

Water As An Economic Good – A Work In Progress

Laurence E.D. Smith
Imperial College London, Wye campus

Working draft for presentation and discussion at the Launch Seminar,
November 18-19, 2004, University of Bradford. ESRC funded seminar series,
Water Governance – Challenging the Consensus.

The purpose of this paper is to characterise the key contributions of the discipline of economics to our current understanding of issues in water policy and water resource management. It also seeks to highlight any gaps or weaknesses in current practice and to identify key areas requiring more work and research.

The obvious starting point for such a review is “Dublin Principle number 4”.

Dublin principle no. 4

Water has an economic value in all its competing uses and should be recognised as an economic good.

Within this principle, it is vital to recognise first the basic right of all human beings to have access to clean water and sanitation at an affordable price.

Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.

International Conference on Water and the Environment, Dublin, January 1992

This has been accepted as a ‘keystone’ of the ‘international consensus’ on future needs for water policy and resource management, and has been adopted by most national and multi-national initiatives and frameworks for action.

The important question is how we interpret and use this principle, as water is not a typical good. It is useful to consider the economic dimensions of water, recognising that the diversity of uses of water reflects its various economic characteristics. These range from the characteristics of marketable “private” goods sold like any other commodity to those of collective “public” goods like flood control (Gray, 1983).

These characteristics are not necessarily independent and a varying combination of them may apply in any given water use. Uses may be completely, only partially or non-consumptive in their use of water, and “waste” or return flows may bring either benefits or costs to others. The pervasive incidence of externalities with water use in part reflects the ‘fugitive’ nature of the resource as it moves, changes form and quality and evades full capture and indeed ‘ownership’ by any one party. Water policy and management must take account of the five dimensions of water use listed below, recognising that the relative importance of these will depend on the set of users, the location of use, and its timing and duration. Implicitly this emphasises the importance of institutional and governance structures in determining the effectiveness, efficiency and equity of the management of this atypical resource (Carruthers and Morrison, 1996).

Economic dimensions of water use

- 1) marketable private good characteristics
 - e.g. bottled water, water supply, irrigation supply
- 2) public (or collective good) characteristics
 - e.g. flood control, navigation, recreation, landscape aesthetic
- 3) common property resource characteristics (differs from public good in being subject to capture, and becoming private on capture)
 - e.g. unregulated groundwater or stream abstraction
- 4) externality characteristics
 - water uses and transactions can have a wide range of positive and negative effects for third parties and society as a whole
- 5) public utility characteristics
 - supply infrastructure frequently has high fixed costs and low cost per unit of supply, tending towards the characteristics of a natural monopoly

Economics recognises 2), 3) and 4) in the list above as cases of ‘market failure’. This term can usefully be interpreted by non-economists in two ways: as the failure of a market to develop and function because of the impossibility of establishing legally defensible and tradable property rights for the dimensions and properties of water use concerned; and as the resulting failure of unregulated markets to deliver the optimal allocation of resources from the viewpoint of society. Thus the existence of water related public goods and externalities or water use, or the fact that unregulated market determined use of common property resources may tend towards exploitation, is recognised by economics as providing the justification for state or other collective intervention in the management of water on the grounds of resource use efficiency alone. (Of course the state or communities may also have other valid objectives for intervention in or regulation of markets other than pure efficiency concerns). A number of initial conclusions follow from this understanding of the diverse range of economic characteristics of water use.

First, whilst Dublin principle no. 4 is of overriding importance given the increasing pressure on limited freshwater resources from competing uses under rapid global economic and population growth, and whilst market-based economic principles and policy instruments have much to offer in terms of solutions, a completely ‘laissez-faire’ approach will never be either possible or appropriate. Any form of economic policy instrument or market-based allocation of water will need to be highly regulated and managed by either state or community. (Thus any remaining stereotypes from the 1980s that economists are proposing free market solutions to water problems should be disregarded).

