# WATER AND POVERTY IN A MACRO-ECONOMIC CONTEXT[12]

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## SUMMARY OF FINDINGS AND CONCLUSIONS

### Myths and Realities Facing Decision Makers:

- The global water picture is confusing and dominated by many misleading myths portraying a growing water crisis caused by demand as well as supply conditions.

- Among these is the myth that poor people are unable an unwilling to pay for reliable public water supplies. This is fundamentally untrue.

- Poor people in metropolitan slums face highly subsidized public water systems that due to lack of maintenance and management are unable to supply the promised cheap water to the poor, who instead are forced to pay sky-high prices for dirty water to private vendors.

- The overarching problem is that politicians do not allow the poor the opportunity to choose to pay the full cost of public water provision.

- Globally, agriculture uses almost 70% of all available water, and in developing countries this share is around 90% on average, with irrigation using almost all of it, but paying only a fraction of the cost of supplying it.

- Inefficient pricing and management of irrigation water supply leads to massive wastage and losses of agricultural output, environmental damage and loss of soil productivity, and loss of water that could have been allocated for more productive uses.

- Total welfare losses from water mismanagement in e.g. China are 1.3% of GDP. Health damages dominate these accounts. No reason to believe it is any less in other large developing economies. Such losses exceed annual global foreign aid transfers.

- There is no correlation whatsoever between access to water and to sanitation on the one hand, and per capita water resources available.

- The emerging global water crisis is thus very much a political and governance crisis and not so much a physical scarcity crisis.

- Relatively small improvements in agricultural water use, could free up considerable quantities of water for domestic uses in places were a supply crisis is felt. There is great scope for "*more crop per drop*", but the policy setting must be tailored to promote efficiency and sustainability.

- Acceptance of "virtual water" as an input in food production in line with any other input factor in a production process would help to reallocate water intensive activities to were water supply is plentiful, and in this way avoid costly unnecessary investments in new water supply systems where water resources are scarce and remotely located relative where it is to be used.

**Macro-economic Dimensions of Water and Sanitation**

- Water sector subsidies impose a significant fiscal burden on developing countries, amounting to US$ 20 billion, i.e. around 40% of overall foreign aid transfers.

- In addition comes US$ 55 billion of annual savings to service providers from raising technical efficiency to best practical levels. This amounts to twice the annual development finance for infrastructure!

- If these technical efficiency losses could be redirected for three years, the one billion poor without safe water could be served in a demand responsive way thus enhancing growth, poverty reduction and much improved life expectancy and health.

- Direct annual income lost due to land and water mismanagement is of the order of magnitude of global foreign aid transfers. At the same time, the preventive, corrective and rehabilitative measures that could prevent such damages would cost no more than 25 – 50% of the annual losses.

- 90% of people who died in natural disasters in the 1990s, died in water related events, and many of these events were magnified as a result of interactive land and water mismanagement. 97% of the victims were from developing countries.

- WHO estimates avoided deaths due to water-related diseases if WHO actions in developing countries were implemented to an amount equal to US$ 186 billion annually, or more than three times annual global developing assistance transfers.

**The Underestimated Sanitation Challenge**

- While more than 2 billion people have gained access to water supply, and 0.6 billion to sanitation over the past two decades, over one billion still lack access to improved water services, 2.4 billion still live without improved sanitation, and 4 billion live without sound wastewater disposal.

- In 2000, the total number of urban dwellers lacking “adequate” sanitation was between 850 to 1130 million, much larger than the 400 million lacking “improved” provision. This means that the funds required to meet MDGs for urban sanitation are likely to be more than double of what has been estimated so far.

- During the last two decades, communities and NGOs have jointly provided toilet and bath facilities to about 4 million urban slum dwellers through community toilet complexes in India. In addition, such action has helped in the construction of private toilet facilities for about 1.5 million urban people in several countries

- However, these cost-effective efforts of community participation have to be scaled-up by a factor of 100 times if adequate sanitation services are to be provided to about 500 million urban poor and slum dwellers over the next decade or so. Taking a conservative figure of $ 20 per capita for providing sanitation services in urban areas, the estimated capital requirements are around $ 10 billion for the poorest in urban areas in Asia, Africa and Latin America.

- Although NGOs play an important role in organizing communities, the institutional structure of NGOs does not enable them to raise capital funds from financing institutions. Innovative institutional arrangements will be required so that NGOs can set-up companies that can raise capital funds and manage financial risks.

- Governments, local bodies, international lending institutions and bilateral aid agencies have to understand and accept that far greater funds are required for meeting the MDGs of providing adequate sanitation than the resources available in the past. Governments and local bodies should consider additional taxes on water use (e.g. in Burkina Faso) and/ or property taxes that are specifically marked and allocated to provisioning of sanitation services to the poor.

