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An orientation to the assessment framework for evaluating economic policy instruments for managing water

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Why you should read this

Evaluation has always been an important step in designing, implementing and improving water policies. Good evaluation is particularly important where clean, fresh water is scarce and policies affect that scarcity.

This orientation document summarizes the key features of the multi-criteria assessment framework (AF) that the partners in EPI-Water (an FP7 project) developed and used to evaluate the impact of economic policy instruments (EPIs) on water outcomes.[1]

After reading this orientation, you will understand how the AF works and what it delivers. You can then use the AF and its Guidance Document -- Zetland et al. (2012) and Lago & Möller-Gulland (2011), respectively -- to evaluate policies and instruments that matter to you.

Policy rationale

Environmental issues are of increasing concern to the EU. This increased awareness requires improved decision-making by all levels of government and by the general community. The EU good governance approach explicitly recommends ex-ante evaluations (impact assessments) of proposed new regulations and policies (including economic instruments) to improve policy design, implementation and outcomes (EC, 2002).

EU Member States evaluate environmental policies in different ways. Several guidance documents for policy appraisal and evaluation have been produced in the EU and elsewhere. The EU Environmental Impact Assessment Directive requires considering environmental benefits of certain large projects. The Strategic Environmental Assessment Directive applies to a wide range of public plans and programmes (e.g. on land use, transport, energy, waste, agriculture, etc.) but not to policy actions. The Blueprint on safeguarding EU water (EC 2012) in particular mentions that several water management problems are related to the insufficient use of economic instruments.

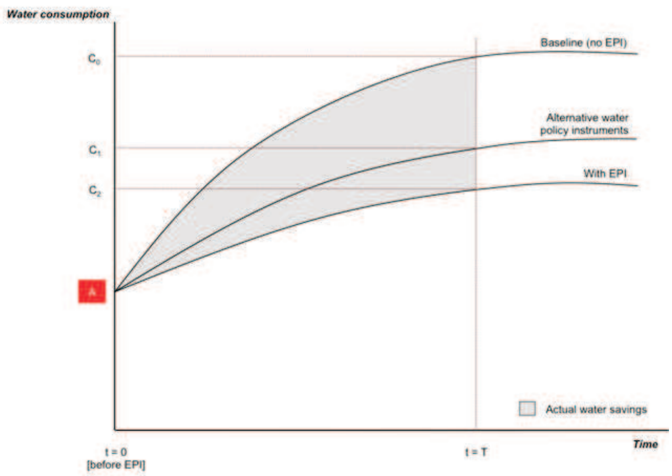

Figure 1: EPI effectiveness is measured against a baseline or alternative policy in terms of progress from the starting point of A (at t=0) to three potential outcomes at t=T: C0 for the baseline scenario with no intervention, C1 for the scenario if an alternate to the EPI is used, or C2 if the EPI is used. This example shows that the EPI was most effective, but that's not always the case.

1 · The AF was used to evaluate 30 ex-post case studies (i.e., case studies of EPIs that have been in operation for some time) that are listed in Annex 1

How to use the Assessment Framework

The EPI-Water project aimed to close this information gap by designing an AF that would consider relevant outcomes while adjusting for pre-existing and simultaneous conditions that affect those outcomes. Members of the project have used the AF to evaluate existing EPIs (ex-post case studies) and design EPIs that can be used to improve water outcomes in the EU (ex-ante case studies). The AF makes it easier to understand how EPIs work or fail, and these results can be used to improve performance of existing EPIs or design and implement new EPIs suitable to local conditions.

An AF compares the outcomes resulting from an EPI to the outcomes that would have resulted with either a "business as usual" baseline of no action or an "alternative scenario" that would have resulted from another policy intervention. Figure 1 illustrates the theory of how these three scenarios may differ in their trajectories, but it is actually quite difficult to clearly identify outcomes of interest and compare them when two (or more) scenarios are likely to be hypothetical.

After identifying scenarios, the AF is used to evaluate the EPIs impact according to multiple, overlapping criteria to which various readers may assign different weights in evaluating success or failure.