Second, the economics literature is rich in theory and empirical work relevant to the management of natural resources with the range of characteristics listed above. Analytical tools and techniques are available for application to water resource management, and if the ‘economics of water resources’ is any less developed than that of land, forests, minerals etc., it is only because of the relative abundance of water as a resource in the past and not because of any unique differences or conceptual difficulties.

However, water management can be particularly complex as noted above and because of spatial and temporal variation in the combination of the resource characteristics in

any given use. Thus a third lesson is that economic analysis must be applied within the context of an integrated approach to water resource management (IWRM as understood by the ‘international consensus, for example as in the vision statement developed by the Global Water Partnership, (GWP, 2000)). Similarly economic analysis and the formulation of economic policy instruments must be both holistic and integrated. For example, any desire to raise water tariffs for a given use, impose taxes justified by the ‘polluter pays principle’, or provide subsidies for socially beneficial water use must take account of issues such as the incidence of return flows and any ‘knock on’ externalities. Water users will seek the cheapest source of supply or waste disposal in terms of private costs, and raising tariffs for supply, for example, without regulation or licensing of direct groundwater or surface abstraction may simply displace demand from one source of supply to another.

It is now appropriate to consider the relevance and potential utility of economic policy instruments in a little more detail. The objectives of the ‘internal consensus’ on water are typically phrased in terms of achieving integrated water resource management and *efficient* use of the resource, achieving *equitable* access to adequate sustainable supplies, and ensuring *environmental sustainability*.

Clearly there is more than one way of seeking to achieve these objectives. The case for a wholly state interventionist “command and control” approach to water management can be made given the pervasive and important instances of market failure highlighted above. However, to the extent that this has been the dominant approach adopted in the 19th and 20th centuries, as motivated by a combination of public health and food security concerns, it does not have a good record latterly in the face of the 21st century challenges of rapidly increasing pressures on natural resources, widespread environmental degradation and climate change. The costs of rehabilitating and making successful such an approach will be high, not least in meeting the requirements for resource use monitoring and management.

Hence the relevance of “principle 4” and the importance of a willingness to explore the potential of economic instruments for water management. Central among these will be the role of water pricing and the possibility to develop arrangements for the trading of water rights.

Formulation of economic policy instruments will similarly need to take account of the goals of *efficiency* (in resource use), *equity* and *environmental sustainability*, but with regard to pricing policy we can add to these the key question of *revenue generation* or *cost recovery*. The importance of this to the ability to sustain and improve water supply services links its achievement closely to the three other goals. The question of how to set the price for water is clearly not straightforward given the potential for both complementarities and trade-offs between these four concerns.

Conventional economic theory explains how pricing policy can influence demand, supply and the efficient allocation of a resource across sectors and uses.

Higher prices can reduce demand through consumption preferences relative to willingness to pay, and by making the means for conservation in use relatively more affordable over time. Substitutes may also become relatively cheaper, although for most water uses there are clearly few substitutes and demand in

most uses can be expected to be relatively price inelastic (although there will be exceptions to this).

Higher prices can increase supply as marginal projects become more affordable and incentives are created to reduce water losses.

Higher prices can also promote the re-allocation of resources between sectors and uses as lower value uses decline through unprofitability and higher value uses bid for any supplies that are released. Subject to the net impact of the externalities resulting from such re-allocation this can contribute to the overall efficiency of resource use and aggregate wealth generation that results.

Advocates of raising water prices make the following additional claims (for example, Rogers et al., 2002).

Higher prices can contribute to environmental sustainability by reducing the demands on the resource base and by reducing pollution loads through increased incentives for the recycling of water.

Higher prices and thus increased cost recovery can raise revenues that can be used to improve the managerial efficiency of water supply services. This can be achieved through improved and sustained operation and maintenance of the infrastructure, improved staff status, training and education, and the improved affordability of better methods and technology for monitoring and management.

