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The Challenge of Improving Water and Sanitation Services in Less Developed Countries

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Abstract

This paper argues that there are many challenges to designing and implementing water and sanitation interventions that actually deliver economic benefits to the households in developing countries. Perhaps most critical to successful water and sanitation investments is to discover and implement forms of service and payment mechanisms that will render the improvements worthwhile for those who must pay for them. In this paper, we argue that, in many cases, the conventional network technologies of water supply and sanitation will fail this test, and that poor households need alternative, non-network technologies. However, it will not necessarily be the case that specific non-network

improved water supply and/or sanitation technologies will always be seen as worthwhile by those who must pay for them. We argue that there is no easy panacea to resolve this situation. For any intervention, the outcome is likely to be context-dependent. An intervention that works well in one locality may fail miserably in another. For any given technology, the outcome will depend on economic and social conditions, including how it is implemented, by whom, and often on the extent to which complementary behavioral, institutional and organizational changes also occur. For this reason, we warn against excessive generalization: one cannot, in our view, say that one intervention yields a rate of return of $x\%$ while another yields a return of $y\%$, because the economic returns are likely to vary with local circumstances. More important is to identify the circumstances under which an intervention is more or less likely to succeed. Also for this reason, when we analyze a few selected water and sanitation interventions, we employ a probabilistic rather than a deterministic analysis to emphasize that real world outcomes are likely to vary substantially.

Contents

1

Introduction

The 1980s were designated the International Water and Sanitation Decade, and the international community committed itself to ensuring that everyone in the world would have access to at least basic water and sanitation services by 1990. This target was not met. While hundreds of millions did receive access to new services, at the end of the decade well over 1.1 billion people still lacked improved water supplies, and more than 2.7 billion lacked sanitation services. By the year 2000, although another billion people had obtained access to improved water and sanitation services, population growth had left the number of those still unserved at roughly the same absolute level. In 2002, at the Johannesburg World Summit on Sustainable Development, the global community made a new commitment to a set of Millennium Development Goals (MDGs), including environmental sustainability. One of the targets under the environmental sustainability MDG is to cut by half the proportion of people in the world living without access to water and sanitation by 2015.

While we certainly hope that the global target for water and sanitation will be met this time, there are grounds for concern. Some important physical and economic features of water supply and

sanitation make it inherently difficult to achieve broad-scale goals such as those of the Water and Sanitation Decade and the MDG water and sanitation target — more difficult than for other MDG targets such as providing access to affordable essential drugs or communication and information technology. These features of water and sanitation have not been well recognized in the existing economics literature or in the policy literature.

Several factors are involved, but a key issue contributing to the difficulty in achieving improved access has been a fundamental misunderstanding of the economics of investment in the water and sanitation sector. The core problem is to ensure that the benefits of *improved* water and sanitation access will be large enough to cover or possibly exceed the costs for those who will bear them: yet surprisingly often, this need is overlooked. There are two aspects to this statement. One is distributional: those who pay the costs are not necessarily those who will receive the benefits. An additional complication is that large-scale water supply infrastructure investments often have multiple goals (e.g., flood and drought protection, hydropower generation, navigation, fisheries, and recreation), which further exacerbates the challenge of designing appropriate payment mechanisms for services delivered to a diverse set of beneficiaries. The second issue is perhaps more surprising but, we believe, no less real. Even considering water supply alone (for which externalities are less significant than for sanitation, as most of the benefits accrue directly to those who consume the water), the incremental benefits of improved access to water and sanitation network infrastructure may simply not be large enough to cover the costs of improved access.

This happens for two reasons. First, for the network infrastructure technologies presently available, the cost of improved access to water is typically large. These high costs are due to the capital intensity of the investments associated with improved water supply, although the longevity of the capital means that it will provide benefits for many years into the future. Second, the incremental benefit can be small. This statement too may seem surprising — after all, we know that water is essential for life. Herein lies the paradox: precisely because water is

essential for life, everybody does manage to have some sort of access to water, however inadequate and cumbersome. It is for this reason that the *incremental* benefit from *improved* access to water may not be so large. Contrast, for example, water supply with electrification. Because electricity is *not* essential for life, by no means everybody has access to electricity in their homes. Without access in the home, there is no affordable or convenient way to use electricity because there is no way to carry electricity home. Therefore, when it becomes available, access to in-home electricity may be *perceived* as a greater boon than access to in-home piped water and sewerage. Consequently, users' willingness to pay for access to electricity may be greater than their willingness to pay for access to piped water and sewerage, even though water is essential for life and electricity is not.

The key to successful water and sanitation investments is to discover forms of service and payment mechanisms that will render the improvements worthwhile for those who must pay for them. In this paper, we argue that, in many cases, the conventional network technologies of water supply and sanitation will fail this test, and that poor households need alternative, non-network technologies. However, for some of these technologies, too, it will not necessarily be the case that improved water supply and/or sanitation will always be seen as worthwhile by those who must pay for it.

We argue that there is no easy panacea to resolve this situation. For any intervention, the outcome is likely to be context-dependent. An intervention that works well in one locality may fail miserably in another. While it may be the same physical technology that is being applied, the outcome depends on economic and social conditions, including how it is implemented, by whom, and often on the extent to which complementary changes — in behavior, in institutions, and sometimes in economic organization — also occur. For this reason, we warn against excessive generalization: one cannot, in our view, say that one intervention yields a rate of return of $x\%$ while another yields a return of $y\%$, because the economic returns are likely to vary with local circumstances. More important is to identify the circumstances under which an intervention is more or less likely to succeed. Also for this reason,

when we analyze a few selected water and sanitation interventions, we employ a probabilistic rather than a deterministic analysis to emphasize that real world outcomes are likely to vary substantially.

This paper is organized in three parts. Section 2 focuses on conventional network technologies for water supply and sanitation. It opens with some general observations that are central to an understanding of the economics of municipal water and sanitation network infrastructure. We proceed from there to a focus on the costs of providing such infrastructure services, and then summarize some empirical evidence on the economic benefits derived from them. We then discuss the economic costs and the benefits involved and note the limitations of the analytical approach used in most such applications. Section 2 closes with some observations regarding the implications of these results.

Section 3 presents the probabilistic analytical approach that we use to analyze investments in the water and sanitation sector. We then illustrate this approach for the case of network infrastructure services. In Section 4 we deploy this analytical framework to examine the costs and benefits of three specific low-cost, non-network water and sanitation interventions (deep boreholes with public hand pumps, total community-led sanitation campaigns, and biosand filters) and one high-cost intervention (large multipurpose dams in Africa).

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