A "New Economy" for Water for Food and Ecosystems

Synthesis Report of E-Forum Results

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1. Introduction

1.1. A "new economy" for water for food and ecosystems: Managing water resources in ways that reflect their values

Water has many values and it has different values to different people. Water resources and water resource ecosystems are prime environmental and economic agents. They have important instrumental value as they are used, inter alia, to support food production in agriculture and fisheries, to sustain biodiversity, to generate energy, to provide basic sanitary services, to alleviate floods, and to attenuate pollution. Water resource management has proved to be a major stimulus to economic growth and stable access to water for highly dependant rural populations is and will remain key. Values of water go well beyond the economic domain and include social, environmental and cultural dimensions. In allocating and managing water resources, fundamental decisions still have to be made about the full range of values for all its uses.

As the limits of water systems have become more visible, situations of water scarcity (in various degrees) have become more common and competition over water resources has intensified. As a result, the last decade has seen a growing interest in knowing the values of water, natural resource accounting, and in managing water resources in ways that reflect their values, as highlighted at several international conferences. It is, however, not always clear how the values of water can be assessed and how these value assessments can be translated into improved management practices. The challenge is to move towards a *"new economy"* for water for food and ecosystems that provides a sound mechanism to manage the values that water resources represent to societies.

The basis for such a "new economy" would be that water resources are managed in a way that reflects their values. Water policy and management decisions should reflect the economic, social and ecological value of fresh water with a given quality and in a given quantity, available in a certain place and at a certain time. This includes an economic perspective, which focuses on economic efficiency, but in addition, it also includes attention for social and environmental values to address fairness and long-term sustainability. Furthermore, stakeholders have different perspectives and preferences that reflect different values. Arguably, a new economy should leave room to accommodate those differences. Finally, a new economy, if it is to find general applicability, has to cut across different levels of water resources management: the local, national, regional and global levels.

1.2. Focus of the report

Numerous challenges arise in moving towards such a "new economy", in which the value of water is naturally taken into account in decision making. Therefore, an electronic forum was organized as a platform for water experts and policy makers from different parts of the world to share their experiences and knowledge on how to address those challenges. This E-Forum was organized as part of the FAO Netherlands Conference on Water for Food and Ecosystems, under one of its three themes (Theme 2: A "new economy" for water for food and ecosystems). Experts participated in the E-Forum through the submission of cases, which documented their practical experiences, and through a moderated electronic discussion that covered different questions based on a discussion paper.

This synthesis report presents the main outcomes of the E-Forum. It is primarily confined to the contributions, cases and background documents that have been provided by E-Forum participants. References to additional literature have been kept to a minimum, as it is not the purpose of this document to provide an exhaustive literature review. Literature reviews on

important topics are already included in some of the background documents for the E-Forum[1]. The E-Forum cases and contributions therefore deal with practical experiences and innovative practices that can help to shape a "new economy". Focusing on the insights that were shared in the E-Forum is expected to provide a sharper picture of the recent developments in dealing with water values in practice. Although it means that the results presented in this report are by no means exhaustive, they do provide certain insights that go beyond the established knowledge that is available in most textbooks on water valuation and water economics, as they indicate some of the requirements and promising directions in moving towards a "new economy" for water for food and ecosystems.

[1] FAO Water Reports 27 and 28 provide extensive overviews of economic valuation of water resources in agriculture and of water charging in irrigated agriculture. Also the E-Forum Discussion Paper for Theme 2 provides more references to some of the relevant background literature; see also Annex III.

2. Assessing the value of water for food and ecosystems

2.1. The need for water valuation

When water is scarce, choices have to be made on the use and allocation of these resources. These choices should take account of benefits to each user, the costs of service provision, and foregone benefits to users who do not have access to water. Although in theory market-pricing and tradable water rights can lead to an efficient allocation in a "new economy" of water for food and ecosystems, the role of these instruments in water management is limited in practice. Water resources and water-related services are generally common pool resources with important public good aspects and this means that market, governance and institutional failures are likely to occur.[2]

Market failures occur for instance when there are important externalities, i.e. side-effects (positive or negative) on third-parties that go uncompensated or unpaid for. When the market does not take into account - internalize - such externalities, it can be argued that the allocation will be sub-optimal. Furthermore, water availability and use will have to serve the greater benefit of society as a whole. Society may for instance attach values to allocations that contribute to more equitable income distribution, poverty alleviation or that encourage rural development, reduce food costs or contribute to food security or self-sufficiency. Especially when there are big differences in the ability to pay for water, the role of free market forces may result in allocations that are socially and politically unacceptable. Water allocations have to meet public demands, which often requires trade-offs between economic efficiency, social equity and long-term sustainability.

More practically, important preconditions for the introduction of markets and prices are often absent. A legal framework to charge for water, including the establishment of well-defined property rights, is also often not in place yet[3] and water distribution infrastructure often does not allow for volumetric measurement and disaggregated supply. Trading infrastructure for water is usually absent and high transaction costs might block its introduction, since introduction is usually conditional upon the size of additional benefits, i.e. efficiency gains, relative to extra costs involved. Finally, there exist often historical, social, cultural, and religious barriers.