Figure 2 shows how criteria are grouped into three outcome criteria and four process criteria. Outcome-oriented criteria describe how EPIs perform. They include intended and

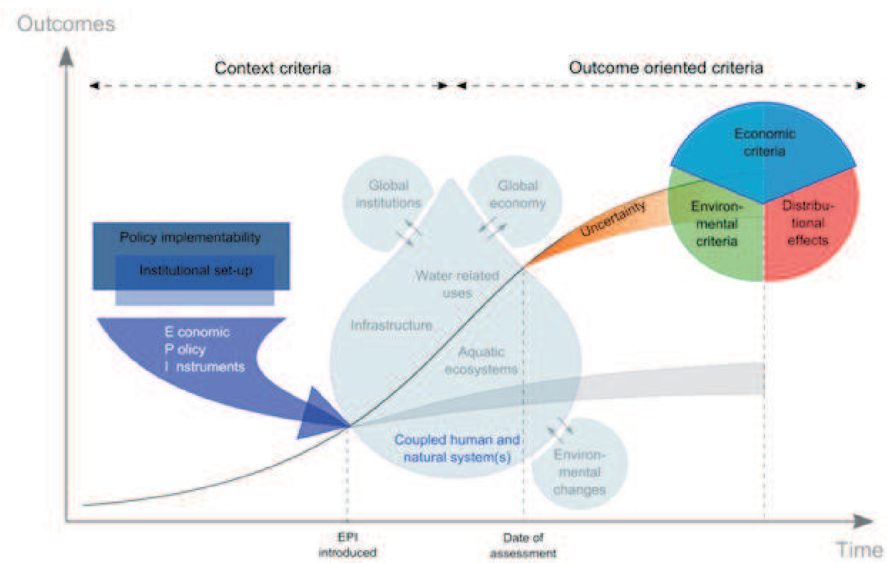

Figure 2: Conceptual schematic diagram of the EPI assessment framework.

unintended economic and environmental outcomes and the distribution of benefits and costs among the affected parties. Process criteria describe the institutional conditions (legislative, political, cultural, etc.) affecting the formation and operation of EPIs, the transaction costs from implementing and enforcing the EPI, the process of implementing the EPI, and the impact of uncertainty on the EPI. The next seven subsections describe these criteria and illustrate how they were used to evaluate the EPIs in in our case studies.

Economic outcomes (EcO)

The economic criterion evaluates EPI efficiency according to cost-benefit analysis, cost-minimization or other methods. Economic efficiency is often evaluated with proxy variables such as the income generated from the use of the EPI, financial costs related to the implementation of the EPI and/or the cost of water delivery.

EPI-Water case studies included economic outcomes such as a water transfer in the interconnected Tagus-Segura river basin (Spain) that increased non-agricultural productivity; see Case Study 1 (CS1) in Annex 1. In Italy, the introduction of water tariffs had a positive impact on households' water consumption showing a decrease by 11% at a national level. Moreover, the introduction of performance indicators in the water tariff formula where water utilities are allowed to increase the prices charged to consumers if water efficiency goals are achieved e.g. reduction in leakages, improvement in the quality of service, resulted in a decrease in water distribution losses (see CS16). Another example coming from Italy, the Emilia Romagna showed that the introduction of volumetric price system in agriculture resulted in a remarkable reduction in tariffs for non-irrigators and therefore in an improved water allocation among farmers and overall water use (see CS7). In Cyprus the introduction of subsidies on practices such as the construction of domestic boreholes for garden irrigation or the installation domestic grey water recycling systems required a time frame of about 3 years to become cost-effective as compared to the selling prices of the desalination plants and water tariffs (see CS20). On the other hand, the introduction of water resource fee in Hungary (see CS5) had a negligible effect on overall efficiency gains, efficient resource use or prevention of overuse. Looking at international experience, the introduction of Water Budget Rate Structure in California resulted in a significant reduction in landscape irrigation and residential water use and an increase in financial revenue for water companies to fund conservation programs (see CS24). In Australia, the water trading in Murray Darling Basin delivered significant gains in gross domestic product and improvements in water use (see CS23).

Environmental outcomes (EnO)

Environmental outcomes are assessed by comparing actual outcomes with alternatives (no action or regulation, for example) and evaluating positive and negative side effects. This criterion connects behaviours that have direct or indirect impacts on water (e.g. irrigation, use of pesticide) to the status of ecosystems and the value of ecosystem services to humans. Environmental characteristics are embodied in measures of water pollution, water abstractions, and so on.