Most surprisingly and perhaps controversially it is also claimed that higher prices can reduce the per unit cost of water supply for the poor. This is achieved when the coverage of supply networks is extended to poor people because of the finance and additional water that become available from the use of higher supply tariffs for existing consumers and users. The poor (and possibly the environment) benefit when reliance on other more expensive water sources is reduced (for example, the long round trip to the well for drawers of water, or purchases from private water vendors).

Given these possible outcomes what should the price of water be? Clearly the answer depends on how we weight the four objectives identified above and the actual outcomes of pricing policy in the real world as compared to the economic model. Economic theory is preoccupied with the efficiency objective and tells us that the price of water should be set equal to the marginal cost of the last unit supplied. Given a free market this is so that users will purchase water until the marginal benefit they gain from the last unit used is equal to its cost (a condition for efficiency), and the marginal benefit gained from the last unit used in all alternative uses will be equal (another efficiency condition and achieved when bidding for additional supply can achieve no further gains). If the resulting allocation is to take account of externalities and public goods then the costs and values involved must be the full (and net) economic cost and values from the viewpoint of society and not just the private costs and benefits for water users (see discussion and figures 1 and 2 below). A market will not determine this optimal price because of the failures in property rights for

externalities and public goods, but in principle a well informed state could at least approximate it.

Clearly such a focus on efficiency may compromise our equally important concern for equity to the extent that it results in price determination without reference to ability to pay. Similarly the goal of environmental sustainability, unless the accounting for environmental externalities is weighted to take account of the needs of future generations as well as those of the present. Lastly it is a well known result that marginal cost pricing (i.e. efficiency pricing) can, given the cost characteristics of public utilities (within capacity the low cost per unit supplied), result in revenue generation inadequate to cover capital replacement costs and in extreme cases even operation and maintenance expenditure; such that some form of average cost pricing must be adopted to meet the goal of cost recovery. For explanation of this and other limitations of marginal cost pricing see for example Small and Carruthers, 1991, Merrett, 1997, and Saunders and Warford, 1983.

To begin to resolve these possible trade-offs and to find a practical way forward it is first useful to remember that price need not be seen as synonymous with either value or cost, and rather that it will be “as set by the political and social system to achieve equity, sustainability and cost recovery” (Rogers et al., 2002). Further insights can be gained through consideration of the components of full economic value and cost for water as identified and categorised by Rogers et al., 1998 (see figures 1 and 2 in annex), and from their empirical estimates for these from a case in India (Figure 8).

Taking Figure 2 first, the breakdown of the possible components of the full economic value of water use re-emphasises the possible limitations of a market based allocation of water with regard to efficiency. In a market water buyers would base their decisions only on the “value to users”, and although the vertical scale is arbitrary and illustrative this could clearly be only a proportion of the total value to society. Faced with a higher price (based on full cost as in figure 1?) users may demand less water and certainly less than may be optimal given the needs of society as a whole.

Similarly in Figure 1 an unregulated market in water would potentially take account of fully supply cost plus opportunity cost, but not externalities. Despite the array of emerging non-market valuation techniques both opportunity cost and externalities are difficult to value even in a static situation, whilst in practice both will be varied spatially and temporally dynamic. Further complication arises once questions of timing, reliability and quality of supply are set alongside those of quantity.

Attempts by the state to set water prices at the level of full cost will clearly be onerous in terms of information requirements, will inevitably involve a degree of subjectivity and judgement, and as a result are likely to become politicised. The point is important as much of the rhetoric of the ‘international consensus’ (including for example, the EU Water Framework Directive) emphasises the need to move towards full cost pricing whilst often remaining ambiguous about exactly which components of full cost should be included.

This is not to say that attempts should never be made to quantify full economic cost and value for water. Despite inevitable qualifications about valuation methods the estimates presented in figure 8 are of clear policy relevance. Estimates that are of the

right order of magnitude are useful, even if lacking in accuracy in absolute terms. Figure 8 reveals the scale of misallocation and inefficiency for a river basin in India that is all too typical of water use worldwide. Such information can better orient policy and investment in the long term. It can indicate for example the sectors in which water use can generate the most value and wealth for society, where water use should be progressively scaled back and which groups are implicitly subsidising the use or consumption of others. Similarly it can suggest which sectors may be high cost in terms of their supply systems, which groups may have the willingness to pay higher tariffs and which groups have the possibility of mutually benefiting from trading water rights.

