



The Challenge of Sanitation and Water

John J. Boland

CRANN Nanoscience Centre

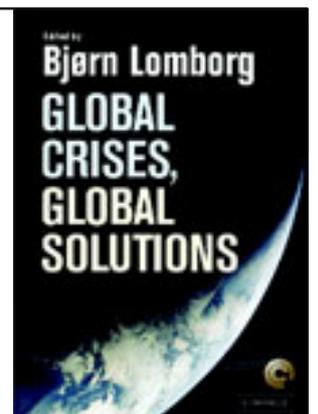
COPENHAGEN
CONSENSUS 2004



This paper was produced for the Copenhagen Consensus 2004 project.

The final version of this paper can be found in the book, 'Global Crises, Global Solutions: First Edition', edited by Bjørn Lomborg

(Cambridge University Press, 2004)



The Water Challenge - A Reply¹

John J. Boland²
9 May 04

Table of Contents:

1. The water and sanitation challenge
 - 1.1 Community managed low-cost water supply and sanitation
 - 1.2 Small-scale water technology for livelihoods
 2. Water and sanitation as commodities
 3. Limited scope for economic intervention
 4. Critique and conclusions
- References

1. The water and sanitation challenge

It is customary to begin discussion of water and sanitation issues with multiple citations to claims of a "global water crisis." The challenge paper (Rijsberman, 2004), properly and expertly decomposes these claims, pointing out which aspects of the "crisis" are truly global and which are, in fact, aggregations of specific and local problems. The reader's attention is then directed to what are arguably the most urgent of the many water crises: (1) the problem of ensuring access to safe and affordable water and sanitation for nearly half the world's population and (2) the problem of providing "dollar-poor" communities with access to water for productive purposes (primarily food production).

The challenge paper makes a detailed case for government involvement in water and sanitation provision, noting that (1) some uses of water have been recognized as a "human right;" (2) private sector organizations will under-invest in water supply and sanitation; (3) there may be capital barriers to entry by private sector firms; (4) some water resources may be common property, or at least open access, resources; (5) some water services are natural monopolies; and (6) water development and use involves significant externalities. The counter argument, also presented, is that private provision of water services has worked well in some situations and in some places. There is some additional discussion of the difficulty of applying user charges to certain water services.

However water and sanitation are to be managed, the costs of managing them badly are unacceptable. Going well beyond the kinds of lost surplus usually associated with economic inefficiency, poor management of water and sanitation leads to significant and pervasive health impacts, damages and deaths due to water-related natural hazards, poverty and malnourishment, and major environmental degradation. These factors point to both the importance of exploiting opportunities for successful interventions, and to the difficulty of fully evaluating the probable outcome of such interventions.

¹ Paper prepared as Opponent's Reply to the Challenge of Frank Rijsberman (third draft, revised 28 Apr 04) for the Copenhagen Consensus project of the Environmental Assessment Institute, Copenhagen, Denmark.

² Professor Emeritus, The Johns Hopkins University, Baltimore, MD, USA.

After briefly describing three candidate but not quantified opportunities, the challenge paper presents two proposed interventions which appear to be justified on strictly economic terms. These are briefly commented on below.

1.1 Community managed low-cost water supply and sanitation

The intended actions designed to bring about community managed provision of water supply and sanitation are not described in detail, but they apparently consist of (low-cost) technology transfer, community organizing, education, etc. The resulting water and sanitation systems would be community managed and financially and operationally self-sustaining.

For evaluation purposes, the end point is defined as achievement of the UN Millennium Development Goals for water and sanitation: to halve, by the year 2015, the proportion of people without access to safe drinking water or to basic sanitation.³ This goal is generally interpreted as requiring provision of access to "improved" water supply and sanitation to some 1.57 and 2.11 billion people, respectively. The challenge paper follows a UN World Water Development Report (2003) in defining "improved" water supply as ranging from rainwater harvesting to household connections, and in defining "improved" sanitation as ranging from simple pit latrines to connection to public sewers. These changes may be, then, very modest improvements. Still, the public health literature predicts significant beneficial effects from even rudimentary provision of water services. Also, any changes that move water sources closer to living areas have the further potential to increase the amount of time available for other household duties or for productive employment.