EPIs addressing environmental criteria in EPI-Water case studies included voluntary agreements between water companies and farmers in Dorset, UK (see CS3) and water abstraction charges for surface and groundwater in Germany (see CS13) led to a substantial reduction in nitrates concentration. The introduction of effluent tax in Hungary and in Germany had a positive environmental impact. The former included improvements in the technology of existing wastewater treatment plants, investments in reducing ammonia and phosphorous, whereas the latter resulted in 93% tertiary treatment of effluents and the adoption of pollution reduction technologies (see CS6 and CS14, respectively). Moreover, the impact of the production of electricity from renewable sources on the environment was included in the design and implementation of EPIs in Germany and Switzerland. In Germany, hydropower plants receive defined payments per KWh to make investments that result in improving the ecological (hydro morphological) status of water bodies next to the plants, “good ecological potential” (see CS18). In Switzerland an incentive for sustainable hydropower production by taking into account the impact in the environment is achieved through a certification scheme called “greenhydro” (see CS15).

Distribution outcomes (DiO)

The distribution of goods and burdens across different stakeholder groups affects social equity and acceptability of EPIs. This criterion focuses primarily on assessing the nature of the distribution, highlighting inequalities in the allocation of goods and burdens as a result of the implementation of EPI (i.e. material living standards, health, education, personal activities including work, political voice and governance, social connections and relationships, environment and insecurity). This approach puts more weight on social well-being, so it's necessary to collect stakeholder views through new interviews rather than borrow "distribution" data from existing data sources. Such collection is time-consuming and difficult to summarize, but necessary if one is to both respect and understand the diverse interests and views of stakeholders. Interviews are most helpful when conducted early in the process of designing and implementing an EPI.

Interviews and scoring of answers in various matrices made it easier to diagnose the relevance of the different impacts of EPIs on different stakeholders. Political engagement, for example, contributed to success when stakeholders felt they were part of the decision process (CS3, CS19, CS26, CS9, CS15) but weakened EPIs when stakeholders thought they were being ignored in top-down implementations (CS4 and Cs14).

Institutional influences (lnl)

Institutions are the formal rules and informal norms that define choices. Most institutions are difficult to describe, highly adapted to local conditions, and effective in balancing many competing interests. Institutional constraints vary in strength, according to their permanence (from culture and religion to constitutions to laws to rules and regulations). Institutions often determine the difference between success and failure of an EPI, due to the way that they can strengthen or weaken the EPI's mechanism, i.e., they are either reliable and robust or unstable and rigid.. We separate institutions and transaction costs (TCs) by associating institutions with exogenous impacts on EPIs and TCs with the endogenous fixed costs of implementing an EPI and variable costs of using it. A water market, for example, is established with fixed TCs and operated with variable TCs, but both are affected (positively and negatively) by institutions.

In Australia (CS23), for example, people were allowed to hold water licenses without owning any land. Further reforms defined water licenses as shares and issue them in perpetuity. Separate bank-like water accounts were then set up and structured so that water was allocated to each shareholders account in proportion to the number of shares they held. The implementation of rights in Chile (CS30) was quite different in practice. Individuals were given permanent transferable water-use rights of "national property for public use" but those rights were not specified, secured and registered in a way that facilitated trading.

Policy implementation process (PIP)

Policy implementation reflects the cost and challenge of moving from a theoretical idea to practical application of an EPI. This criterion considers the adaptability of the EPI, public involvement, institutional factors, and external factors (e.g., EU sectorial policies).

Flexibility and public participation depends on the institutional context. Thus, for the voluntary schemes a flexible design and effective involvement of stakeholders in the design and implementation phases of the policy instruments promote acceptance and participation in the schemes, thereby improving overall implementation of the EPI (CS3, CS19 and CS26). However (CS4), points to potential weaknesses of a flexible design sensitive to stakeholder interests: in this case the tax rates and the reimbursement schemes have offered only weak incentives to farmers to reduce pesticide usage. One explanation might be that the policy response depends on individual decisions without a reinforcement of cooperative institutions such as those set up with the voluntary schemes in the other cases.

