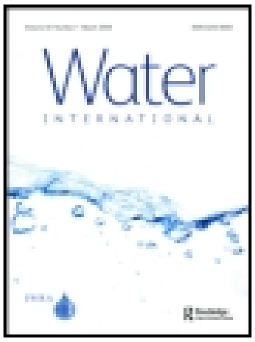

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Resolving the problems of commensurability in valuing water

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ABSTRACT
In this paper a framework is presented for comparing the values derived from the different dimensions of water, without incurring the problems of commensurability. The framework is based on the concept of opportunity cost, which values any good by what one is willing to sacrifice to get it, which is a way of comparing seemingly different things. By simulating changes to a water resource and then measuring the economic, social and environmental impacts in metrics common and accepted by each dimension, a curve of the trade-offs between each metric can be derived. This makes trade-offs intrinsic to decision-making explicit.

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Introduction

Valuing water has long been the domain of economists who have developed methods for quantifying the monetary value of water-related goods and services (Gibbons, 1986; Young & Loomis, 2014). Nevertheless, as wider assessments on and concerns about how water affects the well-being of society and the environment, the issue of valorization has become increasingly important. It is clear that decision-making should no longer be solely targeted at value determination (which becomes inherently difficult as values become disputed, partial, incommensurable and imperfect), but become more orientated towards offering a structured and transparent mechanism that supports a multi-stakeholder process (Hellegers & Van Halsema, 2019). As many participatory processes mask abuses of power and inequity, a more politically explicit process is needed. Valuing water makes the stakes involved more explicit for all of society, as well as for individual stakeholders (Hellegers & Van Halsema, 2018).

Since the adoption of the fourth Dublin Principle in 1992 at the International Conference on Water and the Environment (ICWE) (1992), there has been a formal recognition that water should be considered an economic good. According to this principle, water has an economic value and should take into account affordability and equity criteria as well. The total economic value (TEV) concept, applied to water by Rogers et al. (1998), adopts a more theoretical and economic-based approach to valuation. Since 2000, attention has shifted to methods that also address environmental values (Dyson et al., 2003; Emerton & Bos, 2004), as well as some social values. These developments represent gradual shifts in

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perspectives: from water as an economic scarce good that needs to be priced accordingly, to water as a societal good that has intrinsic values and opportunity costs to society, and eventually to an environmental perspective with even higher intrinsic values and benefits to society (e.g., clean air, clean water, coastal protection, etc.).

These shifts in perspectives lead to shifts in valorizations across scales (local versus society) and across economic domains (private versus public), thus gradually complicating their commensuration into one value or a single valorization framework. As the value of a body of water resides in a number of dimensions spanning the economic, aesthetic, spiritual, cultural, emotional and environmental, it is unclear how these values can best be articulated and whether they could be made commensurable. Water resources are used in the production of almost all goods. Irrigated agriculture is the largest user of water. The economic production value of water use can be derived using marketplace concepts. Good-quality water for drinking, washing and cooking is essential to sustain human life. Domestic water used for garden watering provides the aesthetic values of a verdant garden. Indigenous people attach spiritual significance to water ecosystems (Moggridge et al., 2019). Water is central to their culture and identity, as well as livelihood, but these values are poorly understood. They believe water to be a sacred and elemental source and symbol of life, which has sustained watershed communities. Water-dependent ecosystems provide a myriad of ecosystem services, such as processing waste and keeping water clean, or providing biodiversity, of indirect economic value and of intrinsic value. They can be valued purely for their own sake, or merely from the knowledge of their existence. Individuals express bequest values for ecosystems, wanting to preserve them not just for their own benefit but for the equal benefit of generations to come. Others have a deeply held sense of place and belonging towards water environments, which has an emotional significance for them.

The attachment, or value, people place on each of these different dimensions of the same water body differ not only in scope and size, but also in the scales with which they are measured. For instance, monetary units can be used to describe the economic values associated with water, while a range of physical units can be used to describe the environmental aesthetics and emotional expressions (feelings of dread and euphoria) for the cultural dimensions associated with water. Given that different values are derived from the same body of water, it is clear that any analyst should account for the total value of the resource, not just a limited subset of all the dimensions; the Dublin Principles of 1992 demand no less. More importantly, in many but not all cases, the values of one dimension may well be sacrificed (traded-off) to achieve an improvement in another.

The common method used to undertake total assessments of the resource is to convert all the values associated with these different dimensions into a single unit of measurement, usually placing all values in monetary terms. This method of standardizing units is undertaken because it is believed that it is the only way of making a comparison between the different values. However, rather than resolving the problem of comparison, it actually enhances these problems. These problems of standardizing units are known as the problem of commensurability.