The challenge paper considers the initial investment as well as recurrent costs of providing improved water and sanitation services, but it addresses only the health-related benefits of these services. Following the work of Esrey, et al. (1991), it is further assumed that most health-related benefits derive from the provision of improved means for the disposal of human waste, although the cost of the water supply improvements is included in the benefit cost analysis. This is consistent with another interpretation of Esrey's findings, which is that access to safe water is a necessary, but not sufficient condition for health-related benefits. Sanitation, broadly defined (including personal hygiene and other activities which require water), is the sufficient condition (NRC 1996). The challenge paper estimates the effectiveness, costs, and benefits of the proposed interventions on the basis of studies reported in Evans, et al. (2004).

These and other assumptions lead to regional estimates of benefit cost ratios, ranging from 2.7 (South and Southeast Asia) to 22.3 (East Mediterranean and North Africa). The global benefit cost ratio is stated as 4.9. These results are described as lower bound estimates, due to the omission of any benefit from increased availability of household labor.

A second approach to evaluation relies on the use of Disability Adjusted Life Years (DALYs) as a metric for health-related benefits. The estimates used are based on work by WHO, as reported in Evans, et al., (2004). Because the DALYs consider both mortality and morbidity, this method allows for a relatively comprehensive form of cost effectiveness analysis. In this case, an economic value has been applied to the DALY measure:

³ The goals are based on the paragraph 19 of the United Nations Millennium Declaration (2000) as expanded by the recommendations of the World Summit on Sustainable Development (2002).

\$500/DALY, roughly based on income levels in developing countries and certainly a lower bound on the value of a year of healthy life. It is noted that this valuation of the DALY produces a net present benefit roughly comparable to that obtained through the prior method, given discount rates are in the range of 5-10 percent.

1.2 Small-scale water technology for livelihoods

The second opportunity proposed in the challenge paper is also aimed at the very poor of the world. In this case, the target population is the "dollar poor."⁴ It is estimated that some 1.2 billion people presently live at this level of poverty, of whom some three-quarters are in rural areas. The challenge paper further estimates that about 800 million "dollar poor" people depend on access to water for their livelihood. Most grow crops or tend livestock, while others may engage in fishing, agro-forestry, or aquaculture. The opportunity arises from the observation that relatively low-cost measures are available that could improve access to water, or make that access more secure, thus increasing the output of the productive activities.

The proposal is for a range of interventions not greatly different from the first opportunity: low-cost technology transfer, social marketing of technology, provision for micro-credit, and various kinds of institutional support. It is hoped that farmers would be motivated to adopt such technologies as low-cost drip irrigation systems (which both reduce water use and improve yield, compared to traditional irrigation practices) and treadle pumps (which may make irrigation a feasible alternative to rain-fed agriculture). Other low-cost technologies are also available.

It is assumed that 100 million farm families would adopt the small-scale technology, and that the result would be a stream of benefits in the form of increased crop value. The present value of the anticipated direct benefits is estimated in the range of US\$150 million to US\$300 million, for discount rates of 10 percent and 5 percent, respectively. Costs are on the order of US\$50 million to US\$100 million, giving a benefit cost ratio of 3.0. It is further noted that increases in farm output and agricultural activity can be expected to produce increased economic activity in the region, possibly multiplying benefits by a factor between 2 and 4. Choosing the median of this range gives a benefit cost ratio of 9.0, as reported in the challenge paper. However, no details are provided on the nature of the expected indirect benefits, or to what extent the calculation has excluded transfers.

2. Water and sanitation as commodities⁵

More than a decade ago, an international conference formulated four principles for the development of water resources in the 21st century (Dublin Statement, 1992). The fourth and most controversial of the Dublin Principles is: "Water has an economic value in all its competing uses and should be recognized as an economic good." This was widely and

⁴ "Dollar poor" is defined as those with household incomes of less than US\$1.00 per capita per day, measured in 1985 Purchasing Power Parity.