- Given the limited ability of the poor to pay for sanitation services, the greatest challenge for community sanitation systems has been low tariffs, generating revenues that are too low for cost recovery and financial sustainability of existing or new services. For a long-term sustainability of investments in urban sanitation, the community schemes have to raise revenues from users who are too poor to contribute enough to cover even the O&M costs. Other sources of revenues have to be found to meet O&M costs and a part of the capital costs.

## 1. INTRODUCTION

Water plays a crucial role as a source of life, and a sink of emissions and waste, but according to the U.N. Secretary General, real understanding of the challenges we face is alarmingly low. Some places there appears to be an abundance of water, other places it is critically scarce. Even where there is apparent aggregate abundance of water, the uses of it in production and consumption and as a sink for emissions of waste and residues may render the quality of available water such that there is severe scarcity of certain qualities of it. Therefore depending on local scarcity and category for different uses, water can be worthless or priceless, as it has been strikingly expressed by Craig Davis in the blues song "*You don't miss your water till the well runs dry*".

The global water picture is confusing. The World Commission on Water predict that water use will increase by 50% over the coming 30 years, and that half the worlds population - will live under conditions of severe water stress in 2025. Conflicts over land and water, including those between direct economic use and environmental conservation will worsen. Unfortunately, this development outlook is likely so long as the political water agenda is dominated by the static hydro paranoia that countries must have local food self-sufficiency. The likelihood is strengthened by political acceptance of the resilient and false myth that poor people are neither able nor willing to pay for reliable public water supplies. This myth causes popularity-seeking politicians to shy away from charging for water, and the result is that water systems cannot be sustained even where people, including the poor are willing to pay. Water for livelihood should be the key, not water for producing livelihoods.

In fact, the emerging global water crisis is very much a political and governance crisis rather than a physical scarcity crisis. Reinforcing this impression are the comprehensive findings in the recent U.N. World Water Development Report 2003 (WWDR) on progress since the 1992 Rio Conference: The report consistently reveals that progress has been significant in terms of ambiguous, non-committing and non-controversial declarations resulting from the global mammoth conferences, but very little if any progress is observed where commitments to identified reform needs and real action affecting influential possessors of "grandfather rights" is needed in order to turn the trend away from unsustainable water use development.

A key to sustainable water resources management would be adoption of the "*virtual water*" concept. This means treating water used in e.g. food production like any other input factor in a production process, where the choice between food import or domestic self-sufficiency is cost- and efficiency-based. Countries adopting this planning approach encounter water as a growth-constraining factor to a much lesser extent.

Despite the acknowledged role of water resources in socio-economic development and growth there is little quantitative information on the extent to which water resource degradation impacts on a country's economy. The overall goal of this study is to assess the macro-economic impacts of water resources and their degradation on a country's economy. Specifically, the study aims to collect, collate, and document data and information describing the linkages between a country's economy and natural resource base, focusing on water resources in particular, and use these to estimate macro-economic indicators of the country's vulnerability to droughts, floods, benign water use and water resources degradation. This will provide an economic rationale for a country to promote improved water resources

development and management and be a valuable contribution to preparing water resources management- and efficiency plans and climate change adaptation strategies.

## 2. THE MILLENNIUM DEVELOPMENT GOALS (MDGS) AND THE POVERTY-RELATED CHALLENGES

The MDGs for the water and sanitation sector state is to halve the proportion of people without safe, sustainable drinking water by 2015. This challenge can be seen along four dimensions:

(a) To keep pace with population growth, more than one billion more people need to be served,
(b) Existing coverage and service gaps must be closed; the sanitation gap being very large;
(c) Existing and new services must be made sustainable;
(d) The quality of service must be improved; in many cases well beyond what is labelled "improved" as a MDG criterion, before safe, convenient and adequate service is in place.

The MDG targets thus translate into the following real world 2015 challenges:

- The number of people served by water supply must increase by 1.5 billion and those served by sanitation by 1.87 billion;
- For water, this means providing service for an additional 100 million people per year, or 274,000 every day. This means a significant escalation of investments and reforms compared to the 1990s.
- The sanitation challenges is even more daunting: Services must be provided for an additional 125 million every year until 2015. However, the achievements in the 1990s were around 100 million per year.

## 3. THE WATER DEPENDENCE OF DEVELOPING ECONOMIES – A TYPOLOGY OF REGIONAL ISSUES

Water availability is unequally distributed around the world. Reviewing progress since the Rio conference in 1992, see e.g. chapter 23 in the U.N. World Water Development Report 2003 (WWDR), and taking a realistic outlook towards the likelihood of achieving the 2015 water-related MDGs, a typology of regions emerge as a useful starting point for targeted strategies and action-orientation from a macro-policy and financing perspective, which can facilitate effective and efficient targeted financial and capacity building support.