Some of the market failures and practical constraints may be addressed through appropriate arrangements, but generally, "free market" solutions are rarely found in practice. Therefore, public interventions are required to ensure that water allocations, through market mechanisms or through public channels, satisfy the various demands of society as a whole. However, government and institutional failures can also result in water allocations that marginalize the concerns of certain sectors and that are undesirable in the long term. For instance when they are biased towards sectors that exercise strong economic and political power, or when they are based on insufficient information and ignore certain important values of water to society.[4]

Therefore, insight into the value of water is essential to analyse the implications of water allocation among users on the basis of trade-off analysis that have financial, economic, social and/or environmental implications for those directly concerned, as well as society more generally. An adequate assessment of water values is necessary to support policy decisions with respect to the allocation of water among sectors or countries.[5] Water valuation could be used to

[2] Contribution 7 by Venkatalacham and Contribution 11 by Peeters
[3] Contribution 7 by Venkatalacham
[4] FAO Water Report 27, 2004: *Economic valuation of water resources in agriculture,* pp.40-43 (E-Forum background document); see also Case by Sullivan (Income accounting)
[5] In addition to insight into water values, also the appropriate (institutional) enabling environment is required. This aspect is not further discussed in this report, but is the focus of another Conference theme (Theme 3: the enabling environment)

inform decision makers and stakeholders, to facilitate dialogue and learning, to help stakeholders to express their interests in negotiations and, in summary, to enable transparent, accountable and equitable decision making.[6]

2.2. Methods for water valuation

Numerous methods are available for water valuation, especially when it comes to economic valuation of water resources.[7] However, there is need to go beyond a purely theoretical economic assessment and to reflect preferences of users, to make policies on ecosystem services more rational and transparent and to reveal the hidden social and environmental costs and benefits of policy decisions. For this, the assessment of economic, social and environmental values is indispensable. Some integrative frameworks are available, generally developed and used by the research community. However, their application requires specific expertise and may be quite costly.[8] Experiences with the practical feasibility of methods for water valuation were discussed in the E-Forum, covering both new and existing approaches. It should be noted that the methods and approaches for water valuation that are described in the following sections are not exhaustive, but limited to those methods that were discussed in the E-Forum.

Participatory approaches

Two cases highlighted experiences with participatory approaches to water valuation in Asia (Sri Lanka and Lao PDR)[9] and in Africa (Tanzania)[10], whereas a third case presents plans to do so in Colombia.[11] These approaches are characterized by a strong orientation on stakeholder processes as the main drivers and users of valuation studies. They have a highly practical orientation and they employ a variety of tools and techniques to arrive at an overview of different value indicators in a cost-effective way. A case-based approach is used, using indicators and/or disaggregated analysis to make most use of the data that are available and addressing the specifics of the local situation. Integration of these different indicators is not the main goal, as the different graphs and tables allow for a relative quick overview, while providing more details on the trade-offs among value-dimensions than one aggregated figure or function.

Stakeholder involvement in the valuation process is considered useful to increase the appropriateness of the outcomes of valuation studies, as well as stakeholders' understanding and appreciation of the resulting information: "Scientific research, monitoring and data interpretation by the user and for the user will be best focused and best valued."[12] Therefore, participatory processes are an important element of these valuation studies, using frequent involvement of stakeholders through workshops, surveys, focus group discussions etcetera.

Standardized valuation procedures

Other cases report the use a more formalized valuation procedure that is based on the need for "standardized" frameworks that properly account for the use of water resources. An example of an ongoing attempt to develop a holistic and integrated measure in line with these needs, is the use of the Water Poverty Index. The case in the E-Forum shows how this method helps to overcome problems of incommensurability and how to arrive at quantitative measures of

[6] Contributions 5, 6, 7, 10, 13, 24 by Smits, Peeters, Venkatalacham, Jürgens, and Sullivan.
[7] See for an overview FAO Water Report 27 (E-Forum background document)
[8] See e.g. Discussion paper Theme 2 (E-Forum background document)
[9] Case by Nguyen Khoa et al.; see also CA Research Report Series, forthcoming, *Appraising Irrigation Impacts on Fisheries for Improved Development and Management of Irrigation*, Colombo, Sri Lanka.
[10] Case by Hermans et al.; see also Proceedings of workshop on Water resources management for local development, 8-11 November 2004, Loskopdam, South Africa: *Mapping uses and competition for shared water resources: Conflicts and values in Mkoji sub-catchment, Tanzania*
[11] Case by Diana Lucía Naya and Daniel Castillo
[12] Contribution 15 by Smith

values.[13] A case on income accounting shows the usefulness of this method to derive the value of natural resources as a basis for livelihood activities by indigenous communities.[14]

Formalized and standardized assessment procedures would not only provide useful information to support local or national water resources management decisions, but would also enable comparison of water values from different studies. This would contribute to a dataset of comparable water values that could provide a useful source of reference for future accounts of water use, necessary to achieve transparent and sustainable water resources management.[15]

Rights based approaches – translating basic needs into flow requirements

A rights based approach combined with quantitative assessments, such as the use of Basic Human Needs and Environmental Reserves in South Africa,[16] provides an approach for the translation of "non-negotiable values" into flow requirements. This can be considered as a specific kind of valuation; assessing the implications that safeguarding basic water values has for water flow requirements.