The aim of this paper is to outline a framework for determining and comparing the values derived from the different dimensions of water, without incurring the problems of commensurability. This framework is based on two related economic concepts: those of transformation curves; and their relationship to opportunity cost. Both concepts, used in tandem, can be harnessed to compare changes in different dimensions of the value of water that result from the same resource, with each value expressed in the units in which they were originally specified. This framework is of use to those evaluating infrastructure and policy changes in the water sector. The approach is limited by the data that are available to evaluate such changes. They can only be used to assess the changes that arise from a specific proposed change to the resource base and not to determine the total asset value of that resource. Thus, this paper is of interest to decision-makers in catchments who need to make and account for changes in catchments. The approach specified in this paper ties together what is already known about a water resource and interprets that in a way that decision-makers can effectively and efficiently use to evaluate changes to an existing resource.

To justify the development of a framework for comparing the values derived from different dimensions of water, the next section reviews the need to value water and the third section describes the problems of commensuration. The fourth section discusses the importance of making explicit the implicit changes across a range of measures of value. The fifth section discusses the concept of opportunity costs which is introduced to compare different things that are not usually compared. It allows one to compare what an individual or society is willing to sacrifice in order to get something. Such trade-off values are the rates of exchange between different values that have been measured and result from the proposed change. Various trade-offs are illustrated in the sixth section. Limitations and further refinements are discussed in the seventh section. Conclusions are drawn in the eighth section.

The need to value water

Since 2016, valuing water is one of the four lighthouse initiatives of the High Level Panel on Water (HLPW). The HLPW recognizes that global action towards Sustainable Development Goal (SDG) 6: ensuring the availability and sustainable management of water and sanitation for all, is critical, and therefore is motivated by the need to build momentum towards a common vision for better stewardship of this global resource (World Bank, 2017). Valuing water is an important part of that vision. The HLPW defined five principles that aim to motivate and encourage governments, businesses and civil society to consider the multiple values that societies accord to water and its uses, and to guide the explicit deliberate incorporation of these values into decision-making.

Garrick et al. (2017) outlined four steps towards better valuation and management. Hellegers and Van Halsema (2018) were critical of this process, claiming that the highly political nature of valuing water is not made explicit. In addition, they argued that the link between the larger scale public benefits of water to local uses and impacts was not explicit either. The purpose of valuing water is to inform decisions about water management and allocation and to make their impacts explicit, deliberate and conscious. Hellegers and Van Halsema (2018) recommended a more (politically) explicit process.

The general motive behind valuing water is to identify the worth of water in its competing uses so that decision-makers can better understand and communicate values and trade-offs between different uses (Australian Water Partnership, 2016). Therefore, in this paper, the total value can be defined as 'the aggregation of what a representative group of people want from the use of a resource'. The meaning of 'aggregation' in this case is that the values individuals place on an item can be combined into a total value for all water. By 'representative' the intention is that all the views society may have about the resource can be expressed by people chosen to decide its worth. This group of people aims to represent the views of society. By 'want' it is intended that desires count, not what people might consider to be 'needs'. That 'use' includes economic, environmental and social elements of a good or service or proposal. The 'resource' in this case refers to a body of water.

Determining the purely economic returns to water has long been recognized as being an insufficient measure of the total value from a body of water. There is a need to recognize and measure the social and the environmental dimensions of water. Many more have also recognized the need for an all-encompassing approach.

Rogers et al. (1998) provided a way of illustrating the value of water (Figure 1). While, the two elements of cost and value are clearly seen in the diagram, another more subtle view of the issue of valuing is also displayed: the idea is that many different elements make up the total (or full) value of water. The full value is presented as the outer boundary in the right hand portion of Figure 1 and it is equal to its constituent parts made up of the values derived from the economic returns, societal objectives, etc., all derived from the different dimensions people see in water. They are displayed within and make up the full value of water.

This subtle distinction is important because it highlights two very different needs for valuing water. The first is to know what a resource is worth in its entirety: this is a static measure. It is the value of the asset that is important and is used for national accounting purposes, remediation values, etc. It can be determined by calculating the full value in Rogers et al.'s diagram. The second desire for valuing comes from the need to know what happens if some change is proposed to the water resource: this a dynamic measure. With any proposed change to the resource base, while the full value itself is important (and should presumably be greater after the proposed change than before it), of greater interest are the changes that each dimension contributes to the full value that is of prime interest. It is changes in the proportions of the values that make up the full value that are debated and fought over when a change is proposed, not the presumed and hoped for increase in the full value. Thus, this second desire should take precedence over valuing the asset as a whole.