One such category of countries could be the *mature, post-industrial, temperate countries* where water no longer is not a big issue. The WWDR finds that these countries have come a long way towards implementing chapter 18 of Agenda 21 of the Rio Conference, and the MDGs simply were not meant for these countries. Whatever MDG-water and sanitation challenges remain are first and foremost found in Central and East Europe and the Commonwealth of Independent States (CIS), but these should be within timely reach by domestic action if the political will and priorities are in place. Technical assistance from abroad, could of course speed up the process.

*Latin America and the Caribbean* region are generally water-rich and is found by the U.N. WWDR 2003 to have relatively high water and sanitation service levels, but with large

internal variations, especially between urban and rural coverage. However, as for the other regions, there is a significant gap between "improved service" and "adequate provision", and most rivers and water bodies flowing through cities in Latin America are heavily polluted and facing a worsening of conditions (as was observed for the other regions as well). Water use efficiency in agriculture is low for Latin America, but where water is scarce, high efficiency is obtained.

Central America and the Caribbean experienced 20% of all hydro meteorological disasters during the 1990s, with a large number of deaths relative to the number of people affected and with major economic setback impacts for the countries and communities affected.

Latin America is the most advanced development region in terms of progress towards the water and sanitation MDGs. 22 of the regions countries declare that they are on track or have achieved the 2015 MDGs. Only 3 are lagging or far behind. The countries of the region are slowly moving towards full cost recovery and have moved further in its engagement of the private sector than any other region. However, the central governments provide most of the financing, and will have to play that role together with the private sector in attempting to reach the MDGs.

In the *Middle East and North African* countries the political water crisis has been seen as more imminent than most places. Rapidly growing populations with increasing per capita water consumption claim the rights to the limited water in the few significant rivers and aquifers shared by two or more relatively arid countries.

The *natural legacy* of the region is one of significant climatic variability with frequent severe droughts and relatively little water. Land and water management regimes must be developed in an integrated way and take such variability and scarcity explicitly into account so as to maximize resilience to such events, which can have severe poverty and destabilization impacts, affecting both the structure and performance of economies and a country's ability to eradicate poverty.

The *historical legacy* is one with the most important rivers shared by two or more countries having tense political relations. However, the sharing was often defined by former colonial powers or in the wake of armed conflicts that established the national borders with little or no regard for the hydrological integrity of watersheds or natural water boundaries, or ethnic or cultural boundaries. These nation-state borders today represent serious obstacles to traditional coping strategies. They cause severe vulnerability of people to their natural legacy to which they had earlier adapted. In addition come numerous domestic ethnic and religious tensions and conflicts where water rights and access plays a key role in the search for solutions.

Each of these legacies generates significant political and economic risk to private as well as state investors, and the two legacies mutually reinforce the joint risks to investors in water sector infrastructure, because compared to other regions the investment requirement per unit of desired end product has to be much higher to counter these risks. Poor political relations between neighbour states has lead each country to strive for myopic food self sufficiency virtually regardless of what it costs in economic terms. At the same time, politicians have opted for short-term solutions that can secure their re-election. Providing cheap, subsidized water to the rather well to do urban dwellers and the influential commercial large-scale farmers has been a key component of such politics. This again has led to excessive overuse and wastage of scarce water, and to delays or lack of investments and necessary water and

sanitation sector reforms, which has significantly reinforced the increasing degradation trends observed by the WWDR 2003 for all the water –related environmental trend indicators.

The common denominator of most of the countries in this region is that they face a water- and sanitation crisis due to poor domestic governance, perverse economic and financial sector policies, and unstable and unpredictable political relations to their regional neighbours. External financial resource mobilization should not be considered a critical constraining obstacle to reaching the water and sanitation-related MDGs, but to the extent that external financing promises can facilitate and accelerate domestic reforms that remove obstacles to solving the emerging water crisis, such transfers should be considered.

*Asia* with more that half the worlds population holds more people without access to water supply and sanitation than the rest of the developing world combined. It is a diverse and heterogeneous region with advanced as well as some of the poorest and most exposed economies as far as natural disasters are concerned. And yet, as a region, existing physical and institutional infrastructure and capabilities to improve and put in place additional water and sanitation infrastructure and management capacity is much better prepared for the MDG challenges than e.g. Sub Sahara Africa. The large Asian countries can be said to have rather "mature" water economies with long experience in constructing and operating large and advanced hydro infrastructure and complementary management institutions. A long history of poor governance and perverse water use incentives has resulted in China becoming the most water-stressed country in East Asia. It is approaching what experts consider being the environmental carrying capacity of several of their river basin systems. In the North China Plains there is serious overdraft on the groundwater. Similar overdraft of river basins and groundwater takes place in Afghanistan, Pakistan and Northwest India where the green revolution has been implemented, and in most of the Middle East.

During the 1990s, Asia experienced nearly one third of all worldwide water-related disasters a total of 1.8 billion people were affected, according to U.N. WWDR 2003. What distinguished Asia from Africa in this context is that 80% of those affected by the Asian disasters were impacted by floods, whereas in Africa during the same period, 80% were impacted by drought. Interestingly, investments in appropriate water storage capacity could help alleviate both these opposing types of disaster impacts.