In the case of South Africa, a specific method was developed, the RIDe (Resources Infrastructure, Demand and entitlements) method. Whereas conventional water resources assessment only looks at available resources and demands at a catchment level, the RIDe approach includes an analysis of whether the infrastructure is actually capable of bringing the resources to where the demands are, in a spatially explicit manner. This was found to be a necessary tool in order to deal with the temporal and spatial variability of water resources at sub-catchment scale. For example, the RIDe methodology showed that the Basic Human Need Reserve actually should have an element of infrastructure in it, as having 25 l/p/d at the tap may mean that there must be as much as 60-80 l/p/d in the river.[17] The Environmental Reserve is expressed as a Flow Duration Curve. This means that the ecological flow is not a fixed value but can be expressed in terms of "the flow is not allowed to go below a certain level for more than a certain percentage of the time". For this flow assessment, a building block methodology has been developed, to assess the flow regime required to maintain or improve the habitat status of a certain river.[18]

Contingent valuation

The contingent valuation method is a well-known approach to the economic valuation of especially the non-market values associated with water resources. The debate in the E-Forum repeated part of the broader debate among researchers that has been generated by this method. The outcomes of contingent valuation are often quite sensitive to the applied ranking techniques, questionnaires and survey respondents[19] and sometimes contingent valuation studies are not done in line with the available guidelines.[20] This may introduce various types of bias in the valuation outcomes, which calls for a cautious use of these valuation techniques and for informing users not only of its outcomes, but also the reasonable margins of uncertainty. The short discussion in the E-Forum led to the conclusion that this method can be very useful, but that nevertheless its outcomes should be treated with prudence.[21]

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[13] Case by Sullivan; see also C.A. Sullivan et al., 2003: The Water Poverty Index: Development and application at the community scale. In: *Natural Resources Forum* 27, pp.189-199.
[14] Case by Sullivan; see also C.A. Sullivan, 2002: Using an income accounting framework to value non-timber forest products. In: Pearce, D. (ed.) *Valuation Methodologies*. Edward Elgar, Cheltenham.
[15] Contribution 24 by Sullivan
[16] Contributions 5 and 14 by Smits
[17] Contribution 14 and Case by Smits; see also WHIRL Project Working Paper 10, 2004: *Resources, Infrastructure, Demands and Entitlements (RIDe): a framework for holistic and problem-focussed water resources assessments,* NRI, Chatham.
[18] ibid.
[19] As is clear from Contribution 3 by Mollard
[20] Contribution 8 by Venkatachalam
[21] For instance, Contribution 11 by Peeters and Contribution 13 by Venkatalacham

3. Incorporating water values into water management practices

Assessing values is one thing, putting them into practice is another. In a "new economy" of water for food and ecosystems, water would need to be managed in a way that reflects its values. During the E-forum options were proposed that all could contribute to a more equitable sharing of costs and benefits among stakeholders, to more efficient water use and water allocations and to more sustainable practices. In discussing these options, three different levels can be distinguished: the local user level, the river basin or catchment level and the global level.[22]

3.1. Values in water management at the local level

Cost-effective improvements in local water productivity

On the local user level, a crucial role is to be played by measures that increase local water use efficiency and local water productivity. This entails the use of technologies and practices that are cost-effective and thus can help to "create values", either by increasing the value of product over the volume of water depleted or by making more water available for beneficial uses. For instance, under the appropriate conditions rainwater harvesting schemes can offer a promising cost-effective technology,[23] improving water use efficiency and increasing yields with low, erratic rainfall on low potential soils. However, the implementation and adoption of such technologies is not straightforward and requires certain social and economic conditions to be met. Smallholder farmers already operate in an environment fraught with high levels of risk due to climatic and price variability. The risk levels and income potential for investment of labour and other inputs must be acceptable, if the new techniques are to find use among farmers. The benefits generated by the new production technologies must be apparent to farmers as early as possible in the technology development or on-farm adaptation and adoption phase.

The case of rainwater harvesting

For infield rainwater harvesting (IRWH), research in South Africa[24] shows that there is a significant increase in farm income when farmers adopt rainwater harvesting compared to the income levels achieved under conventional crop cultivation. By adopting the simplest form of in-field rainwater harvesting – without the use of mulches in the basins and the runoff area, farmers can increase their income by about US$ 130 per hectare in the case of maize production. The results of investment analyses suggest that farmers can increase their income by undertaking IRWH, and that the investment will payoff over time. Stochastic dominance analyses show that farmers will receive more profit with a lower risk of failure when using the IRWH techniques, which contributes to economic sustainability. Estimations of the required farm size to produce enough food or income to meet the requirements of an average household in Thaba Nchu found that about 8 hectares of land are required to produce enough food (income) to last a family of 5 from one harvest to the next. With rainwater harvesting, these areas are substantially lower at about 3 to 5 hectares. However, technology transfer, training and extension are important in this respect to demonstrate that such practices improve livelihoods

[22] These three levels are taken from the case by Hoekstra: *The three levels of efficient water use*; see also Value of Water Research Report Series No.11, 2002: *Virtual water trade: A quantification of virtual water flows between nations in relation to international crop trade*, UNESCO-IHE, Delft, the Netherlands.

[23] Case Wattenbach et al.

[24] Case by Botha et al.; see also Water Research Commission Report No. 1176/1/03, 2003: *Water conservation techniques on small plots in semi-arid areas to enhance rainfall use efficiency, food security, and sustainable crop production* and Water Research Commission Report No. 1267/1/04, 2004: *Socio-economic study on water conservation techniques in semi-arid areas.* Pretoria, South Africa

and income, social and cultural well-being of households in rural communities. Providing insight into the benefits of new technologies for community members and adequate involvement of resource users, will increase the adoption rate of new technologies.