Overall, synergies were found with the Water Framework Directive. Generally it can be said that EU policies, such as the Renewable Energy Directive, showed synergies with EPIs addressing Hydropower (e.g. CS17 and CS18). Incentives provided by the EU Common Agricultural Policy presented barriers to the successful implementation of EPIs targeting diffuse agricultural pollution. EU policies which target effluent quality from point sources, such as the Urban Wastewater Directive, were found to create synergies with the EPIs addressing point source pollution (CS14).

Co-operation between government units, such as Ministries, proved to be of vital importance in a wide range of case studies, e.g. to implement the policy mix to address diffuse pollution from agriculture in CS13. Also, cooperation between stakeholders greatly facilitated the implementation of EPIs, CS10, where the cooperation between farmers, golf course managers and residents was the key to the success of the water reuse project. CS13 illustrated how budgetary considerations and consequent cooperation between Ministries and stakeholders influenced the design of the EPIs and thus enabled its implementation.

Transaction cost impacts (TCI)

Transaction costs (TCs) represent friction, i.e., the time and money cost of moving from idea to action to conclusion, or the costs of implementing and using EPIs. Ex-ante TCs (from, e.g., negotiating new property rights) are equivalent to fixed costs; ex-post TCs (e.g., from monitoring) are equivalent to variable costs. TCs are identified by examining the steps from design and implementation (ex-ante) to monitoring and enforcement (ex-post).

The uneven distribution of market pricing information in Chile (CS30), for instance, particularly disadvantaged market participants with fewer resources, increased transaction costs and thereby, limited water trading activities. That was not the case in Colorado (CS 22), where trade or rental of water permits were not even reviewed by state water agencies.

Uncertainty impacts (UnI)

An EPI's impact on any criterion is subject to uncertainty from imprecision (missing knowledge, estimation, inaccuracy or ambiguity), complicated interactions among policies, and/or future costs/benefits. Uncertainty assessment described the “level of confidence” associated with the assessment results using a set of “pedigree” criteria. These were variables that represented an explicit account of the quality of information and the processes underlying the knowledge production process. Confidence was expressed using the same five qualifiers as in the IPCC AR5 Uncertainty Guidance note, i.e., “not clearly related,” “weak correlation,” “well correlated”, “good fit or measure” and “exact measure (Mastrandrea et al. 2010). Each qualifier was coded from 0 to 4, with 0 being as “not clearly related” and 4 as “exact measure”. These values were then used to evaluate the quality of information for the environmental and economic outcomes and distributional effects of an EPI.

The overall results highlighted that at an aggregate level the variables employed to capture the environmental objectives of an EPI such as the level of water pollution or the use of pollutants, proved to be a good fit or measure. The variables were chosen mainly from direct measurements of a small data sample with commonly accepted reliable methods (for instance, the introduction of increases in pollution charges in Serpis (Spain) through a reduction in BOD and phosphorous (see CS8). Looking at the variables used to evaluate the economic objectives of an EPI such as the delivery of water at low cost or the income generated from the use of the EPI, it was concluded that on aggregate, they were an exact measure deriving from direct measurements of a large data sample with commonly accepted reliable methods. For instance, the water transfer in the interconnected Tagus-Segura river basin in Spain (see CS1) or the introduction of subsidies on practices in Cyprus (see CS20). Finally, as far as the variables used to capture the distributional objectives of an EPI are concerned, they provided less encouraging results compared to the environmental and economic criteria (for example, the financial compensation for environmental services in the case of Evian Mineral water in France (see CS19)). It was concluded that although inequalities and changes seemed to exist due to the introduction of the EPI across various groups, further research is needed on the quality of data, in order to adequately capture the distributional impact of an EPI.

How do criteria interact?

Criteria relate in the following way: EPIs target objectives by producing outcomes on economic and environmental dimensions. These outcomes are associated with distribution patterns that affect the social impact of an EPI. Impacts for all three of these criteria are subject to the influence of institutions, which affect the process of implementing the EPI and the transaction costs associated with its design, implementation and operation. The sequence of implementing changes associated with the EPI affects its performance, as realized outcomes are only one example drawn from the set of potential outcomes. That said, a change in circumstances (i.e., uncertainty) may change the set of potential outcomes.