The information is less useful as a means to actually set water tariffs for the reasons given above. This particularly applies in the short to medium term (20 years or more?) given that most water users may currently pay tariffs that fail to meet the first level of O&M costs, let alone any of the other components. Rapid tariff increases towards full cost levels are neither practical nor politically feasible, particularly in low average income economies such as India. The reallocations of water use that could come with rapid and significant tariff increases of the order of magnitude suggested by this data would also result in significant additional social and transaction costs for the period of adjustment.

Despite these limitations we should support the proposition that estimates of the full cost and value of water for different sectors are available as public information as part of a IWRM strategy. We should also concur with the recommendation by Rogers et al., that such estimates should present the context for setting water prices or effluent charges, and for other policy instruments such as incentives for pollution control, or investment of scarce capital in extending the coverage of supply networks to poor (and often high cost) urban and rural areas.

For example, using Figure 2 to provide the context and a conceptual guide can lead us to a more practical short term assessment of priorities for water pricing. This is with the recognition that capital available for investment in improved water management, and specifically for achievement of the Millennium Development Goals for water supply and sanitation provision is limited and subject to fierce competition from other deserving sectors such as health and education, and other sources of poverty alleviating growth and income generation. The backlog of investment required for the 'global water sector' is daunting and ultimately there are only five sources of payment for this.

These are:

- water consumers through user charges, penalties and other payments;
- domestic taxpayers, through state subsidies
- overseas taxpayers through the grant element in aid programmes and other concessional loans
- voluntary donations by local and international citizens, plus inputs in kind by users and communities
- private equity investment (though likely to be limited in scale and ultimately financed by user charges) (Winpenny, 2004).

Accepting that the 'lions share' of finance for a large and better water sector will have

to come from water users themselves it is reasonable to assert that the full supply cost (as in Figure 2, and based on future capital replacement costs) should be the target for water tariffs in all uses. The argument is thus one of placing revenue generation (or at least full cost recovery) as the priority goal to guide pricing policy. So what of efficiency, equity and environmental sustainability? Here we can use Figure 2 and the concept of full economic cost to make some observations by sector.

For water supply the full supply cost per unit of supply is likely to be relatively higher than for either agriculture or industry because of the need to meet safe quality standards and because of the prevalence of piped, and often pumped, distribution networks. In contrast water volumes are relatively small (in comparison to agricultural use) and thus opportunity cost in aggregate is less significant in terms of allocation efficiency. In any case most people would agree that public health has a priority claim on the resource, whilst objective valuation of full economic value is likely to support this (leaving aside the further contribution of rights based arguments to the debate). Environmental externalities, particular of reservoir construction or abstraction of groundwater for major urban centres, can be significant but should be minimised or mitigated by high standards of construction and management. Where the costs of this cannot be justifiably financed from other sources, they should be included in the full supply cost and hence tariff. Equity is the main challenge to the target of full supply cost recovery. For groups for whom ability to pay is a real constraint, progressive increasing block tariffs that can provide a 'lifeline' supply to the poor at a below-cost rate, and higher charges for use beyond this minimum volume will be needed. There may also be alternative means of providing direct income support (perhaps as water vouchers etc.) to such groups that will help avoid compromising the performance and sustainability of the infrastructure and tariff structures that are administratively complex and costly. Whether state or privately operated, regulation and governance of the utility must allow for financial autonomy and accountability, and seek to ensure that the goal of extended coverage of supply to all groups is achieved.