The challenge is first and foremost to reform Asian institutions for effective, efficient and sustainable operation so that they can become attractive investment targets for private and institutional investors and for government. It should then be possible to have the system expanded to coverage in line with the MDGs. The major capital intensive water management systems (e.g. large multipurpose dams and canals) in e.g. China and India, and many individually well designed and functioning sanitation and water supply systems in urban areas throughout the region, suggests that there is scope for domestic – or at least regional – implementation of the "best-practice" activities needed for the MDGs to be achieved. However, parallel economy-wide and financial sector reforms are needed for the necessary domestic and regional public and private sector capital mobilization so that this can take place smoothly and without delay towards a state of cost recovery. This again could attract foreign direct investment in the sector. Overseas development assistance cannot realistically solve the financing needs for meeting the MDGs of the region, but would be necessary in the smaller, poorer and less credit worthy economies, some of which are found by the U.N. WWDR 2003 to be lagging or far behind a schedule for reaching the water and sanitation sector MDGs, and

for these as well as due to their natural legacy should be categorized more like the countries in Sub Sahara Africa (see below).

*Sub-Sahara Africa*, on the other hand, is where the real MDG-challenges are mounting. Here water and sanitation impacts has a number of very significant impacts on the lives of poor people, such as (see Moss et al (2003), p.55):

- Poor people spend at least a third of their incomes for the treatment of water-borne diseases like malaria and diarrhoea. In addition comes the value of the productive incoming earning time lost due to these diseases, and all the suffering.

- In rural areas women spend up to 6 hours a day on water collection chores. Again, this is productive time lost plus much less time available for families to be together for the care and comfort of the children and social activities and recreation.

- In rural areas 90% of school age children are needed by their families as direct or indirect income earners to make ends meet. Their responsibilities include time consuming and demanding activities such as water collection, and bringing the livestock to water sources. Of the 10% who are able to reach school, only 15% are girls. Teachers strongly prefer assignments to schools where there is reliable safe water and proper sanitation facilities (along with other basic infrastructure that provides for a more comfortable life).

Why does Sub Sahara Africa distinguish itself in such a sad and dismal way?

The *natural- and historical legacies* of Africa combine to undermine the continent's water resources endowment as a factor of economic growth. The *African natural legacy* is one of very high hydrological variability, with inter-annual and intra-annual extremes of precipitation, temperature and river flows, resulting in frequent catastrophic floods and droughts relative to other regions of the world, see Grey and Sadoff (2002). In order to manage hydrological variability, early African societies developed coping strategies, such as pastoralism, mobility and seasonal migration, with people moving in response to water and land pressures.

However, the *historical legacy* is one of more important rivers shared by two or more countries than on any other continent; the sharing defined by former colonial powers that established the national borders with little or no regard for the hydrological integrity of watersheds or natural water boundaries, or ethnic or cultural boundaries. These nation-state borders today represent obstacles to traditional coping strategies and causes severe vulnerability of these peoples to the natural legacy to which they are subject and had earlier adapted.

Each of these legacies generates significant political and economic risk to private as well as state investors, and the two legacies mutually reinforce the joint risks to investors in water sector infrastructure, because compared to other regions the investment requirement per unit of desired end product has to be much higher to counter these risks.

Where such variability occurs, land and water management regimes must be developed in an integrated way and take such variability explicitly into account so as to maximize resilience to such events, because such losses of the natural wealth of nations can have severe poverty

impacts, affecting both the structure and performance of economies and a country's ability to eradicate poverty. This is particularly important in Africa where less than 5% of the agricultural land is irrigated (In contrast 30-35% of agricultural land, producing 2/3 of the agricultural output, is irrigated in Asia).

An adverse evil poverty circle presently observed in Africa results from these legacies: High investments require low political and economic risks and well functioning financial markets. Political risks, however, increase with unstable political climates and such adverse and unpredictable political climate is more likely when several states have to agree on how to manage a common resource (e.g. watershed or river basin). At the same time, with several states involved, sophisticated and professionally strong transnational management institutions with mutually accepted monitoring capacities must be in place, but this requires an adequate supply of highly skilled experts from all the affected countries to fill the required positions. While these are key conditions for economic growth and prosperity, these same conditions will not appear unless economic growth takes place and a sufficient human capital base has been established. Africa is unfortunately far away from reaching such a development and governance stage and individual country markets remain much too small to take advantage of scale- and scope economies.

Facing such risks and uncertainties, both smallholders and large-scale commercial investors are likely to adopt risk averse investment behaviour. This has so far promoted patterns of development that result in a growing population entangled in a poverty trap. Getting out of such a trap would require technical and political solutions to the obstacles such countries and communities are facing. A major obstacles in this context (also observed in parts of the Middle East) is that the economic fragmentation that could result from tensions of shared rivers encourages the adoption of economically inefficient policies that focus on in-country food- and power self-sufficiency, rather than on food and power security through trade and integration, even if the cost of doing so is much greater than the costs of imports, see Grey and Sadoff (2002), p.5.