The problems of commensurability

The problems of commensurability arise because analysts attempt to provide a single measure that satisfies the two objectives of accounting for the full value of a resource and the changes in contributions from each dimension. It would appear that combining the two into a single measure seems so logical because one (the full value) is equal to the sum of the other (dimensional parts). However, to achieve this unity of purpose requires valuing every dimension by a standard set of units. This act leads to the problems of commensurability.

The task of combining different elements and standardizing units into a single entity requires a scale that is both similar and appropriate to all the constituent parts from which it is derived. In the water sector, with so many different values in existence, it is easy to argue that a single unit of value representing all values not only lacks similarity, but also is not an appropriate thing to do.

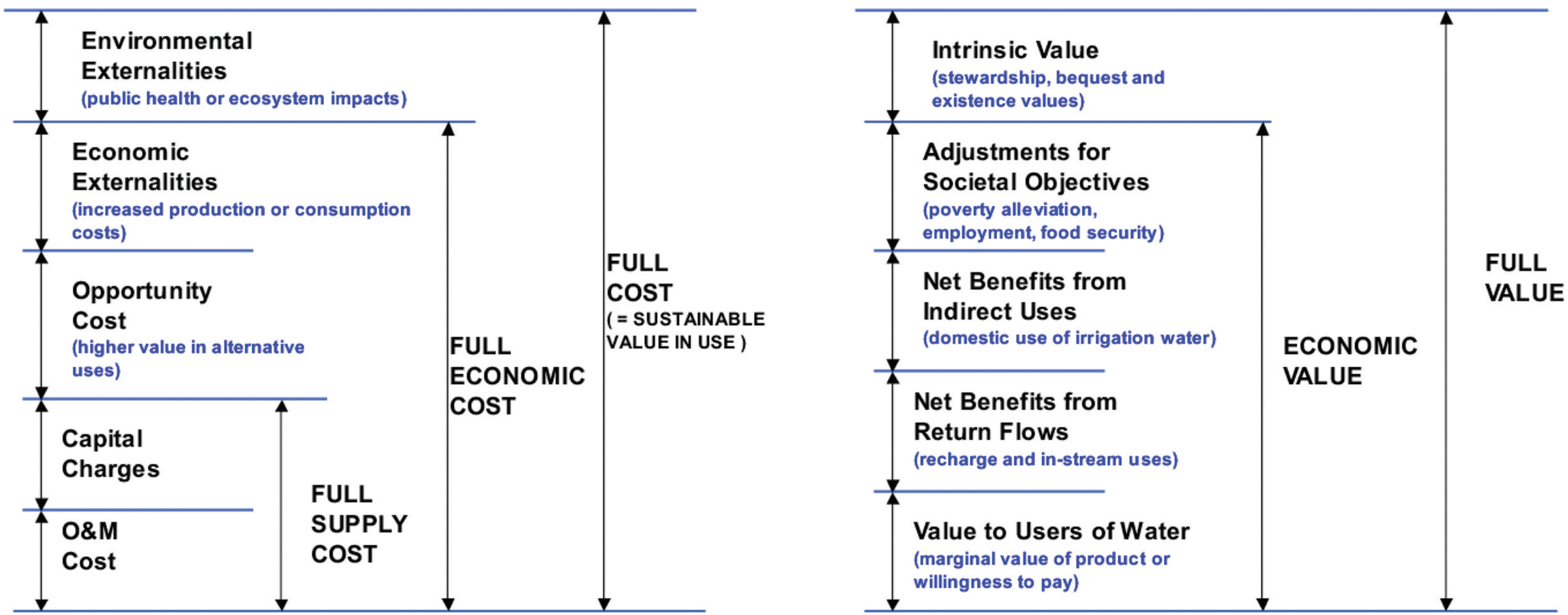

Figure 1. General principles for cost and value of water. Source: Rogers et al. (1998).