In summary the focus for water supply should be on revenue generation, through setting tariffs to cover full supply costs. Efficiency of resource use is given less priority although tariff increases will contribute to this both through direct influence on demand levels and through the potential improvements in management efficiency and coverage. With the right combination of 'cost recovery tariffs' and supporting policies and measures, improvements can also be made in terms of both environmental sustainability and equity. For example, if starting from low tariff levels then rises may need to be progressive and accompanied by awareness creation, education and possibly user participation. Water consumers need to see transparency and accountability, and that improvements in service quality, coverage and the environment result from higher charges.

For agriculture the same weight should be given to full supply cost recovery on the grounds of ensuring effective and sustainable operation and maintenance of supply systems as well as the financing of future capital replacement. However, more weight should be given to efficiency concerns and relatively less to equity. The actual tariff that results may be lower than for water supply because of lower quality requirements and potential economies of scale. Even at this level of tariff some existing irrigation will be unprofitable and should be allowed to progressively cease

(with progressive tariff rises) unless farmers respond by adding value through crop diversification and adoption of more water efficient technology, etc. Societal objectives of sustaining rural employment or preventing a more environmentally damaging shift to intensified or extensified rainfed agriculture may justify continued subsidy of supply for a transitional period.

For agriculture the efficiency concern arises from the high volume of water used. Opportunity cost is thus likely to a large element in full cost where there is competing demand from other sectors, but again this is dynamic and difficult to quantify accurately. It may also be politically infeasible to include in tariffs (indeed it may not be defensible to the extent that it implies charging for water rights that farmers consider that they have already paid for through abstraction licenses or incremental land values). Thus although there are many practical obstacles to making water markets work (see Perry et al., 1997 for a comprehensive exposition), ideally we wish to use a market based mechanism to expose farmers to the opportunity cost of their water allocation, creating a situation in which sale or leasing of water rights can be a profitable alternative to lower value use on the farm. The significance of return flows can complicate the situation with regard to agricultural water use, but it should not be impossible to devise workable arrangements for the trading of water rights and experience with such initiatives is accumulating.

Given the scale of water use in agriculture environmental externalities can be significant and may need to be addressed by a range of measures. Higher tariffs should boost the incentives for on-farm measures such as more controlled application and adequate drainage. A combination of investment and tax or subsidy measures may be needed to address other issues, and as for water supply, costs of these may need to be included in the fully supply cost tariff. (Similar arguments to those presented in this section are set out by Briscoe, 1997, with more detail on adjustment of tariffs to account for return flows and externalities).

Given the inherently lower level of the supply cost tariff (in most scenarios) less weight needs to be given to equity. Even the poorest farmer who can put water to profitable use will have both willingness and ability to pay for that water, as well as being likely to be better off than his or her neighbouring rainfed farmer of comparable scale. Subsidised irrigation supply can thus only be justified for periods of transition, particular when correcting the inefficient investments and water allocation decisions of the past, or when seeking to stimulate growth in poor rural areas with few alternative sources of non-farm livelihoods. None of this means that there should necessarily be less irrigation than there is presently, but just that in the long term all irrigation should make profitable, water efficient and environmentally sustainable use of the supply it receives.

The situation for industry lies somewhere between water supply and agriculture. Industry should similarly pay the full supply cost for water, including any environmental costs of sourcing that water or mitigating environmental damage caused. Industry should also pay the full costs of its wastewater treatment and disposal. Efficiency, environmental and cost recovery objectives can be served by this policy, whilst equity is only a concern if sustaining employment in an unprofitable industry can be justified on social grounds. Here as with the cases of poor water consumers or unprofitable farmers, the struggling industry would be best

and most efficiently assisted by direct measures to support income and not measures that may compromise the performance and sustainability of water supply services.

In conclusion a pragmatic application of economic concepts tells us that with regard to water pricing we should focus on the goal of cost recovery and make effective use of the revenue generated to achieve our water resource management objectives; including universal provision of adequate water supply and sanitation. This can contribute immediately to improved efficiency in resource use and environmental sustainability even if it remains a “second best” policy for these objectives. Longer term refinements in pursuing such objectives can be made with reference to the concepts of the full economic cost and full economic value of water. Equity considerations are important, particularly with regard to water supply, and the case that full supply cost based tariffs can improve coverage of supply networks needs to be tested and carefully monitored on a case by case basis, assuming appropriate governance structures are put in place. It should be possible to achieve equity goals with the careful use of appropriate tariff structures (if it is accepted that these imply subsidy by wealthier water users) or other income support measures.