Meeting the MDG targets mean tripling the rate at which additional people gained access to water in the 1990s, and quadrupling the rate at which they improved sanitation, according to the U.N. WWDR 2003.

As for the other regions, there is a great gap between the share of the populations that have "improved" versus "sufficient and safe" provision of water and sanitation services, and the health burden is seen in the water-related indicators measuring the state of African children under five. This burden from diarrhoeal diseases can be up to 240 times higher than in high-income nations. Almost 90% of the global annual 1.1 million deaths from malaria occur in Sub Sahara Africa. Children under five are excessively represented in this group, and malaria is their leading cause of death. It is estimated to slow economic growth in African countries 1.3% per year. Almost 83% of the more than 250 million people worldwide infected by bilharzias are in Sub Sahara Africa.

Even in parts of *Africa* where water resources have been only modestly exploited, the potential for irrigated agriculture is rather limited due to a combination of high costs of construction and operation, remoteness from markets, unsuitable sites, and extreme hydro climatic variability.

In contrast to Asia, natural water related disasters in Africa are predominately droughts, but some extreme floods have also caused major setbacks for some of the world's poorest countries. Storage capacity investments would be an obvious relief providing resilience against the damaging impacts such natural events, since storage capacity is a tiny fraction of what it is in richer countries with much less hydro climatic variability.

Sub Sahara Africa faces a need for massive financial injections in order to meet the water related MDGs. While economy-wide and sector-wide economic and governance reforms coupled with financial sector upgrading could pave way for significant amounts of local and foreign capital mobilization, this is the region where a substantial increase in capital on concessionary terms is needed if the MDG goals shall be within reach by 2015. And even with such capital injections in place, sustainable solutions cannot be guaranteed unless a massive human- and institutional capital upgrading takes place simultaneously by means of formal education and training in the required technical and administrative skills. Adding to these challenges is the need to have in place good governance as a basis for a trustworthy dialogue between the target groups and the government.

WSS-typologies can also be organized for *categories of urban areas* as a basis for targeting investments and operating initiatives, see WWSP (2003), p. 167-169. In this case, rather than focusing on geographic regions characteristics, it appears to suffice to group urban areas according to the country income category because the present level of provision of service correlates closely with level of income.

In *high-income countries*, there is more or less universal provision of advanced water and sanitation facilities, and other city water services, usually provided by public sector utilities. The priority issues in such cities are on preserving good health and environment. Actions therefore are focused on preventing microbial and chemical contamination of water distribution systems, management of residuals from water treatment, ensuring that the impact of effluent from wastewater discharges on receiving waters remains within acceptable levels. In order to succeed, such utilities are concerned with optimising the efficiency of utility operations, and cater to appropriate asset renewal.

In *middle-income countries*, a great deal of the WSS infrastructure is in place, but often in poor condition and perhaps not even functioning in a reliable manner. Typically the service delivery systems are under funded, poorly managed, constrained with a poor revenue basis and poor revenue collection. They therefore tend to be in a poor state of maintenance with high levels of water leakage, and inadequate wastewater treatment, with limited capacity and capability to enforce regulations on industrial pollutants. The primary concern in such cities is cantered around the above deficiencies.

*Lower-income countries* face all of the above problems in a magnified way. This is both a cause of and due to the fact that in addition, they have far less WS infrastructure in place, usually only covering the well-established high and middle-income parts of the city, while rapidly growing uncontrolled squatter areas are not covered. At the same time, they have much less developed institutions and management systems. Overall therefore, their capacity to deliver WS-services to their dwellers is usually very limited and only functioning where the rich and influential live. In addition to lacking basic WS-services in densely populated slums, these same areas tend to be those most exposed to industrial pollution and floods.

## 4. WATER AND FOOD PRODUCTION

Worldwide, agriculture is by far the largest user of water with 69%, compared with 23% by industry and only 8% by households. In contrast, agriculture's share of GDP in 2001 was only 5% globally, while industry's share was 31% and that of services 64%.

In developing countries, however, the water share used by agriculture is very much higher, e.g. 97% in Pakistan, 93% in India, 87% in China, 86% in Egypt, and 76% in Indonesia, to list a few of the most populated developing countries, see World Bank (2003). At the same time, for low income countries, with their more than 2.5 billion people (or 41% of world population) in 2001, agriculture constituted 23% of GDP, ranging from 25% in India and China to 17% in Egypt and 16% in Indonesia. Furthermore, agricultural value added per agricultural worker in low-income countries was only 11% of that among the upper middle-income developing countries; see World Development Report 2003, tables 1–3.