3.2. Values in water management at the catchment level

Payment schemes for environmental services in watersheds

Payment schemes for environmental services (PES) offer an example of a mechanism that can be applied at the catchment level to translate water values into economic incentives and financial flows. It means that upstream farmers in a catchment are financially compensated by downstream users to maintain or modify a particular land use that affects the availability and/or quality of downstream water resources. PES schemes can help to promote the adoption of good agricultural practices through financially rewarding their positive environmental externalities. This can simultaneously safeguard water resources and food security. PES schemes can benefit poor people, contributing to food security and rural development, by generating direct payments to people in rural areas in return for water management activities that are unrecognized and unrewarded.[25] Examples of PES schemes can increasingly be found, as illustrated for instance by cases in Colombia and Ecuador.[26] There are different ways to organize PES schemes, for instance using land ownership or specific activities as basis for compensation. The latter is proposed under the label of *green water credits* in another case of the E-Forum.[27]

Challenges in implementing PES schemes

Despite the (potential) benefits of PES schemes, also some challenges remain, one of which is related to financing these schemes. Many of the existing schemes rely on external financial resources, which raises questions as to their ability to operate independently on the long run. Schemes that do not rely on external financial resources are usually those that are created by companies or other large users linked to or located in urban areas, such as breweries, large municipal drinking water providers or hydropower producers.[28] In these schemes there is a clear link between downstream benefits and upstream management practices, and downstream beneficiaries have the willingness and the ability to pay upstream farmers and landowners for the provision of water-related services. The willingness to pay of downstream beneficiaries is likely explained by the fact that the PES schemes generate private benefits, like improved water quality for downstream users or water availability for hydropower generation, that are relatively easy to translate into monetary terms. When it concerns social or environmental benefits, or when downstream beneficiaries do not have the means to pay, external funds are more likely to be needed to compensate upstream land users.

This brings us to another remaining challenge, which is related to the determination of the amount of compensation to be paid for the environmental services. In most of the existing payment schemes, the amount of compensation is based on the (direct) opportunity cost for either the upstream or downstream parties to switch to another activity, or it is politically imposed.[29] In both cases, it usually is not based on thorough socio-economic or biophysical studies that would reflect the links between upstream activities and their impacts on broader societal, environmental and economic values of water resources downstream. Steps in this

[25] Contribution 9 by Kauffman and Case by Dent
[26] Cases by Silvia Ortega, Pablo Lloret, Diana Lucía Maya & Daniel Castello, Marcela Quinterno & Ruben Daria Estrada and FAO, 2004, *Payment Schemes for Environmental Services in Watersheds*, Land and Water Discussion Paper 3.
[27] Contribution 9 by Kauffman and Case by Dent
[28] Contribution 16 by Kiersch
[29] Contribution 16 by Kiersch and FAO Land and Water Discussion Paper 3. – opportunity costs here refer for instance the costs a drinking water company would make for treating polluted intake water, or costs forgone by hydropower producers due to loss of energy generation capacity.

direction are being taken, as reported in a Colombian pilot study described in the E-Forum, but this pilot study has yet to make the step from study to implementation.[30]

The quantification of water-related benefits is needed in order to increase the transparency and consequently feasibility of payment schemes for water-related environmental services. This should enable participants in the scheme to verify what value they get for their money. However, this requires more information and data on upstream/downstream and land and water linkages, whereas costs of monitoring are high and may well exceed the ability to pay by local water users. Therefore, there is a need for low cost monitoring techniques.[31] A part of the solution could come from the use of modeling tools and from using existing and already operational instruments such as measuring of groundwater levels and river discharge. Soil management at farm level could be monitored at relatively low cost by remote sensing, calibrated and evaluated with field-checks.[32] Nevertheless, the issue of knowledge and information requirements for a well-designed PES scheme does raise the issue of the economic efficiency of using mechanisms like PES; the costs for establishing and administering such schemes may well offset the benefits in some cases.

The role legal frameworks in PES schemes: learning from the carbon market

Recent experiences with markets for environmental services in other sectors could yield useful lessons for water-related PES schemes. For instance, the carbon markets that are now being established on a large scale might provide some useful insights. Although an important difference is that emission reductions in the carbon market are not location specific, whereas in water management the spatial dimension is key in issues of allocation, there are some interesting lessons to be learnt.[33]

The current carbon market reflects a "willingness" to pay for a global environmental service and the market prices for emission reductions, which are more or less determined by actual demand and supply. However, demand and supply have been stimulated and/or regulated by the policy maker, through a legal framework which is supposed to express citizens' preferences with regard to the protection of a global environmental good and/or the prevention of disservices generated by climate change. If a common framework was to be adopted to allow for trade on water related goods and services, a previous assessment of attached values and their relative importance to stakeholders would be important to facilitate the prioritisation of values to be reflected in this framework. The legal framework agreed upon by the parties determines which values will have to be reflected in the transactions providing services and as a result also in the cost of providing these services.[34] Thus, an adequate legal framework and accompanying enforcement mechanisms are key to the way in which PES schemes work and to their contribution to desired outcomes.

Rights based approaches in river basins

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

[30] Case by Lucía and Castillo
[31] Contribution 16 by Kiersch
[32] Contribution 18 by Kauffman
[33] Contribution 10 by Jürgens
[34] ibid.

Basic needs can be protected by setting legal standards for minimum allocations that are required for these needs. In South-Africa, the Basic Human Needs Reserve (BHNR) is used to meet minimum needs for domestic water and the Ecological Reserve is used to ensure the sustainability of the water resource base.[35] The BHNR is expressed as a certain volume of water per person per day (in this case, 25 l/p/d), whereas the ER is expressed as a required Flow Duration Curve, which is based on current habitat status and future management category. One of the findings in the Sand River catchment in South-Africa was that in order to maintain the current habitat status, hardly any water can be used over and above the BHNR and ER. This shows that also for rights based approaches, even some of the basic rights can not be treated as absolute rights in practice and hard choices have to be made in situations of severe water scarcity.