It is difficult to use an AF that simultaneously asks authors to consider an EPI one criterion at a time and then asks the authors to weight and aggregate these criteria into an overall assessment of EPI performance, especially when the borders among the criteria (e.g., economic costs and transaction costs) may seem arbitrary. It's even harder to reflect on the relative importance of criteria when their relative weights may change with the case study and the observer. Our case study descriptions go some way towards addressing each of these problems, exploring EPI performance over a number of pages instead of creating a single, numeric "outcome," but such a nuanced approach requires unusual attentiveness from readers, something that is hard to find among policy-makers who are often pressed for time and the need to give stakeholders fast and definitive decisions.

As an example, consider the interaction of criteria in CS 11, which examined a Dutch national tax on groundwater extractions. The tax was formulated with existing institutions in mind, the provincial groundwater tax, the general move towards "green taxes" in the 1990s, existing interest groups, and a water management regime that attempts to balance between too much and too little water. These exogenous factors affected the implementation of the EPI, which, for example, exempted most farmers from the tax and gave a special rate to industrial users. These exemptions changed over time, but their immediate effect was to place nearly all of the tax burden on fewer than 20 drinking water companies. This distribution burden was intentional, since those companies were considered to have the economic ability to pay the tax (and pass it along to customers); farmers were too numerous to track as well as too difficult to measure in their joint use of ground and surface waters (high transaction costs). Ironically, it's hard to measure the environmental impact of this "green tax" since there was no effort to connect the tax with behavior and water levels. This uncertainty may have been intentional, but it was also used as an excuse to abolish the tax when it was reassessed in 2010.[2]

A comparison to other assessment frameworks

Assessment frameworks are used to evaluate the impact of policies across dimensions that may not overlap or reconcile, using appropriate indicators. Rather than borrow an existing assessment framework, EPI designed its own assessment framework (EPI AF) for ex-post and ex-ante case study assessments.

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2 · EPI-WATER (2010:12): "EPI-Water will develop a comprehensive multi-dimensional assessment framework that will help comparing in a systematic manner the advantages and disadvantages of EPIs (or combination of EPIs). In addition to effectiveness/cost effectiveness and efficiency, the framework will include equity and distributional impacts, applicability and implementability, transaction costs, etc…. a review of the application of economic instruments for water management in Europe illustrates the much wider diversity of instruments that are already in place in selected Member States. However, these have received limited attention so far and no robust (scientific) assessment of these instruments is available today."

This section compares EPI AF to other assessment frameworks:

Canton et al. (2010) use indicators (as defined herein) to assess how structural reforms can encourage green growth. Their indicators are grouped into "areas" of cost efficiency, sound use of public finances, strong markets, and long-term productivity. Using broad definitions, these areas and their indicators include EcO, and EnO, plus a partial PIP, but they do not address DiO, InI, TCI or UnI. Canton et al.'s indicators are meant to be quantified and used to rank/compare EU countries. The EPI AF is meant to facilitate the evaluation of an EPI within a country or region, according to local goals and constraints.

EC (2011), like Canton et al., focusses on indicators that can be quantified, normalized and aggregated to make it easier to compare EU member states. A "second step" is required to include qualitative information. EPI AF uses both quality and quantity data to describe and analyze EPIs, but – as before – performance is based on local goals and needs rather than comparison with other EPIs or locations. Such a method makes it easier to mix or compare indicators according to subjective weights that reflect local outcomes of interest.

BIO (2012) has a framework for assessing direct or trade-related use of resources (material, energy, water, land) within the EU. This framework is aimed directly at accounting for physical flows with the purpose of meeting resource efficiency targets. It does not integrate policy or instruments. It could perhaps be used as a complement to EnO, except that physical measures such as water footprint do not include relevant indicators of water stress (EnO), the value of water in use (EcO), the role of water in communities (DiO), and so on. Young (2002) focuses on the levels (stocks) of various environmental indicators.

Pelletier et al. (2012) describe a way of evaluating the EU's "sustainability footprint" as a function of EcO, EnO, DiO and InI. They also include PIP, TCI and UnI in their discussion, which is aimed at EU policy makers interested in current outcomes and potential future changes in policy. This paper complements EPI AF at a higher level, as the EPI AF is more detailed.