Irrigation consumes 67% of the overall global water use; in many developing countries this share is estimated to be around 85% of all water use. Irrigated land produces 40% of food on 17% of the agricultural land, and 90% of expected increase in food production in the next 25 years is to come from already cultivated areas. That means a need to double the productivity of irrigated land, and this requires significant investments in irrigation and drainage upgrading for food production and for water supply to meet the demands for water from other sectors, see World Bank (2003a).

It is increasingly observed that excessive uses and abuses of water resources in different activities can have severe adverse productive-, environmental- and health effects that can reach levels that are significant. The resulting erosion, salinization, compaction and many other forms of soil degradation affect 30% of the worlds irrigated lands, 40% of rainfed agriculture lands, and 70% of rangelands. The effect of this (to a very large extent water use-related) degradation on overall productivity has so far been limited by bringing new lands under cultivation. However, cumulative global productivity loss due to land degradation has been roughly estimated at 12% of total productivity from irrigated land, rainfed cropland and rangeland over the past three decades, amounting to an average annual rate of productivity loss of 0.4%, see Crosson (1995) and World Development Report 2003, p. 85. This average, however, is based on such diverging observations as on the one hand, virtually no overall loss of soil depth or quality in China and Indonesia over the last three decades, and on the other, a one third reduction in overall productivity growth from technical change, education, and infrastructure investments in Pakistan.

The case of water logging and salinity in Pakistan is particularly severe. Inefficient water pricing (far below costs) and poor management policies have provided perverse incentives to large-scale water users and discouraged investments in maintenance and operation of irrigation and drainage systems. The results include excessive water consumption in irrigation, unregulated pumping of groundwater with dissolved salts, inadequate or no drainage, and large leakages from the canal system resulting in a dismal delivery efficiency of water from canal head to root zone. Taken together, this has contributed to more than a third of the gross command area being waterlogged, and 14% of it being saline. Salinity retards plant growth, and it has been estimated that this has reduced Pakistan's agricultural output by nearly 25%, see Chakravorty (1998), p.278..

However, according to Allan (2001), p. 13, there should be no anxiety in neither the Middle East nor any other region of the world as regards the availability of water for drinking and domestic use and for almost all industrial and services sector uses. Current and future tension will be about water for food production, which requires about 90% of the available water in the region. However, water can be imported and it can be derived from desalination at costs that are constantly lowered as a result of technological progress. Most important though, food can be imported from places where it can be produced more cheaply and in this way water can be imported as "*virtual water*". In fact more water is used in the Middle East in its "*virtual*" form through food and products imports than the flows in the Nile.

In the case of Israel – where water information is treated as a national security issue – almost all water is used for food production, and yet; agriculture generates only 3% of GDP. Put differently, more than 97% of the GDP comes from 5% of the nations water devoted to industry and services, Allan (2001), p. 79! And yet, Israel displays one of the highest water use efficiencies in irrigated agriculture. Between 1951 and 1985, total output from irrigated land grew ten-fold, with only a fivefold increase in irrigated acreage. At the same time, official numbers show aggregate water use to have increased only threefold, and water use per hectare dropped 40%! Crop production per hectare almost tripled, see Bhatia et al (1995) and Chakravorty (1998), p.277. A complete package of measures to ensure efficient use of water where each farmer is allocated water based on his area cultivated, his crop mix, and water requirements for each crop. This allocation is combined with progressive block tariffs where the first block is covering 80% of the allocation, and penalties for wasteful practices. Finally, water is priced at a premium during peak periods. This explains to a large extent the high efficiency outcome with sprinkler irrigation and drip technology.

## 5. WATER QUALITY AND HEALTH

The poor often must use polluted water while many industries gain access to municipality treated water and then return untreated effluent – many are colourless and odorless, but highly toxic - to waterways. While more than 2 billion people have gained access to water supply, and 0.6 billion to sanitation over the past two decades, over one billion still lack access to improved water services, 2.4 billion still live without improved sanitation, and 4 billion live without sound wastewater disposal, see World Bank (2003a). The urban population is expected to grow by 1 billion in the coming 15 years. Many of these will live in unsanitary slums.

Because they come into contact with polluted or infected water, the poor suffer debilitating diseases. More than one billion people are annually affected by diarrhea-related and other water-borne diseased; 2.2 million of these die from it, of which 1.8 million are children under 5 years of age, UNWWDR (2003). At any time, around one billion people also suffer from roundworm infections, half a billion from trachoma, and 0.2 billion from schistosomiasis, see e.g. World Bank (1993). 3.5 million children die from waterborne diseases every year, World Bank (2003a) . In Bangladesh alone, between 25 and 60% of the 130 million population might have had long-term exposure to excessive natural arsenic contents in their water, which is considered the largest mass poisoning in world history, UNWWDR (2003), p.86. In China, excessive natural contents of fluoride in drinking water are estimated to have crippling skeletal effects on some 30 million people.