In order to deal with water distribution in a transboundary catchment, the Senegal River Water Charter was presented as a novel way to enable a more transparent and accountable process of stakeholder involvement. In this case, users and riparian states would discuss sharing of water resources not based on negotiating water *withdrawals*, but rather based on optimal satisfaction of *usage requirements.*[36]

3.3. Values in water management at the global level

Virtual water trade

On the global level, water availability and demand vary across countries, with some countries being water stressed and others water abundant. For water stressed countries, one of the options to deal with the water stress is importing agricultural products from other countries with more water available. In this way a water scarce country that does not have access to sufficient "real" water could save on its water resources through the imports of "virtual" water by importing agricultural products that have a large amount of "embedded" water. In fact, these virtual water flows are already playing an important role, as estimations indicate that 15% of water use in agricultural sector is used for producing exporting products and 34% in the industrial sector.[37] However, although this concept of virtual water was introduced already in the early 1990s, relatively little progress has been made, both in generating reliable basic data on virtual water flows and in promoting the concept as a pillar of national policies that combine water and food security with economic development.[38] It should also be noted that the bulk of the embedded water that is internationally traded in crops as wheat, maize, soya and sugar is soil moisture from rainfed production rather than a transfer of stored water

Global markets for water related environmental services?

Virtual water trading could theoretically be realized within the existing structures for global trade and thus, from a water management perspective, seems to be a relatively straight forward option to move towards improved "global water use efficiency."[39] Another way to promote practices that take into account water values globally, would be to scale up the local and national payment for environmental services schemes to a global level. Here, one could draw lessons from experiences in the creation of other global markets for environmental services such as the carbon markets. However, at this point it remains difficult to identify promising water related services, other than virtual water trade, that could meaningful be traded on a global market.

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[35] Case and Contribution 14 by Smits and WHIRL Project Working Paper 8, 2004: *Modelling scenarios for water resources management in the Sand River Catchment, South Africa*. NRI, Chatham.
[36] Case by Mame Dagou
[37] Case by Hoekstra; see also: Value of Water Research Report Series No.16: *Water footprints of nations*, UNESCO-IHE, Delft, the Netherlands.
[38] ibid. and Theme 2 Discussion Paper
[39] ibid.

4. Emerging insights on values and a "new economy"

The previous chapters cover a range of existing and new approaches for the integrated valuation of water for food and ecosystems, as well as certain mechanisms to include values of water resources into water management practices. Based on these results of the E-Forum, certain insights emerge that are of relevance in moving towards a new economy of water for food and ecosystems.

4.1. Uncertainty

The various E-Forum cases and contributions indicate that water valuation is difficult due to the complexity of water systems, which results in numerous uncertainties. Therefore, learning and knowledge development are necessary, both on the methods and their use by experts, but also on the physical characteristics of (agro-)ecosystems.[40] Water valuation requires knowledge of the available water resources, their use and their replenishment, but also of the causal mechanisms that impact them. The latter is required to enable valuation of the actual water-related benefits of existing (agro-)ecosystems and the impact on those by new activities or structures. Water users and decision makers need to be able to "verify what they get for their money"[41]. Unfortunately, this often proves impossible due to lack of monitoring data and lack of (scientific) knowledge. Political and institutional constraints may further distort the outcome of valuation studies.[42]

To a certain extent, knowledge can be enhanced through more research and monitoring arrangements can be installed, but of course all of this comes with a cost. Although (simulation) models, existing monitoring instruments and low-cost alternatives offer some perspective,[43] these will not be able to eliminate all uncertainties and thus the question of dealing with uncertainty in valuation will remain an important one. Once decision makers and water users are aware of water related benefits, their willingness to pay may increase, but what to do if these water related benefits cannot reliably be assessed? How to proceed in the light of uncertainty?

Within the E-Forum cases and discussions, certain elements can be distinguished that can be used to build a strategy to deal with uncertainties: quantification of uncertainties, using different valuation tools and methods to make best use of the information that is available, and using an iterative and adaptive approach. This is very much in line with the good practice reported for the Lesotho Highlands Water Project in a case for the African Pre-Conference on Water for Food and Ecosystems, where adaptive management and regular monitoring were used to cope with the levels of uncertainties involved in assessing impacts and causal chains between dam releases and impacts on ecosystems and downstream communities.[44] This supports the notion of adaptive management, as a continuous process of learning-by-doing, as a useful strategy to deal with uncertainties in future valuation studies.[45]

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[40] The issues of learning and knowledge for water for food and ecosystems are covered in more detail under Theme 1 of the Conference (*Fostering Implementation: Know-how for Action*). However, the importance of these issues for valuation and the connection between the Conference themes warrants a discussion of their implications for water valuation as well.

[41] Contribution 16 by Kiersch

[42] Contribution 13 by Venkatalacham for instance points to distortions on values assessed through contingent valuation when stated preferences are influenced by existing government policies or promises by politicians to provide water supply free of charge.