The trading of agricultural water rights should be developed where possible, and particularly where irrigation is uneconomic and/or environmentally unsustainable. It should be recognised that where the practical and institutional constraints to such trading arrangements are too great, then “harsher” command and control measures for the reallocation of water may ultimately be necessary.

IWRM requires holistic and integrated economic analysis of all water uses informed by the conceptual framework of full economic cost and value and, if possible, empirical estimates of these for competing sectors and water uses. Economic policy instruments will rarely be most effective in isolation and packages of support policies, investments and other measures are needed (Winpenny, 1994, provides a good guide to this). The right ‘policy mix’ will be location and situation specific, it will probably be evolutionary rather than a “big bang” reform package, with the phasing and timing of measures being important. Its formulation and implementation will also be likely to benefit from multi-stakeholder involvement and coordination.

Much of the ‘international consensus’ is on the right lines from an economics perspective but whilst it should be sophisticated in its use of economics for analysis, it should be pragmatic and as simple as possible in its recommendations. Universally applicable prescriptions are in any case few if any, and international initiatives should concentrate on developing the tools of analysis and policy development, and on sharing experience, so as to best support high quality location specific analysis and a resulting diversity of solutions.

In terms of knowledge gaps, the following are a rapidly assembled selection of priorities.

More work on the full economic value of water supply and sanitation. Although the MDGs exist the case for capital investment may still need to be made in competition with other priorities (as evidenced for example by the relative neglect of water supply and sanitation in many country PRSPs, (Millennium Project, 2004)).

Better analysis and documentation of case experience for the sequencing, pace and necessary package of reforms and other measures. A particular focus should be on appropriate governance and regulation arrangements to ensure that equity and environmental sustainability objectives can be achieved when tariffs are progressively raised to full supply cost levels.

More work on evaluation and development of appropriate arrangements and regulation for trading of water rights and transaction cost minimising institutional aspects of this.

Research on the cost savings compared to use of economic and regulatory policy instruments alone that come from accompanying investments in education and awareness creation, and processes of multi-stakeholder participation and social learning.

Lastly further development and application of methods for non-market valuation of the environmental externalities often associated with water supply and use.