⁵ The arguments in this section are paraphrased and abbreviated versions of material that previously appeared in Boland (2001) and Boland (2003).

probably correctly interpreted as meaning that water should be treated like any other market good,⁶ a view that runs counter to considerable opinion, then and now.

The notion that "water is different" is embedded deeply in the psyche of most water engineers, planners, and managers. After all, the argument goes, water is essential to life. While the same can be said for food, shelter, and clothing, there are few advocates for a "food is different" or "clothing is different" position. Throughout history these essential services have been almost universally commodified and traded in markets. But not water. Over the six millennia separating the first irrigation systems in ancient Babylon from the vast water supply systems of today's megacities, water supply and wastewater management has been the work of government much more often than not. This historical fact seems congruent with our cherished beliefs. Water is, after all, the "enabler and sustainer of civilization" (NRC, 1991). It is said to be the very "source of life" and an "inalienable individual and collective right;" it has even been argued that "society must collectively assume all of the costs" of water supply.⁷

One might conclude, therefore, that water is truly "different," and not a market good like food or shelter. One might also conclude that various modern innovations such as full cost recovery and privatization are inappropriate or harmful. But these conclusions are not correct. They arise from a basic misunderstanding about the subject of the debate. Water supply, especially in the developing world, is a distinctly different thing from the stylized, even mythical, notion of water embodied in the "water is different" arguments.

There are at least three pieces to the argument. First, it is asserted that "water is different:" it is not an economic good like ordinary market goods. The second piece of the argument is that water is, in effect, a public good which should be available to all and, at least for basic uses, unpriced. Finally, the argument says that it is the responsibility of government to determine how much water should be provided, when and where, and to assume the costs of this service. Parallel arguments can be asserted for many sanitation services.

In economics, we make a distinction between public goods and market goods. Market goods are said to be rival and excludable. It is these characteristics that make it sensible and possible for a market to allocate market goods. When one or both of these characteristics are missing, the good is said to be some form of public good. This attribute is associated with market failure, where markets either cannot allocate the good at all, or do so inefficiently.

But what kind of good is water? If we are speaking of water in the environment, then it cannot be a market good except in very special circumstances. Normally, water is ubiquitous. It is everywhere around us. It would be impractical or impossible to levy a charge for water in the environment, and then exclude nonpayers. So this is clearly a public good.

But water in the environment is not what the writers of the Water Manifesto had in mind. They were concerned about water that is collected, stored, transported, and then made

⁶ Little noticed in the ensuing controversy was the sentence that immediately followed the Fourth Principle: "Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price." (Dublin Statement, 1992)

⁷ These statements first appeared on the Internet. (Committee for the World Water Contract, 1998) The Contract was later elaborated and published in book form by Ricardo Petrella (2001).

available for human uses at the time and place of need. To accomplish this requires a set of services that we know as "water supply." And water supply is clearly rival (water supplied to one person is not available to another) and excludable (if a charge is levied, nonpayers can be excluded). Water supply is, therefore, a market good, while water in the environment is not.

But this is not the whole story. Water does more than wash faces, flush toilets, and irrigate driveways. Universal access to a supply of safe water, coupled with safe means for disposing of human wastes, brings important health benefits--taken for granted in industrial countries, but yearned-for in many developing countries. And the benefits are not just to the users of water individually, but to communities collectively, e.g. as communicable disease incidence drops. Also, water supply systems free household members, usually women, from the time-consuming and laborious tasks of carrying water and managing its use. This expands the labor force, increases income, and improves the quality of life. The point is that these water-related services are not market goods--they are collectively-consumed public goods.

The Water Manifesto takes a rather simple line: water is a public good and not a market good. Reality is more complex. Water in the environment is generally a public good, while water supply is a market good, but one with important public good aspects. Similarly, the safe disposal of human wastes into the environment is a public good, while the safe removal of such wastes from human contact is a (mostly) market good, again with important public good aspects.

This intertwining of public and market goods is not unique to water and sanitation. Similar arguments can be made for many other services of urban infrastructure: electric energy, public transportation, communications, etc. By comparison, water and sanitation services are distinguished by the relative prominence of the public good aspects, and by a history of public sector provision which has tended to obscure the market good aspects.