[43] Contribution 18 by Kauffman

[44] Report of the African Pre-Conference "Water for Food and Ecosystems: Make it Happen!" held in Addis Ababa, Ethiopia, 4-6 November 2004 (http://www.fao.org/ag/wfe2005/docs/finalreport.pdf)

[45] Adaptive management has not been covered specifically in the E-Forum but the E-Forum discussion points to adaptive management as a promising strategy. It is discussed in more detail elsewhere, for instance by Arrow, K., et al., 1995, Economic growth, carrying capacity, and the environment. In: *Ecological Economics* 15(2), pp.91-95 and M.J.G. van Eeten and E. Roe, 2002, *Ecology, Engineering and Management: Reconciling ecosystem rehabilitation and service reliability*. Oxford University Press.

4.2. The role of markets and pricing

When thinking of a new economy of water for food and ecosystems, the issues of water markets and pricing incentives naturally come to mind. The E-Forum results indeed identify such instruments as promising tools for a "new economy", for instance through virtual water trading and as part of certain Payment for Environment Services schemes. However, the discussion on the latter shows that the use of market mechanisms in PES schemes comes with some specific requirements:

1. A clear link between downstream benefits and upstream management practices.
2. Downstream benefits that are relatively easy to translate into monetary terms and that can be ascribed to certain users (who then can pay)
3. Downstream beneficiaries that have the ability to pay upstream farmers and landowners.
4. A legal framework and accompanying enforcement mechanisms that regulate the way in which PES schemes work and their contribution to desired outcomes.

When upstream-downstream linkages can not be assessed reliably, when benefits are mainly social or environmental in nature, or when downstream beneficiaries do not have the means to pay, the use of market mechanisms is more difficult and external funds or subsidy schemes are more likely to be needed. Furthermore, the costs for establishing and administering PES schemes may well offset the benefits in those cases.

These results indicate that the role of market mechanisms in water resources management appears to be smaller than what was envisaged a decade years ago in the Dublin declaration[46] and than what is stated in the more recent EU Water Framework Directive: "Member states shall ensure that by 2010 water pricing policies provide adequate incentives for users to use water resources efficiently...."[47] The E-Forum discussion clarifies that it is hard in practice to solve water problems that are essentially political in nature (income distribution, environmental sustainability, gender equity) through markets and pricing. Such issues can be better understood through valuation, but different types of market-failures and practical difficulties explain why market and pricing solutions are rarely found in practice.

In the end, the political character of water resources management means that neither analytic valuation studies nor markets can be the primary drivers of water management decisions. Due to the political character of many water-related problems, politicians and stakeholders are the ones to be responsible and take responsibility for water management decisions. They may chose to use pricing instruments or to establish markets to establish a more efficient water allocation among users, but these will then require a well-formulated legal framework that safeguards certain basic societal values, as well as the institutional arrangements to enforce this legal framework. Instead of markets, policy makers and stakeholders can also choose to use other allocation mechanisms such as a right-based approach or participatory negotiations through local stakeholder platforms. Water markets and water pricing instruments do have a role in the new economy, but for now it seems to be limited to those situations where certain (institutional) requirements are met.

However, the role of markets and pricing in a new economy of water for food and ecosystems should not only be restricted to that of *water* markets and *water* pricing. Probably more important and interesting are the roles of the markets for the products and services derived from water use. Markets for agricultural products, fish, timber, tourism, hydropower, etcetera are the markets that enable local stakeholders to sustain their lives and to invest in the sustainable management of productive ecosystems. This role of market mechanisms has not been covered extensively in the E-Forum, but is visible in the concept of virtual water trade. How to use and improve existing (agricultural) trade and market systems to better internalize the different values

[46] International Conference on Water and the Environment: Development Issues for the 21st Century; Dublin statement on water and sustainable development (www.wmo.ch/web/homs/documents/english/icwedece.html)

[47] Art.9 of the EU Water Framework Directive

of water resources that are currently still considered externalities remains a key challenge for the "new economy".[48]

4.3. Water values in theory and practice

In the presence of significant market failures in the field of water for food and ecosystems, policy interventions are required to ensure that water allocations and water management practices meet the various demands of society as a whole. Water valuation is generally considered a useful tool to enable transparent, accountable and equitable decision making[49] and to "provide policy makers with relatively simple and understandable information, which will never be perfect, but can make politics more accountable and can create increasing public awareness and support."[50]

This indicates that the outcomes of water valuation studies should be used to support policy decisions: "experts must be at the service of stakeholders."[51] At the same time, it is recognized that decision making is done through a political process in which valuation studies might not always be used as envisaged by analysts and in which other considerations might prevail.[52] In fact, the information provided by a valuation study that indicates sectors in which water use can generate most value to society "is highly political (...) and likely to provoke conflict or at least accusations of inaccuracy and bias when presented 'cold' to stakeholders lacking the 'shared frame of reference' and collective analytical capacity (...)."[53]

This illustrates the gap that appears to exist between the theoretic benefits of valuation studies on the one hand and the practice of decision making for water management on the other hand: "studies are often done independently from political processes and multi-stakeholder platforms (but aim to target those groups) (...). So how do we link more strategically works done by researchers, NGOs and others to the real development policies, or how do we stimulate effectively a dialogue process if necessary?"[54] Water policies are being made and schemes are being designed based on economic incentives to promote a more equitable and sustainable management water resources. However, it seems that those are rarely based on a thorough water valuation study.

4.4. Stakeholder oriented valuation

An important remaining challenge for the new economy is to close the gap between the theoretic benefits and the practical lack of use of water valuation. As any challenge, there is no easy answer to address this gap, but the E-Forum results support the idea that a stakeholder oriented approach offers a promising starting point to improve water valuation and its contribution to real-world water policies and water management arrangements.