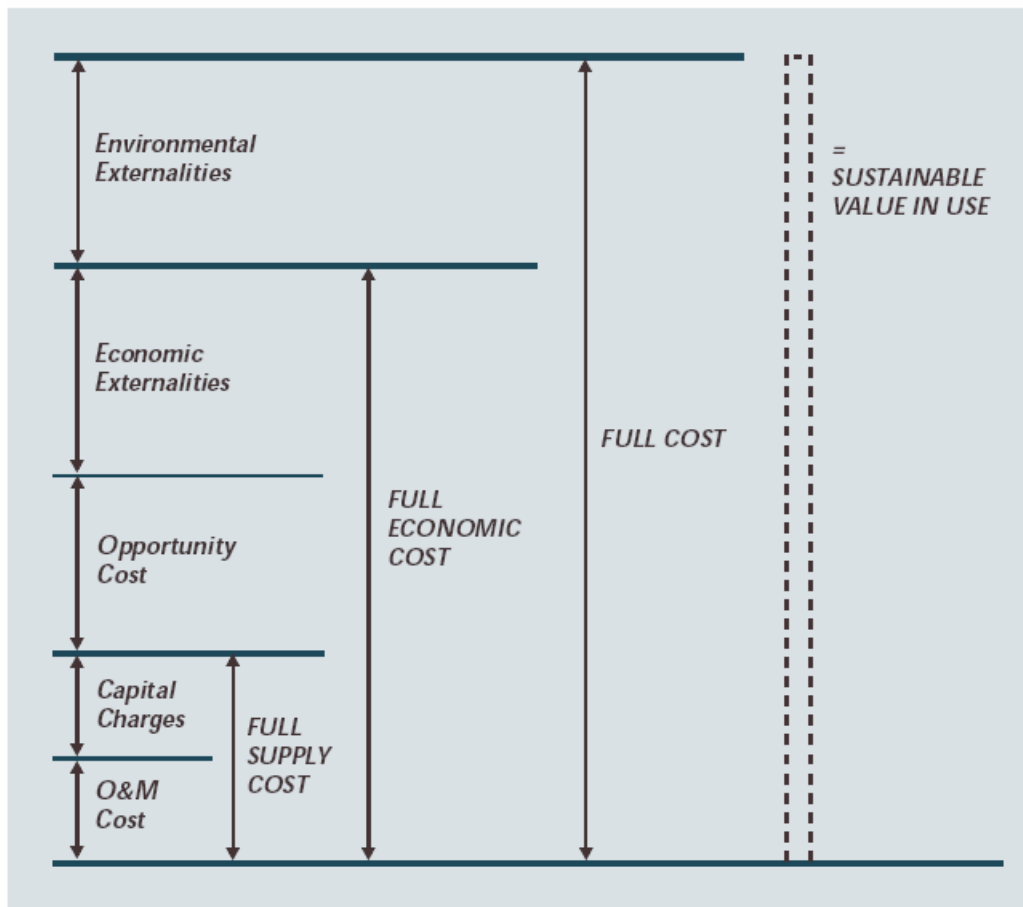


Figure 1. General Principles for Cost of Water.

From Rogers et al., 1998.