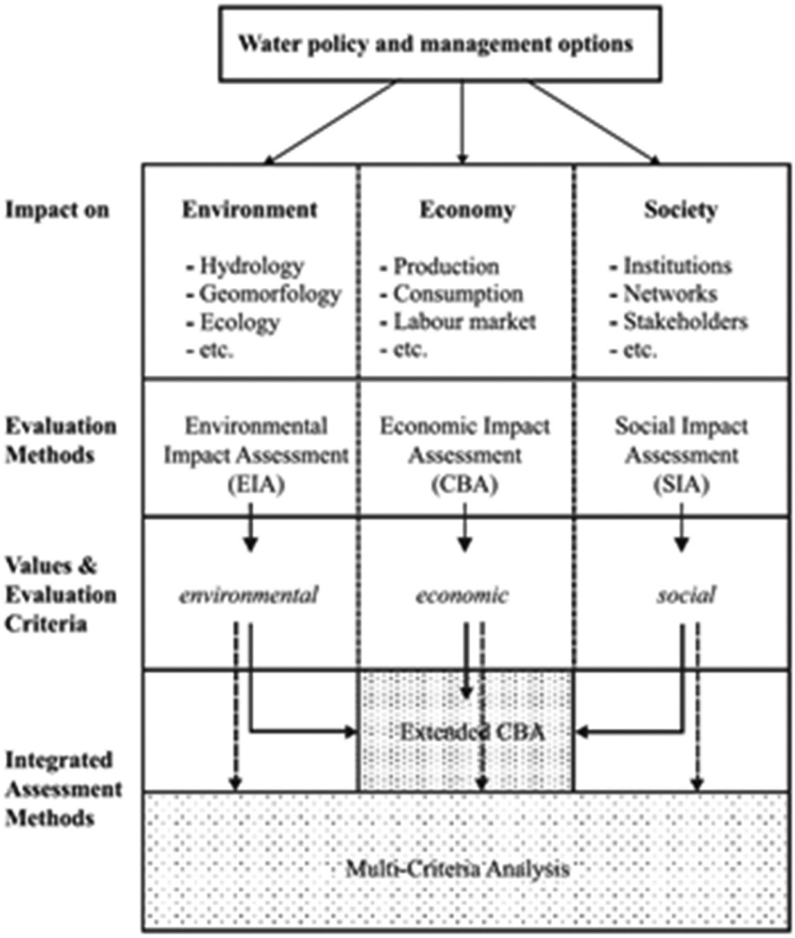

Figure 2. Assessment framework. Source: Brouwer & Van Ek (2004).

Brouwer and Van Ek (2004), in a comprehensive assessment of flood control in The Netherlands, raise an interesting question. In their abstract they state:

An important research question remains how to assess, integrate and trade-off (1) significantly different types of impacts in a methodologically sound way in both cost–benefit and multi-criteria analysis, and (2) significantly different types and quality of available knowledge and information about these impacts. (p. 1)

Their analysis can best be described in diagrammatic form where they undertook individual assessments of the economic, social and environmental impacts of flood-mitigation policies (Figure 2). They draw elements and impacts from these assessments and incorporate them into a cost–benefit analysis and a multi-criteria analysis in order to evaluate the value associated with undertaking changes to the infrastructure. Brouwer and van Ek's approach is emblematic of many who recognize multiple values associated with water and the need to account for them. However, as they recognize so openly, their results are subject to the problem of commensurability.

The problems with commensurability in studies of valuation are about the suitability and the appropriateness of undertaking a standardization task. Because these individual values are not measured by the same standards, the problem arises in how to articulate these individual values for comparison purposes. Standardizing these values in monetary terms, for instance, does not make much sense if one values the political outcomes from introducing a measure. In this instance, measuring the number of votes that might result from the change would make more sense, but that output to an economist is meaningless.

Expressing all value components in a common measurement unit places limitations on the valuation process. It is open to questions of what the appropriate rate of exchange between different values should be and how these rates of exchange may change over time, space and scale. Thus, illogically, the aim of gaining comparability and compatibility amongst values is transferred to an argument about the size of a range of the rates of exchange.

Placing all values in terms of one measure tends to prioritize the dimension of the chosen measure over other dimensions. Attempts to overcome this problem by weighting some dimensions over others biases the analysis, as weighing is political in nature and pertains to ideas about subjectivity, interpretation and constructivism in policy analysis.

It could be argued that commensuration is ultimately a political act, since it transforms the importance of each dimension into the values society places most importance on, or what the most powerful and loudest voices want. Commensuration is a political act because it transforms the categories people use into values that do not represent what is meaningful to them. It redefines the terms of the debate into a political process, even when done as 'scientifically' or as 'rationally' as possible (Nelson Espeland & Stevens, 1998).

Valuing different dimensions in a common set of units erases nuances within and among the multiple elements being aggregated. In any assessment in which commensuration is undertaken, it should be asked: Does the result presented come from the proposed change to the system, or from the calculation method itself (which often reflect epistemic perspectives) or a combination of the two? Thus, commensurability is not a solution to the problems it seeks to solve. Yet, the aim of providing a degree of transparency that allows trade-offs intrinsic to decision-making and priority setting explicit still exists.

Making the implicit values explicit

The aim in undertaking an act of commensurability is to compare two or more different things in an appropriate and suitable way. Using similar units between different elements may well achieve this in a limited manner. However, it should be noted that comparisons can and do occur between elements with different units. For instance, in much of economic theory elements are compared and trade-offs established that have different units (labour and capital, for instance). The construction of a production possibility frontier and its concomitant transformation function and the marginal rate of transformation, compare the trade-offs between the production of two different goods constrained by the availability of resources. There is no standardization of units in the evaluation of a production possibility frontier. It should be asked if the same concepts embodied in a production possibility frontier could be adapted to compare the different values of different dimensions of water, without standardizing the units between them and thus incurring the problems associated with commensurability.