The poor are particularly vulnerable to such water-related impacts because they have no social security and being ill means loss of an already bare minimum income, and loss of ability to supply labour in a productive way so as to escape poverty. Furthermore, it forces poor families to take children out of school and give up education in order to replace the sick adults as income earners. Thus the likelihood increases that these children also become captive to poverty, see e.g. Hansen (1993).

Poor hygiene may, in part, be traced back to lack of water in sufficient quantity. A reduction in the time required to collect water may translate not only into greater net water availability, but also into more time for mothers to engage in childcare activities, including feeding and hygiene. The WWDR (2003), p.115, points out that a twenty-fold reduction in time used for water collection resulted in thirty times more water used for child hygiene. This is found to have very considerable impact on the incidence of life-threatening diarrheal disease and blindness caused by trachoma.

Sachs (2001), pp.103-108, provides a "best" estimate of the combined effect of interventions that could reduce the total deaths in the developing world due to infectious diseases and maternal conditions by around 8 million per year by 2015. A large portion of these deaths result from poor water supply, water pollution and inadequate sanitation. This number translates into 330 million DALYs (Disability Adjusted Life-Years). An economic value of this welfare improvement is discussed below.

## 6. CLIMATIC VARIABILITY IMPACTS: FLOODS AND DROUGHTS

Catastrophic events such as floods and droughts are visible examples of the impact of climatic variability on real growth, and poor water and land management regimes can significantly magnify such damages. The extreme variability in rainfall and river flows in many developing countries clearly affects real output performance, most acutely in the agricultural sector which is highly susceptible to extreme hydrological variability and associated landscape vulnerability, but to some extent in almost all sectors of these economies, especially where the economy is heavily natural resource-based. This threatens the survival of the subsistence farmer at one level; the competitiveness of agri-business in a globalizing world at another level; and the structure and performance of national economies, at a third level. The incomes and expenditures of much of the population will depend on agricultural production, amplifying the effects of hydrological variability throughout the economy, as demonstrated in Figure 1 below.

Where there are extreme natural variations in river flows, there is a need to invest more in water storage to buffer variability than elsewhere in order to mitigate the adverse effects of rainfall variability. For example, in temperate Europe rainfall is relatively regular, and lakes, wetlands and groundwater storage provides significant "natural regulation" capacity. As a result, over 40% of runoff is available for productive uses. In the semi-arid parts of Spain and Portugal, however, only 10% of the runoff is available through "natural regulation". These countries have therefore invested in 150 times more water storage capacity per capita than neighboring e.g. France, and also than in Germany and in the U.S.A.

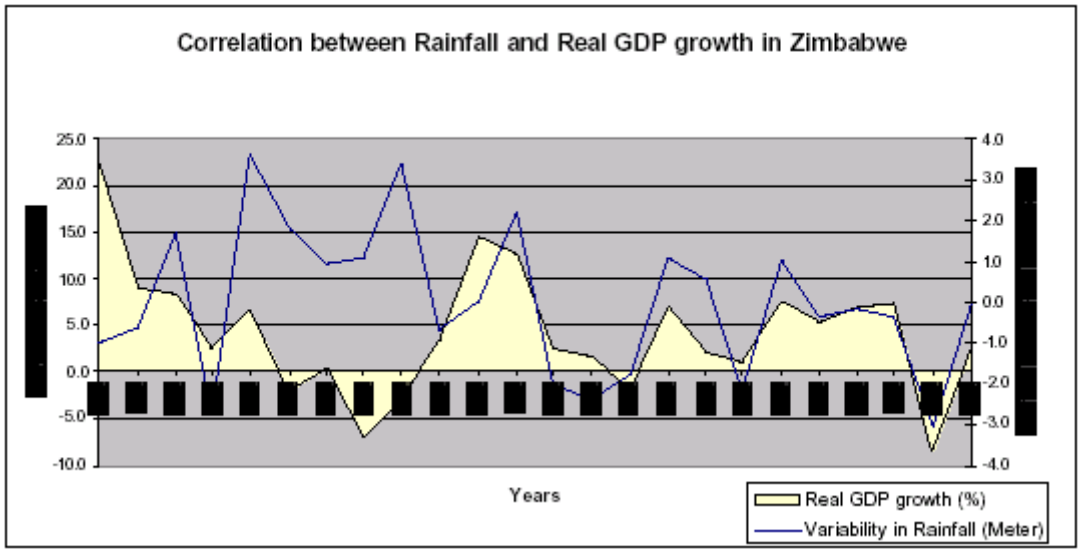
In sharp contrast, one finds that such buffer capacity is just a tiny fraction in poor arid and semi arid developing countries where it would be most needed compared to countries where such variations are much less and moderate. The ability of African water resources managers

to mitigate against major variations in river flow is thus very limited and the consequences have recently been observed in the form of such catastrophic floods as recently experienced in Mozambique. To find optimal solutions to such problems, one needs to adopt a watershed approach, and where the watershed is shared by two or more nations, international trust and cooperation must be established for this to provide effective and efficient outcomes of a sustainable nature.