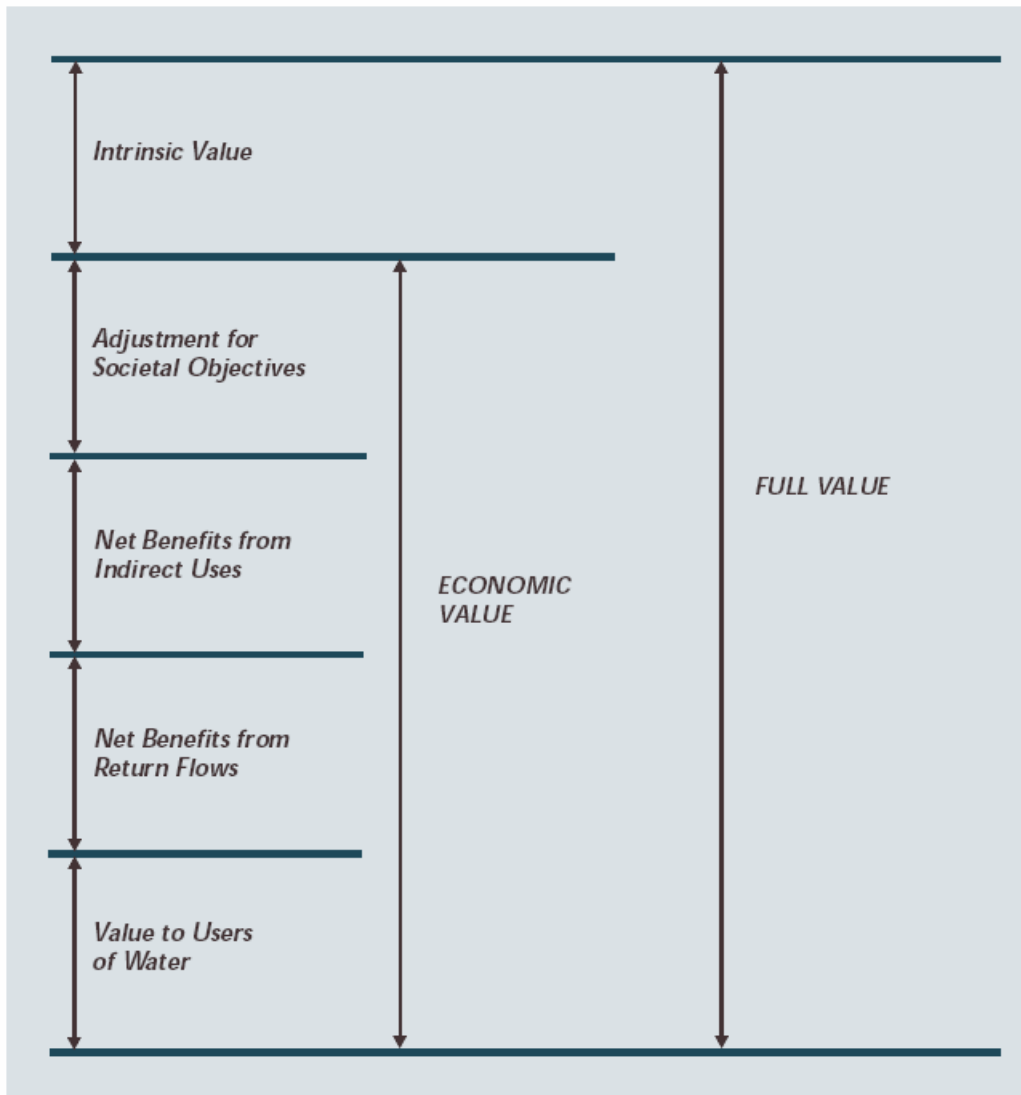


Figure 2. General Principles for Value in Use.

From Rogers et al., 1998.



Figure 8. Comparison of Value in Use, Costs and Tariffs for Three Sectors in the Subernarekha River Basin, India.⁹

From Rogers et al., 1998.

References

- Briscoe, J. (1997). Managing Water as an Economic Good: Rules for Reformers. *In* "Water: Economics, Management and Demand" (M. Kay, T. Franks and L. E. D. Smith, eds.), pp. 339-361. E & FN Spon, Chapman Hall, London.
- Carruthers, I. D., and Morrison, J. A. (1996). Institutions in Water Resource Management: Insights From New Institutional Economics. *In* "Water Policy" (P. Howsam and R. Carter, eds.), pp. 205-212. E & FN Spon, London.
- Gray (1983). Water: A Resource Like Any Other? *Agriculture and Forestry Bulletin* 6, 47-49.
- GWP (2000). "Towards Water Security: A Framework for Action." Global Water Partnership, Stockholm.
- Merrett, S. (1997). "Introduction to the Economics of Water Resources," UCL Press, London.
- Millennium Project (2004). "Interim Report of Task Force 7 on Water and Sanitation." UNDP.
- Perry, C. J., Rock, M., and Seckler, D. (1997). Water as an Economic Good: A Solution, or a Problem? *In* "Water: Economics, Management and Demand" (M. Kay, T. Franks and L. E. D. Smith, eds.), pp. 3-11. E & FN Spon, Chapman Hall, London.
- Rogers, P., Bhatia, R., and Huber, A. (1998). "Water as a Social and Economic Good: How to Put the Principle into Practice." Global Water Partnership, Stockholm.
- Rogers, P., Radhika de Silva, and Bhatia, R. (2002). Water is an economic good: How to use prices to promote equity, efficiency and sustainability. *Water Policy* 4, 1-17.
- Saunders, R. J., and Warford, J. J. (1983). Water Supply Pricing. *In* "Pricing Policy for Development Management" (G. M. Meier, ed.), pp. 207-215. Johns Hopkins University Press, Baltimore.
- Small, L., and Carruthers, I. (1991). "Farmer-Financed Irrigation," Cambridge University Press, Cambridge.
- Winpenny, J. T. (1994). "Managing Water as an Economic Resource," Routledge, London.
- Winpenny, J. T. (2004). Who will pay for the World's water? "Presentation to ICEA, January 7, 2004".