The first stage of a valuation process aimed at knowing how the different dimensions change because of some proposed change requires knowledge of what actually changes. From an economic perspective, it may well be a range of economic factors, all measured in terms of a currency; while from an environmental perspective, it may well be changes in a range of physical factors, all related to the ecosystem; and from a social dimension, it may well be changes in an entirely different set of metrics again.

These measures can (and should) be derived from a range of studies on the proposed change, such as a benefit–cost analysis, an environmental impact assessment and a social impact analysis, at the very least. While some care must be undertaken to understand the limits and overlaps in each assessment, it should be noted that the data from each assessed measure would be specified in different units. Further, because the interest is in assessing the changes that result from a proposal, each item measured should have a record of the original value (a figure derived from the current situation) and an estimate of the value that arises from undertaking the proposal (an after-figure). The difference between these two observations is the change in each variable arising from the proposal itself and it is specified in the units that are appropriate to the value each attests to represent.

Dividing the differences by the original value for each (and multiplying by 100) yields the percentage change each measure experiences with the proposal. While this does allow some comparisons to be made, especially regarding the size of the impact a proposed change may well have, it is not a relative value that can be used in a comparative valuation process. All that it reveals is the extent each individually measured component is affected by the change. What it does do is make explicit the implicit changes across a range of measures of value.

Determining the relative value

To compare the impacts a proposed change has on each measure of value requires the application of the concept of opportunity cost, a fundamental concept in economics. The concept of opportunity cost states that: 'Any good can be valued by what one is willing to give up to get it.' Opportunity cost is only one approach to defining value from the many that exist. Most importantly, however, it is a direct way of comparing seemingly different things that are not usually compared. It is based on the need to compare, confront and decide what an individual or society is willing to sacrifice in order to get something.

Dividing the individual difference of each measure of value by the value of the difference in every other impact measured yields a table of the trade-off values of the change in each individual measure against all the other individual measures. These trade-off values are the rates of exchange between different values that have been measured and result from the proposed change. Mathematically, they can be expressed as follows:

$$RE_{i,j} = \Delta x_i / \Delta x_j$$

where $RE_{i,j}$ is the rate of exchange between i and j; and Δx_i and Δx_j are the differences in i and j that result from a change.

The rates of exchange are the opportunity cost of the proposal because they show what is sacrificed to get another unit of something else that is also desired. These values are measured by different metrics, and there is no need to standardize these, as the loss or gain in one value can be directly compared against the change in another. In other words, units are expressed in terms of x_i divided by units of x_j.

The logic of this way of observing trade-offs is equivalent to those specified in a production possibility frontier/transformation curve, which reveals how much of one good has to be given up to get a certain quantity of another. For the purposes of this study, two important elements and one qualification emerge from an assessment of production possibility frontiers/transformation curves and the resulting marginal rate of transformation. First, that the units in the production possibility frontier are not the same for the two goods in question. Each is specified in the units of production of each individual good. They need not be comparable in any way, shape or form. Second, that a trade-off exists between changes in the production (the outcome) of each good. Generally, to produce more of one requires less of the other, yielding the marginal rate of transformation. It should be noted that while production possibility curves are generally negatively sloped, they could be positively sloped if and only if the two goods were by-products of one another. The qualification that needs to be noted is that the production possibility frontier itself implies full employment and efficiency of all resources used. If that were not the case, then some point within the frontier would exist, and improvements to efficiency and the employment of more resources would yield a move towards the frontier.

For the purposes of valuing water, it must be asked why the values derived from water are not displayed in a similar manner to that of a production possibility frontier describing the production of goods. The values derived from measuring two different dimensions of water value could be placed on opposing axes. The changes in each value metric before and after the proposed change could then be mapped in a similar way to those of goods. The variations in values arising from the proposed change will ascribe an arc that reveals the trade-off between the two values. The slope of this arc is the rate of exchange between the different values. It should be noted that in this analysis no points on the ascribed curves reflect a point of full employment and maximum efficiency, only the reality of changing elements of value from an existing situation.

Using this approach, the implicit trade-offs between values are made explicit and meaningful in a way that can be visualized without having to resort to the standardization of units and invoking the problems of commensurability.