Once it is accepted that water and sanitation are commodities, it becomes clear that efficient provision and use can be achieved through appropriate pricing and related commercial practices. But if it is also accepted that these commodities have important public good aspects, it is also clear that their provision must be subject to government (or at least public) control, so as to protect the public goods. Where the provider is not the government, it may have no incentive to provide universal access, to meet safety and environmental standards, to insure that the poor receive adequate services, etc. Interventions which help the provider become financially sustainable and which promote efficient pricing do not insure that public goods are provided in the proper amounts. Similarly, interventions which focus on the public goods may not lead to efficient provision of the market good. Proposed interventions must recognize this complexity, and must be clear about their specific objectives.

3. Limited scope for economic intervention

Both opportunities described in the challenge paper can be characterized as bottom-up strategies. That is, they seek to improve the ability of individuals, households, and communities to take actions that will result in improved water and sanitation services. In this sense, these opportunities are consistent with the lessons of decades of disappointing initiatives. Time and again, attempts to impose top-down solutions (institutional

strengthening, institutional reform, reorganization, regulations and standards, etc.) have produced little or, at best, temporary improvement. On the other hand, there are distinct limitations to what can be accomplished through bottom-up approaches.

The challenge paper describes the proposed opportunities in very general terms, with few details. In the case of the first opportunity, it can be assumed that social marketing, training, and community mobilization activities will be used to help develop an organization competent to deliver improved water supply and sanitation services. The community organization would then be acquainted with a range of appropriate low-cost technology. A variety of financing and self-help measures would be needed to construct the facilities. Finally, users will be expected to pay fees and/or contribute labor in return for the improved services. Most practitioners agree that this is a sound approach.⁸

According to a conventional rational analysis of this problem, because the benefits to the community may far outweigh the cost, the community is expected to welcome any assistance in achieving these benefits. But whether all of this is feasible in any given location depends on many factors beyond the control of the intervenor. There may be reasons why the community is unable or unwilling to organize (internal divisions, prior negative experience with similar efforts, etc.). The proposed technologies may be unsuitable for historical or cultural reasons. It may be difficult to achieve financial sustainability because of problems with levying or collecting sufficient revenues.

These issues are real, but they do not preclude success. The problem is to understand exactly what barriers may be encountered and to craft a place-specific intervention that avoids them. Different forms of organization may be appropriate in different places; not every community can achieve a locally managed activity. Even private sector firms can be considered, provided that regulation and oversight can be provided.

The relative social acceptance of alternative technologies is a complicated topic, especially in the case of sanitation. Issues of habit, privacy, cleanliness, etc., may result in rejection of certain types of facilities (e.g., latrines) in certain places. It is important to understand what will be acceptable before proceeding.

Financial sustainability requires a tariff which is socially acceptable and which can produce the needed revenues.⁹ Even in very poor countries, this is almost always achievable in the case of water supply. All households demonstrate significant willingness to pay for improved water services. Some urban households may already pay a substantial fraction of disposable income for water obtained from vendors.¹⁰ Of course, the tariff must also provide for those households which cannot or should not be required to pay the full cost of improved water service. There are a number of ways to accomplish this, generally by providing a basic level of service at a low cost or at no cost. Proper tariff design allows this to be done without distorting the price signals received by other households (Whittington, et al., 2002).

⁸ Early reports of apparent success of interventions of this kind are steadily accumulating; most recently in Kazakhstan (Michael Curley, personal communication).

⁹ This assumes that the tariff is correctly set, that users are billed accurately, and that most bills are paid. Each of these conditions represents a major challenge in most developing countries, although early indications are that community-managed systems may have fewer collection problems.

¹⁰ Whittington and Choe (1992) found water vendor costs ranging up to 40 percent of disposable household income.

Sanitation services present a different problem. Because of the large public good component of sanitation services, household-level willingness to pay may be low to nonexistent. Industrial countries solved this problem by bundling wastewater services with water supply, thus exploiting the higher willingness to pay for water as a revenue source for wastewater management. But the pattern in developing countries has been to provide water supply first, then attempt to implement sanitation improvements later. This requires increasing the water tariff to pay for sanitation, a highly unpopular approach. A better strategy is to bundle the services from the outset where possible, and to make maximum use of contributed labor to reduce the cost of sanitation improvements.