Stakeholder input is essential to provide a strong link between the analytic valuation of water resources and the use of this information in decision making. The values stakeholders (including politicians) ascribe to water lie at the basis of their water management decisions and strategies.[55] It is a challenge to identify the right balance between those different values, such as economic and social values and this balance is generally only achieved through political processes. These processes are not only about water and economic values, but rather, stakeholders are often

[48] A further discussion of this topic is provided in another paper prepared as part of the Conference on Water for Food and Ecosystems: Burke et al., Water for food and ecosystems: the road from resource dispute to reconciliation. In: *Sustainable Development International* (forthcoming)
[49] Contributions 5, 6, 7, 10, 24 by Smits, Peeters, Venkatalacham, Jürgens, Sullivan (resp.).
[50] Contribution 6 by Peeters,
[51] Contribution 3 by Mollard (echoed by others)
[52] Contribution 3 by Mollard, 5 by Smits, 11 by Peeters
[53] Contribution 15 by Smith
[54] Contribution 22 by Vallee
[55] Contribution 26 by Groenfeldt

fighting over about whose values are more desirable. Therefore, identifying and describing the value perspectives with which stakeholders observe water resources is a crucial first step.[56]

Once value perspectives are known, uncertainty and resource constraints require analysts to carefully target the limited resources they have available for quantifying the related values. As stakeholders are the ones who have to use the resulting information as a basis for decisions, they are the logical starting point to identify the need for (quantitative) value assessment. Stakeholder involvement in the valuation process would further increase the appropriateness of its outcomes, as well as stakeholders' understanding and appreciation of the resulting information on water values: "Scientific research, monitoring and data interpretation by the user and for the user will be best focused and best valued."[57]

Stakeholder-oriented valuation should not be taken to mean a one-way communication of demands from stakeholders to water valuation analysts, but rather as a dialogue among stakeholders and including analysts, to which analysts can contribute their specific expertise and skills. However, all-in-all, the resulting process should be stakeholder rather than analyst-driven. If analysts ignore stakeholders' demands, for reasons of ignorance or simply because of practical difficulties, the stakeholders that make the decisions will most likely ignore the outcomes of valuation studies. This makes those water valuation efforts useless for all other than academic purposes, which would be a waste of their potential.

Of course one should also recognize that the known limitations and constraints of stakeholder participation apply to stakeholder-oriented valuation as much as to participatory and decentralized water governance[58]. Stakeholder input is not easy to organize if the proper institutional arrangements are not in place and might be impaired by lack of time or education or by other practical barriers that hamper communication between analysts and stakeholders. Also, participatory analysis approaches have the potential for creating or exacerbating conflicts[59]. Nevertheless, the bottom-line seems to be that: "If we want to be efficient, we have to listen to stakeholders and other actors."[60]

[56] Ibid.
[57] Contribution 15 by Smith
[58] These issues are the focus of discussion under Theme 3 of the Conference and E-Forum (*The enabling environment*), to which readers are referred for details.
[59] Case by Nguyen-Khoa et al.
[60] Contribution 3 by Mollard

5. Conclusions

This report presented a synthesis of an E-Forum where practical experiences were shared on how to move towards a "new economy" for water for food and ecosystems, in which water resources are managed in ways that reflect their values. These values might be different for different stakeholders and they include economic, social and environmental values. Furthermore, they can be found at different levels, from the local user level to the river basin level and ultimately the global level.

Insight into different values of water and water-related services is essential to ensure that water allocations satisfy the various demands of society as a whole. In theory, market-pricing and tradable or transferable water rights can lead to an efficient allocation of water for food and ecosystems. In practice, the role of these instruments in water resources management is limited due to market failures and practical constraints. Generally, public interventions are required, but also those public interventions can result in undesirable water allocations through government and institutional failures, for instance when they are biased or based on insufficient information. Therefore, water valuation is needed to support stakeholders and policy makers in making balanced and transparent choices.

Values can be assessed by using the existing methods for water valuation, but their application is usually affected by the uncertainty inherent in analyzing complex systems. Furthermore, there appears to be a gap between valuation studies done by researchers and experts and their use by policy makers in practice. Stakeholder-oriented valuation and adaptive management emerge as key strategies to cope with these challenges. This means that known valuation methods should be applied in a stakeholder-oriented, participative, adaptive and iterative way. Although this may sound as a mere repetition of the usual rhetoric in integrated water resources management, several examples of cases in the E-Forum give these concepts a meaning through practical illustrations of their applications in water valuation.

Notwithstanding the need for public interventions, water markets and pricing incentives can be useful in managing water resources in ways that reflect their values. However, markets and pricing incentives are not the only elements to be incorporated in a "new economy", their use is influenced by various conditions, and, if they are used, they need to be regulated in the public interest. The use of market mechanisms and payment schemes is more likely to work if water related benefits are relatively easy to translate into monetary terms and can be ascribed to certain beneficiaries, when these beneficiaries have the ability to pay for these benefits and when a clear legal framework is in place, including well defined rights in use, together with institutional checks and balances. Market mechanisms and pricing incentives can be usefully combined with rights based approaches, to ensure that the basic needs of vulnerable groups and sectors are met. Markets can also play a role to regulate water-related benefits indirectly, through the use of the existing markets for agricultural products to increasingly "internalize externalities", for instance by promoting the concept of virtual water trade.