Illustrating the framework

To illustrate this framework, assume for simplicity that there are just two values of interest in the discussion of a change to a water resource: the economic returns measured in monetary terms (US$ million) and environmental outcomes measured in the area of land affected (ha). In most analyses the environmental dimension could be turned into a monetary value by working out the value of the land (US$/ha) and multiplying that by the quantity of land affected. This would result in questions about the value of the land, which is a problem of commensurability, as land has not only a production value but also an amenity value, whose rate of exchange may well differ depending on the size of the change assessed.

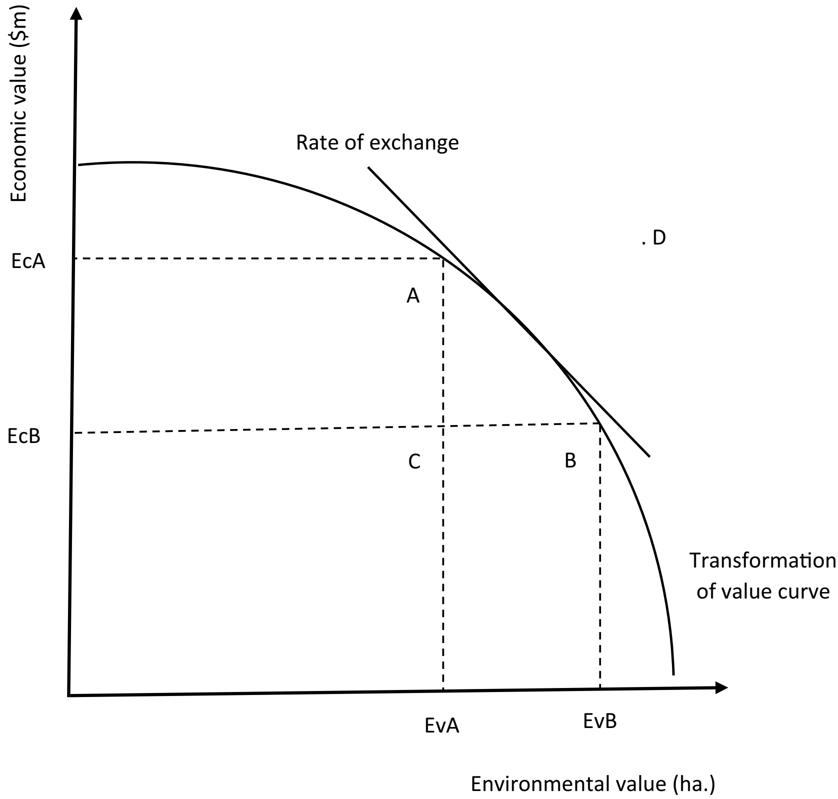

Figure 3. Transformation of the value curve and rate of exchange.

An alternative would be to map the economic and environmental changes in a space delimited in economic values (US$ million) on one axis and environmental values (ha) on the other (Figure 3). The changes in values that arise from the proposed change to both the environment and the economy (say from A to B) are explicitly shown along the transformation of the value curve and the rate of exchange between them can be calculated. For instance, if a change along the transformation curve is contemplated from A to B, the loss in economic values (of EcA–EcB) is balanced against the rise in environmental values (of EvB–EvA). If the opposite change were proposed, the result would be in the opposite direction. In the case shown in Figure 3, the marginal rate of the change in values (the rate of exchange) is equal to the slope of the transformation of value curve (or in Figure 3, it is equal to (EcA–EcB)/(EvB–EvA)). In other words, every unit of change in economic value results in the opposite change in environmental value, and vice versa. This rate of change varies as the size of the change and the points along the curve change.

Unlike the production possibilities frontier, where points on the interior are considered inefficient, points on the frontier are efficient and points beyond the frontier are unattainable, such logic does not apply to the transformation of value curve. Points along the transformation of value curve are derived from the changes arising from an alteration of the current environment. A point outside the curve (like D) or inside it (like C)

Table 1. An example of a change.

Dimension	Measure	Units	Original	New	Difference	% Change
Economic	Net returns	US$ millions	10	12	2	20
	Local support	US$ millions	100	120	20	20
	Benefits	US$ millions	110	132	22	20
Social	Jobs	no.	20	10	−10	−50
Environmental	Frogs	no.	100	100	0	0
	Trees	no.	50	40	−10	−20

represents different value outcomes. Clearly, a move from either A or B to C (Figure 3) yields an inferior outcome in terms of the total economic and environmental values, whereas a move beyond the curve (from A or B or from C to D) results in a superior outcome as the values of both factors improve. Moves between A and B represent the trade-offs in values that will arise from a proposal to change a water resource.