The argument for bottom-up, user-driven approaches is that they respond to the actual needs and constraints of the affected community, and thus have a much higher likelihood of success. A corollary to this argument is that each local intervention must be prepared to adapt to those needs and constraints; it must identify each possible barrier to success and attempt to provide a solution. While economic tools are important, much barrier identification and adaptation relies on the skills of other social scientists (sociologists, anthropologists, etc.). There is no "one size fits all."

4. Critique and Conclusions

The challenge paper focuses on two areas of great need: (1) the several billions of people who presently lack access to safe water and/or safe means for disposal of human wastes and (2) the nearly one billion very poor people whose livelihood depends on an adequate supply of water for irrigation, stock watering, etc. The first opportunity is described as a set of bottom-up interventions designed to facilitate the formation of community-managed, self-sustaining organizations which can deliver improved water and sanitation services. The second opportunity involves the introduction and social marketing of a number of low-cost technologies which promise to increase the net income of those who use water for productive purposes. In both bases, the interventions are expected to provide large net benefits, with benefit cost ratios of 2.7 and higher.

One major question, applicable to both opportunities, is how to predict the degree of successful implementation. In the case of the first opportunity, each individual intervention must be tailored to the culture, history, and situation of the affected community. Some of these adaptations will be successful in leading the community to develop improved water supply and sanitation services; others will not. The challenge paper avoids this issue by merely stating that the Millennium Development Goals will be met: that is, half of the unserved population will be served by 2015. Whether this is achievable in the stated time frame, or at all, is unknown. While experience with approaches of the kind proposed has been encouraging, it can also be assumed that the easiest problems have been addressed first (the "low-hanging fruit"). No one can say how effective this approach will be if implemented on the massive scale and in the compressed time frame contemplated by the challenge paper.

The second opportunity raises a similar question. In this case, it is assumed that there exist low-cost, cost-effective technologies that can increase the income of some 100 million very poor families. If this is true, one must ask why there is not already a large demand for and widespread adoption of these technologies. The answers implied by the challenge paper are that the technologies are not widely known and that there are financial barriers to their

adoption (the potential beneficiaries have insufficient cash and no credit). The nature of the opportunity is that providing information and financing (micro-credit arrangements) will lead to widespread adoption. In fact, the challenge paper assumes nearly 100 percent adoption.

Despite these criticisms, it is probably true that both interventions are highly beneficial. Even if the first opportunity was limited to several hundred million people, instead of several billion, the benefits would likely exceed the costs by a large margin. Similarly, a more limited application of the second opportunity would still produce large benefits. Since each of them consists of numerous individual, mostly independent projects, there are few economies of scale in implementation. If the sites are first screened for expected benefits, it would be possible to pick the best applications first, producing benefit cost ratios even higher than those estimated in the challenge paper.

In presenting evaluations of the two opportunities, the challenge paper notes the prevalence of cost effectiveness analyses in the literature, many of them measuring outcomes in terms of infrastructure built, or institutions created, rather than as services delivered. In other words, benefits are measured in terms of inputs, not outputs.¹¹ The challenge paper recognizes this problem and attempts to avoid it by providing, in each case, an economic measure of the value of services provided. On the other hand, the number of persons served is predetermined for both opportunities, so there is an element of rigidity in this analysis, as noted above.

Another issue for the first opportunity arises out of the need to develop financially sustainable community-managed service delivery organizations. This is perhaps the most difficult achievement, especially in countries where water utilities have traditionally depended on subsidy, where there is no tradition of cost recovery, where many water bills go unpaid without consequences, where utility managers feel no accountability to their customers, etc. There is little or no experience with devising public institutions that will reverse this set of expectations. Some cases of privatization appear to have achieved this, but it is not clear that a community-managed organization will succeed immediately.

