits and social acceptance. The set of measures considered is comparable to the foreseeable effort required by the WFD implementation. The basinwide costs of the proposed measures from all fields (agriculture, point sources, morphology, continuity) were estimated at a net present value of 56 - 102 million Euro for a 20-year horizon, and 70 - 149 million Euro over 50 years. Of these costs, agricultural measures account for 39–79%; followed by point sources (5–17%), morphology (10–29%) and continuity (6–17%). On the benefit side, three categories were considered in detail: benefits from improved biodiversity, recreational value, and the indirect use values of nutrient retention in buffer strips. While the first two were assessed through a transfer of benefit estimates from other sites, the nutrient retention in buffer strips was valued using replacement costs (i.e. the cost of nutrient removal through wastewater treatment). Total benefits amounted to 150-197 million Euro (net present value over a 20-year period), or 294-388 million Euro over a 50-year period. Most benefits took the form of biodiversity protection, whereas recreation contributed about a quarter of total benefits. Benefits exceeded costs by a ratio of at least 1.4:1, and up to 5:1.

Source: Hirschfeld J, Dehnhardt A., Dietrich J. (2005). Socioeconomic analysis within an interdisciplinary spatial decision support system for an integrated management of the Werra River Basin, Limnologica 35, 234–244.

Valuation: how is it done?

A number of valuation methods exist through which the economic value of water resources can be assessed. Valuation methods can be broadly subdivided as follows:

Cost-based and benefit-based approaches. The former look at the cost of repairing, avoiding or compensating for damage, and use this information as a proxy for the benefit achieved – thus assuming that the benefits are at least as high as the costs. This is a strong assumption, and while cost-based approaches have the advantage of being relatively quick and inexpensive, their information value is limited. By contrast, the benefit-based approaches attempt to derive an estimate of the actual benefits created by an intervention.

Within the benefit-based approaches, **market-based and non-market-based methods** can be distinguished. Market-based methods measure benefits through actual market transactions, e.g.

looking at the value of water as a production factor in agriculture and industry, or through the market price of fish caught from a river. Unfortunately, it is in the nature of environmental improvements that many of its effects are not reflected in market transactions. To elicit these effects, non-market-based methods are needed.

Within the non-market-based methods, there are **revealed-preference and stated-preference methods.** Revealed-preference methods (such as hedonic pricing or the travel cost approach) infer the influence of environmental factors on observed market transactions – e.g. studying how water quality improvements affect house prices nearby a river. By contrast, stated-preference approaches (such as contingent valuation or choice experiments) elicit how much individuals would be willing to pay for an improvement in water quality. The AquaMoney Guidelines for Practitioners discuss these methods and their application in more detail.

Water use being valued	Applicable valuation methods						
	Market analysis	Production function	Replacement cost / cost savings	Avoidance cost / averting behaviour	Travel cost method	Hedonic pricing	Contingent valuation / choice
Potable water for residential use	●	●	●	●		○	●
Water for irrigation	○	●	●				○
Water for livestock watering	○	●	●	○			
Water for food products and other manufacturing	●	●	●	○			
Cooling water for power plants	○	●	●	○			○
Hydroelectricity production		●	●	○			○
Water transport	○	●	●	○			
Commercial fishing	●	●	●	●			
Transport, treatment and medium for wastes	○	●	●	○			
Prevention of saline intrusion	○	○	●	●			○
Water support for prevention of land subsidence		○	●	●		○	○
Natural erosion, flood and storm protection		○	●	●		○	○
Shoreline stabilisation	○	○	●	●	○	○	○
Sediment removal	○	●	●	●			
Biological diversity provision			●	○	●	○	●
Climate regulation (micro- and macroclimate)			●	●		●	●
Recreation (bathing, boating, fishing etc.)	●	●	●	●	●	●	●
Cultural, historical and aesthetic values					●	●	●

Valuation: what is the added value for decision making?

The valuation of benefits can improve water-related decision making in different ways:

- **Transparency:** e.g. by making explicit the trade-offs that underlie a decision. One particular quality is that economic valuation, irrespective of its outcomes, tends to provoke criticism and thereby spark off public debates;
- **More efficient decisions and improved welfare:** it may help to prevent inefficient policy choices and instead identify policies that produce welfare gains to society.

Yet, it is not only the outcome of a valuation study – i.e. the monetary estimate of a benefit – that provides an added value for the decision maker. It is also the process of conducting the valuation study that generates important information:

Stakeholder analysis: a crucial step in any valuation study is to translate improvements in the water body into benefits for the users of that water body. This requires knowledge of how the water body is being used, by whom, and how these uses will be affected. Such information can be

highly useful to understand and communicate the importance of the WFD for the general public, and to organise support for the implementation of measures.

Public perception: another by-product of many valuation studies is that such studies often deliver an assessment how the general public perceives the current status of water resources, how well it is informed about water issues, and how relevant water quality improvements are perceived.

Example: defining the "economic jurisdiction" at the River Tame

Ian Bateman et al. (2006) assessed the willingness to pay for water quality improvements at the River Tame, a tributary of the Trent in Central England. They were specifically interested how the residents' valuation of water quality improvements changed with increasing distance to the river – suspecting that residents further away from the river would derive a lower benefit from improvements, as they were less likely to use the river, and closer to alternative watercourses. Indeed, the researchers found that distance from the river had a significant influence on the benefits derived from improvements in water quality. In this way, the "economic jurisdiction" of water protection measures can be identified – defined as the sample of the population that actually benefits from water quality improvements. As the authors argue, this economic jurisdiction will often differ from the political jurisdiction, which follows administrative boundaries. Neglecting such differences can lead to a serious under- or overestimation of benefits: in the case of the Tame, extrapolating the individual benefits to the entire political jurisdiction would overestimate the actual benefits by a factor of 16.

Source: Bateman, I.J., B.H. Day, S. Georgiou and I. Lake (2006). The aggregation of environmental benefit values: Welfare measures, distance decay and total WTP. Ecological Economics (60) 2006, 450 - 460

Valuation: What will AquaMoney deliver?

The AquaMoney FP6 project was commissioned to produce science-based guidance for the calculation of environmental and resource costs and benefits to support the WFD. It will provide guidance for three different audiences:

- **Guidance for practitioners**: this document explains how to carry out valuation for specific questions addressed in the WFD, and which methods to use for which types of water uses and pressures. The document is written for experts carrying out valuation studies, and requires some economic knowledge.
- **Terms of reference for policy advisors**: this document explains how to set up and commission a valuation study, how to interpret the results, and how to translate the results into policy recommendations. It is intended for administration officials who commission and oversee valuation work, or consultants and academics using the results of valuation.
- **Guidance for policy makers:** documents such as this policy brief, explaining the basic concepts of economic valuation, its role in the WFD implementation process, and its limitations.

Furthermore, 10 case studies of water valuation in the WFD context will be carried out as part of the AquaMoney project, which serve to test the guidelines in real-life conditions, and which will also provide practical illustrations how such methods can be usefully applied in practice.

More information can be obtained from www.aquamoney.org

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