This example can be expanded to include more than two dimensions, to as many as required, but more than two dimensions cannot be easily illustrated diagrammatically. To expand the example, it could be argued that because of a proposed change three economic indicators (all measured in US$ millions) are considered to be important, along with two environmental indicators (frogs and trees) and one social indicator (jobs). If all are measured in their appropriate units, the original and new situations are reported and differences in those two are calculated in both absolute and percentage change terms (Table 1).

A pictorial representation of the absolute and percentage changes resulting from this example are shown in Figure 4, where the areas of greatest change are identified. In the example shown, the large increases occur in the economic values and the large reductions occur in the social and environmental dimensions. It should be noted that the change in frog numbers is equal to zero and therefore can be ignored from the analysis. That is not to say that frogs are worthless, just that in the calculation of the value of this change they are not affected.

To calculate the rate of exchange (or the trade-offs) between each of the variables, divide the individual difference of each measure by every other measured change (see multidimensional Table 2). To interpret these values, it could be said that for every

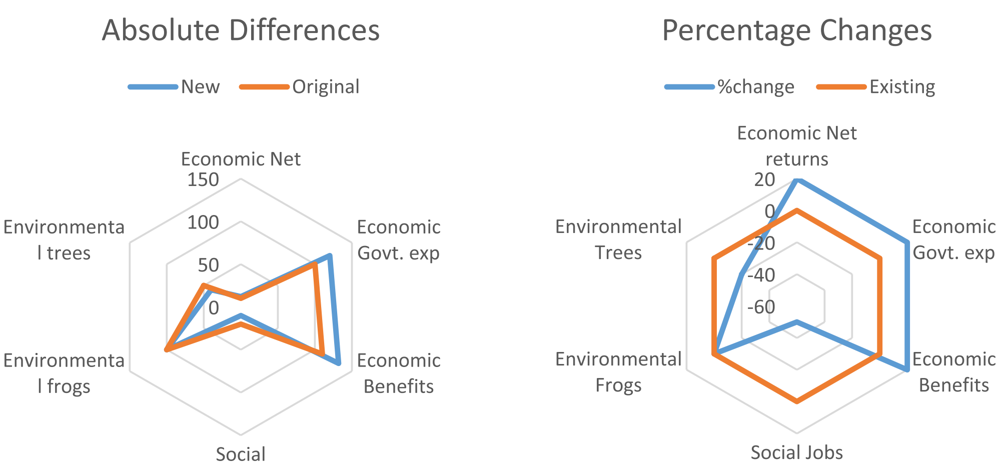

Figure 4. Absolute and percentage change differences.

Table 2. Calculated trade-off between each indicator.

				For every unit of these columns . . .				
				Economic			Social	Environmental
				Net return	Government expenditure	Benefits	Jobs	Trees
			Units	US$ millions	US$ millions	US$ millions	no.	no.
. . . we get so many units of this row	Economic	Net returns	US$ millions	1	0.1	0.1	−0.2	−0.2
		Local support	US$ millions	10	1	0.9	−2	−2
		Benefits	US$ millions	11	1.1	1	−2.2	−2.2
	Social	Jobs	no.	−5	−0.5	−0.5	1	1
	Environmental	Trees	no.	−5	−0.5	−0.5	1	1

US$1 million of net economic return in value comes at a cost of five trees of environmental value and five jobs of social value. A number of questions regards these values can then be realistically asked. For instance, is each tree and job worth US $200,000? Other interesting issues can be seen in Table 2 as well. For instance, while it is noted that each US$1 million of net return gained, requires US$10 million-worth of local government support, whether or not this is a good outcome can be debated. Those who receive local government support might applaud the value, while those worried about government expenditure and a budget deficit might have the opposite view.

Limitations and further refinements

The approach outlined above has concentrated on determining the relative changes in values that arise from a proposed change to a water resource. While the problems of commensurability have been avoided, little has been said about what happens to the total value of the resource. The implication from taking this approach is that values are seen as multifaceted elements. No longer would or should values be expressed in terms of a single metric. Rather, to use the example specified above, the total value of an existing water resource is equal to US$10 million in net returns and US$100 million in local government support and 20 jobs and 100 frogs and 50 trees. After a proposed change it is still equal to 20 jobs, 100 frogs and 50 trees.

The approach relies on valuing wants from the economic perspective of opportunity cost. It implies that anything can be traded away to determine the value to society. Yet, it could be the case that some changes in value seem small, but are in reality relatively large and important (i.e., changes in the numbers of an endangered species). These issues need to be addressed in addition to making the values explicit.