The experiences that were exchanged in the E-Forum contain examples of promising steps forward in bringing about a "new economy" for water for food and ecosystems, but also help to see the constraints and requirements. At this stage, the experiences mainly reflect local initiatives with quite unique characteristics, and the challenge for the immediate future would be to further investigate how these proposals, practices and initiatives can be successfully applied in a more generic way. A "new economy" needs practices that cut across different scales and that can be replicated in future cases under different conditions. In this way, the E-Forum experiences provide an important step in the continued exploration of arrangements that help to manage water resources in ways that reflect their values, across scales, sectors and regions.

Annex

This annex contains lists of cases, user contributions and background documents that have been used as a basis for this synthesis report. The complete texts of these documents can be downloaded from the E-Forum website: http://www.fao.org/ag/wfe2005/eforum_en.htm

I. List of E-Forum cases for Theme 2

- New Perspectives on the Impacts of Irrigation on Fisheries
  Sophie Nguyen Khoa
- The Three Levels of Efficient Water Use
  Arjen Hoekstra
- Green Water Credits
  David Dent
- Culture, Irrigation, and Ecosystems in the northern Rio Grande Basin, New Mexico (USA)
  David J. Groenfeldt
- Análisis de la acción colectiva para el Manejo de cuencas Estudio piloto-cuenca de la Laguna de Fuquene, Colombia
  Diana Lucía. Maya V. y Daniel Castillo B
- Income Accounting Framework
  Dr. Caroline Sullivan
- Water Poverty Index
  Dr. Caroline Sullivan
- Supporting Local IWRM in Mkoji Sub-Catchment, United Republic of Tanzania: Some Lessons on Water Valuation and Institutional Development
  Hermans/van Halsema/Kadigi/Sokile/Mahoo
- Bio-Physical Requirements and Socio-Economic Acceptance of Infield Rainwater Harvesting and Conservation in the Semi-arid Central Region of South Africa
  J.J. Botha, G. Kundhlande and A.J. Sanewe
- Caso Cuenca Laguna de Fúquene (Colombia)
  Marcela Quintero and Rubén Darío Estrada
- Community-based Water and Land Participatory Decision Making in the Senegal River
  Ms Mame Dagou
- Un fideicomiso como herramienta financiera para la conservación y el cuidado del agua, el caso del Fondo ambiental del agua en Quito, Ecuador
  Pablo Lloret
- Pago por servicios ambientales, una alternativa que contribuye al manejo y conservación de bosques y páramos, Cantón Pimampiro, Provincia de Imbabura, Ecuador.
  Silvia Ortega
- Understanding the Basic Human Needs Reserve and the Ecological Reserve in the Sand River catchment, South Africa
  Stef Smits
- Sharing Water Between Society and Ecosystems
  Wallace/Acreman/Sullivan
- Economics of Water Harvesting for Improved Rainfed Agriculture in Africa
  Wattenbach/Beernaerts/Dixon/Upton

II. List of E-Forum discussion contributions for Theme 2

- Theme2_discussion
  01_Dr VanHalsema
- Moderator Intro Theme 2
  02_Leon Hermans
- Theme2 contribution1
  03_Eric Mollard
- Moderator2
  04_Leon Hermans
- Rights Base Approaches
  05_Stef Smits
- Valuation and Politics
  06_Willem Peeters
- Valuation and Regulation
  07_L. Venkatachalam
- Valuation and Politics (2)
  08_L. Venkatachalam
- Green Water Credits
  09_Sjef Kauffman
- Carbon Markets
  10_Ingmar Jürgens
- Valuation and Market Failures
  11_Willem Peeters
- Moderator_Day2
  12_Leon Hermans
- Valuation & Institutions
  13_L. Venkatachalam
- Human and Ecological Reserves, Valuation & Politics
  14_Stef Smits
- Valuation and MSPs
  15_Laurence Smith
- PES
  16_Benjamin Kiersch
- Theme 2 Moderator_Day 3
  17_Petra Hellegers
- Valuing Benefits and Services
  18_Sjef Kauffman
- Trade-offs and Valuation
  19_Petra Hellegers
- Water Valuation and Allocation, Not Local But Global
  20_Willem Peeters
- Trade-offs and Compensation

21_Dhruba Pant

- Valuation: an In-experienced Field
  22_Domitille Vallee
- Theme 2 Moderator's Day
  23_Hermans_&_Hellegers
- Water Poverty Index
  24_Caroline Sullivan
- Costs and Benefits
  25_Rob Jongman
- Water Management Not Politics, But Values
  26_David Groenfeldt
- Valuation of Ecosystem Services and Livelihoods
  27_V.V. Sugunan

III. List of background documents and links for Theme 2

Background documents

Discussion paper Theme 2 , prepared by Theme 2 Moderators

A New Economy for Water for Food and Ecosystems. Introduction to Theme 2 for the African Pre-Conference, by Ben Y. Ampomah, Water Resources Commission, Ghana

Economic Valuation of Water Resources in Agriculture. FAO Water Reports 27

Water Charging in Irrigated Agriculture. FAO Water Reports 28 (forthcoming - PDF)

Payment Schemes For Environmental Services in Watersheds. FAO Land and Water Discussion Paper 3.

Links:

Payment Schemes for Environmental Services in Watersheds. Results of a Latin American E-Forum, 12 April - 21 May, 2004

Value of Water Research at UNESCO-IHE

Putting the Right Value on Ecosystems, IWMI

Value - Counting Ecosystems as Water Infrastructure, IUCN

The Ecosystem Marketplace

Virtual Water and Water Footprints