EPA (2004) provides a framework for assessing the potential for water quality trading, taking EcO, EnO, InI, PIP, and TCI into account. It also discusses the importance of DiO and UnI. The framework uses a self-assessed, bottom-up perspective to evaluate the potential for trading given the existence of a cap on total maximum daily load (TMDL) in waterways. It is therefore much more narrow than the EPI AF, which can assess a variety of EPIs. That said, EPA (2004) exemplifies a specialization of EPI AF guidelines.

From assessment results to action

Policy assessment is necessary for the design of new policies and improvement of existing policies. They are part of the EU good governance approach and increase transparency. Often policies are designed with assumptions, guesses and expectations as to how they will affect outcomes, and ex ante impact assessment are hardly required in any Member States (see Dworak, et al, 2010). This lack of ex-ante forecasts, combined with even more-frequent lack of ex-post evaluation, means that policy makers – and the citizens they serve – cannot evaluate the impact of implemented policies or improve the design of future policies. This failure to "close the loop" represents simultaneously a failure of good governance and a missed opportunity for improving outcomes in the EU.

The results from the AF can be presented either quantitatively or qualitatively and both approaches aim to simplify complex information and make it accessible to a broad audience. However it is important to note that assessment methods, specifically quantified, can be difficult to understand which influences their use in decision making.

The most difficult aspect often is how environmental issues are valued in monetary terms. Especially, non-economists have a higher scepticism towards the concepts of using price-tags or in assigning other types of quantitative values to environmental goods which are not traded in markets. Also the results and the explanation of the environmental benefit assessments are not understandable for the public and so the various stakeholder groups are often dissatisfied. The acceptance and uptake of the presented results and their use in the decision making process is also depending on the tradition of policy making within the different EU countries (Dworak, et al, 2010).

The members of EPI-Water have stepped into this gap with their assessment framework to tackle a problem that exists in the EU (and around the world), a problem that undermines the function, promise and popularity of policy makers and regulators, i.e., a failure to link policies, actions and outcomes using clear and objective evidence. The EPI AF helps water managers, decision makers, regulators and stakeholders evaluate the effectiveness of water policies across multiple, overlapping criteria – a result that supports the EU's The Blue Print on Safeguarding EU Waters (EC 2012).

We invite policy makers everywhere to modify and use the AF to meet their own needs for designing, implementing and evaluating instruments that use economic and non-economic means for managing water and other social goods.

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Annex 1: Assessment Framework and

These documents can be downloaded by clicking on the hyperlinked title or visiting http://www.feem-project.net/epiwater/pages/download-public-deliv.html.

Assessment Framework (Deliverable 2.3)
Comparative analysis of case studies (Deliverable 3.2)

Case studies (Number, location, country, EPI)

CS01 Tagus (ES) – water transfers
CS02 Ebro (ES) – voluntary river restoration
CS03 Dorset (UK) – payment for pollution reductions
CS04 Denmark – pesticide tax
CS05 Hungary – water resource fee
CS06 Hungary – water load fee
CS07 Emilia Romagna (IT) – agricultural water tariffs
CS08 Serpis (ES) – water pollution charge
CS09 Llobregat (ES) – intersectoral water transfer
CS10 Tordera (ES) – incentives to use reclaimed water
CS11 Netherlands – groundwater tax
CS12 England & Wales – residential metering
CS13 Baden-Wurttemberg (DE) – water abstraction chanrges
CS14 Germany – effluent tax
CS15 Switzerland -- hydropower
CS16 Po (IT) – water tariffs
CS17 Po (IT) – green energy certificates
CS18 Germany – payment for green hydropower
CS19 Evian (FR) – payment for pollution reduction
CS20 Cyprus – drinking water conservation

CS21 China – pollution charges, abstraction charges, input subsidies
CS22 Australia – salinity offsets
CS22 Colorado (US) – water trading
CS23 Australia – water rights unbundling
CS24 Israel – urban water pricing
CS25 Ohio (US) – water quality trading
CS26 NY (US) – payment for watershed protection
CS27 California – water tariffs and budgets
CS29 North Carolina (US) – water quality trading
CS30 Chile – water markets