Finally, there is the issue of public goods. Where water and sanitation services have been provided by government, it has been presumed that government would promote and protect the public goods. In fact, government-owned agencies in some developing countries have been severely dysfunctional, failing to provide adequate quantities of the market goods as well as the public goods. Where private sector firms are the providers of service, the responsibility for ensuring that public goods are adequately provided falls squarely on government, and government may or may not fulfill this charge. It is not yet clear what advantages a community-managed organization may have. One argument is that it will attend to the public goods at least as well as a government agency would and that it will also be a more effective provider of the market goods. A contradictory argument is that the community-managed organization will have little incentive to protect health, environment, etc., relying on the government to attend to these matters.

In summary, the challenge paper presents two provocative and meritorious opportunities. Their justifications would be more persuasive if they either used more realistic adoption

¹¹ One (unnamed) industrial country has recently been heard to count as beneficiaries of improved water supply the entire population of a river basin, where the only action taken was the organization of a new water management agency.

goals, or if they were presented in terms of phased, incremental adoption. Also, the justification is silent on the considerable difficulty and complexity of adapting each intervention to local beliefs, customs, and situations. However, this omission does not detract from the potential benefits to be gained, it merely casts further doubt on the assumed level of adoption.

The proposed opportunities are well worth further elaboration and development. In the case of the first opportunity, particular attention should be given to the two issues for which there is little satisfactory experience: (1) the means of adapting interventions to local conditions and (2) the strategies for achieving financially sustainable delivery of services. In the case of the second opportunity, efforts to promote the adoption of low-cost technologies must begin with a clear and detailed understanding of why those technologies will not be adopted in the absence of intervention.

References

Boland, J.J. 2001. Should water be considered a commodity: Yes. in *History in dispute; Vol. 7, water and the environment: global perspectives*. St. James Press. pp. 281-284.

Boland, J.J. 2003. Thinking about the demand for water services: why is it so difficult to understand? The 2003 Abel Wolman Distinguished Lecture, National Research Council of the National Academies, Washington, DC, April 21, 2003.

Committee for the World Water Contract. 1998. The water manifesto.

Dublin Statement. 1992. International conference on water and the environment: development issues for the 21st century. 16-31 Jan 1992, Dublin, Ireland. Geneva, World Meteorological Organization, 1992.

Esrey, S.A., J.B. Potasch, L. Roberts, and C. Shiff. 1991. Effects of improved water and sanitation on ascariasis, diarrhoea, dracunculiasis, hookworm infection, schistosomiasis and trachoma. *Bulletin of the World Health Organization*. 69(5):609-621. Cited by Rijsberman (2004).

Evans, B.G., L. Hutton, and L. Haller. 2004. Closing the sanitation gap - The case for better funding of sanitation and hygiene. Paper prepared for Roundtable on Sustainable Development, 9-10 March 2004, OECD, Paris. Cited by Rijsberman (2004).

NRC. 1991. *Opportunities in the hydrologic sciences*. National Academy Press, Washington, DC.

NRC. 1996. Water and sanitation services for megacities in the developing world; in *Meeting the challenges of megacities in the developing world: a collection of working papers*. Washington, DC.

Petrella, R. 2001. *The water manifesto: arguments for a world water contract*. New York: Palgrave Macmillan Ltd.

Rijsberman, F., 2004. The water challenge. Paper prepared for the Copenhagen Consensus project of the Environmental Assessment Institute, Copenhagen, Denmark.

UN Dept. of Economic and Social Affairs. 2004. Plan of implementation of the World Summit on Sustainable Development. Division for Sustainable Development.

UN General Assembly. 2000. Millennium declaration (55/2).

UNWWDR (UN World Water Development Report). 2003. *Water for people, water for life*. UNESCO, Paris.

Whittington, D., J.J. Boland, and V. Foster. 2002. Understanding the basics. In *Water tariffs and subsidies in South Asia*, Water and Sanitation Program-South Asia, New Delhi, India, published on the Internet at <http://www.wsp.org/pdfs/Water%20Tariff%201_press_27th%20Feb.pdf>, pp. 1-16.

Whittington, D., and K. Choe. 1992. Economic benefits available from the provision of improved water supplies. WASH Technical Report No. 77. US Agency for International Development, Environmental Health Project, Washington, DC.