It should be noted that only small marginal changes can be assessed using this approach. A big change to water use could result in the extinction of some component of value of the resource, something that is beyond calculation using this method. To do so would result in the value of the extinct attributes falling to zero and thus being excluded from the analysis. Interpreting marginal changes in values should only occur close to the mean (say 10%) to be meaningful. Further, all changes may not be linearly related. As a consequence, it is advised that analysts conduct a sensitivity analysis around the mean of values obtained to assess whether changes in some values are more

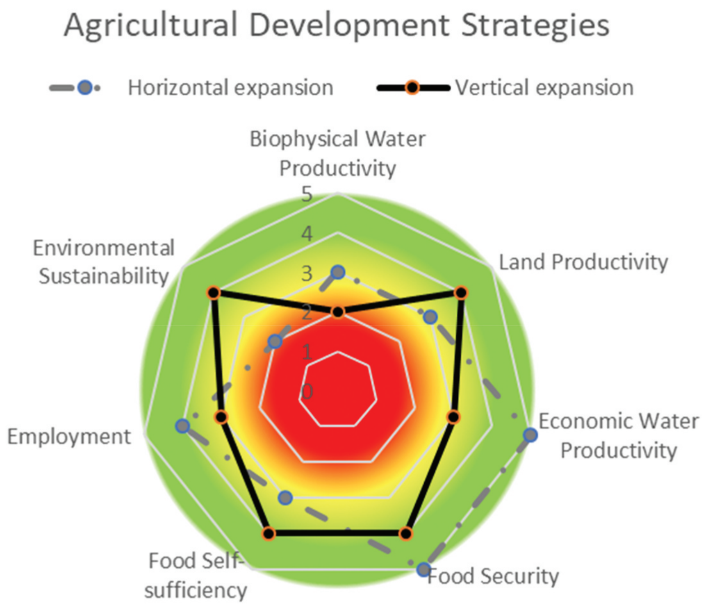

Figure 5. Scoring of horizontal and vertical expansion strategies on a set of indicators.

dynamic than others. Marginal changes are very small incremental changes that do not affect the larger (macroeconomics) totals except in aggregate. As 'margin' means 'edge', marginal changes are adjustments around the edges of what is being contemplated. This is consistent with the needs of those who could use this method, decision-makers and stakeholders within a catchment contemplating changes to the management of a water resource system.

This framework has been applied to different agricultural development strategies in Egypt and food security strategies in Jordan. It could also be applied to other policy domains. The framework could make explicit the trade-offs across food security, food self-sufficiency, employment, environmental sustainability, water productivity, and land productivity of horizontal expansion and vertical expansion strategies in Egypt. The two strategies were extracted from policy reviews and discussions with experts. The horizontal expansion strategy represents that new, uncultivated lands are taken into production to produce high-value crops for the export market. The vertical expansion strategy represents a raise in the land productivity of staple crops on existing agricultural land for the domestic market.

Figure 5 presents a graphical overview of how the strategies score against each other on a set of indicators. It also shows the various trade-offs that emerge. Although the scores for the various indicators are up for discussion, a very clear trade-off is presenting itself. Namely, whether a country should pursue reclamation of new areas for economic profitable agriculture that scores high on crop and economic water productivity but has many environmental impacts, or whether the country should increase its land productivity on existing areas, with no increases in the number of jobs generated, but with a higher environmental sustainability.

Conclusions

The value of water resides in a number of dimensions spanning the economic, cultural, spiritual, emotional, aesthetic and environmental. This poses commensurability challenges because these values are embedded in starkly contrasting conceptual valuation frameworks whose languages do not overlap sufficiently to permit scientists to compare them directly.

The starting points for people who compare values are too different to find easy ways to compare them. Such different value frameworks represent contrasting norms and convictions, belief systems and discourses which are incommensurable. It is therefore unlikely that one overarching valorization framework could ever exist. The framework and approach outlined in this paper results in an explicit specification of the values derived from the different dimensions of water which allows for comparability, without incurring the problem of commensurability.

At this point, it must be asked if the standardization of units is even required in a valuation process. The answer depends on why the valuation process it being undertaken. It transpires that a good picture of the different values derived from the different dimensions of a resource produce can be obtained without undertaking the standardization of the units that measure value. This picture is sufficient to allow for a comparison of the trade-offs between different values in light of a change to the resource. However, it may be of less use when the desire is to know what the absolute value of a water resource is. In other words, it can be used to determine marginal changes in values, but not necessarily the total worth (or full value) of an asset. However, it can be used to determine the full or total value of water if a multifaceted view of value, one that accepts that there is more than one dimension to valuing water, is adopted. With this in mind, the process outlined in this paper is sufficient to assess the important questions surrounding an assessment of the value of undertaking a change, and possibly in determining its full value.

The economic value of water can only be as great as the foregone benefits to society one is willing to consider. Rather than trying to commensurate these disperse services into one valorization value (and framework), there is more merit in taking a structured approach, one that is geared towards making explicit these dispersed values of water to society.

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