A good example of cross-border cooperation that should be transferred to watershed management more generally in Africa and the Middle East is that of the Southern Africa Power Pool where seven countries have established interconnections among themselves, thus lessening the vulnerability of energy supplies to the hydrological variability faced by each of the participating countries, and at the same time reducing generation capacity and reserve requirements, see Grey and Sadoff (2002), p.9.

At the local level and smaller scale, but with substantial scope for regional application, traditional technologies hold substantial potential for improved water resources management for increased water supply and food production. Investments that improve water control, and water retaining characteristics of the soil, such as the low input traditional indigenous zais- and tassas technologies which is applied in arid and drought stricken Burkina Faso and Niger, could lower the climatic risk, enhance and stabilize crop yields considerably, IFAD (1999).

**Figure 1. Correlation between rainfall and real GDP growth in Zimbabwe*.**




* In this diagram we see the correlation between rainfall and real GDP growth:, except in the period before 1980 – the year of the ZIMCORD conference, the correlation is extraordinary; before 1980, the independence struggle had, not surprisingly, a greater influence on GDP growth than rainfall (Source: Grey and Sadoff (2002)).

## 7. MACRO-ECONOMIC IMPACTS OF NATURAL DISASTERS

The economic costs of environmental degradation have been estimated at 4 to 8 percent of gross domestic product (GDP) in many developing countries, World Bank (2000). Between 1991 and 2000 over 665,000 people died in 2,557 natural disasters, of which 90% were water related events, UNWWDR (2003), p.12. 97% of the victims were from developing countries. There is abundant evidence of the broad economic impacts of droughts and floods:

- the Zimbabwe drought of the early 1990s was associated with 45% decline in agricultural production, an 11 % decline in GDP and a 60 % decline in stock markets;
- the 1997- 98 El Nino floods in Kenya caused economic loss estimated to exceed $1.7billion;
- the 2000 floods in Mozambique led to a 23 % reduction in GDP;
- the drought of 2000 in Brazil to a halving of projected economic growth (World Bank, 2002);
- in the 1998 El Niño, Peru suffered US$2.6 billion in damages to public infrastructure, equivalent to 5% of GDP;
- losses due to landslides in Venezuela in 1999 cost US$10 billion, equivalent to 10 % of GDP;
- in Honduras hurricane Mitch caused damages equivalent to 70 % of GDP, with huge repair costs (10 % of GDP) and increase in poverty from 63% to 66%.

## 8. MACRO-ECONOMIC VISIBILITY OF WATER RESOURCES MISMANAGEMENT

However, few studies have been undertaken to assess more specifically the macro-economic impacts of water resources degradation. Mismanagement of water for large-scale irrigated agriculture can be a major macro-economic factor. On a global scale, the World Bank (1993) found overgrazing of rangelands and irrigated agriculture to be the leading causes of land degradation and desertification, and estimated the direct annual income lost in the 1980s to be US$ 42.3 billion, an amount equal to overall gross annual foreign aid transfers. At the same time, it was estimated that the annual costs of preventive, corrective and rehabilitative measures were in the range of US$ 10 – 22 billion.

In e.g. Uzbekistan, irrigated agriculture comprises 35% of GDP, 60% of foreign exchange earnings and 45% of employment. Inefficient management of water resources can cost such societies dearly when irrigated agriculture is the dominating water user. The shrinking of the Aral Sea in Central Asia is perhaps the most devastating case. The surface of the sea has declined 50% since around 1960, and the 3.5 million people around it have suffered severe losses from declining fisheries, loss of wetlands, and health damages from blowing salt and highly saline groundwater, see World Bank (2003b).

The World Bank has undertaken a study in Kenya that concludes that poor water resources development and management approaches costs the country significantly more than US$ 48 million per year, about 0.6% of GDP. The country's inadequate preparedness to rainfall variability cost the country at least Kshs 295 billion between late 1997 and mid-2000. This was 15% of the GDP earned during that period (Mogaka et al).

The main challenge where irrigation mismanagement has taken place is then to increase water productivity in order to achieve *"more crop per drop*". The typical situation is one where the irrigating farmers are charged only a tiny fraction of the operating and maintenance costs for water supply and none of the capital costs. Cost recovery in irrigation systems is only 10% in the Philippines, 13% in Pakistan, and 25% in China, according to the World Bank (2002) which has estimated that developing countries spend as much as US$ 10 – 15 billion per year on irrigation subsidies and poor farmers are the primary beneficiaries of such subsidies. This amount equals 20-25% of global official development assistance. Not only does this represent

inefficient use of government revenue; it also results in lack of system maintenance, poor irrigation and drainage services, substantial leakages and losses of valuable water, and severe environmental damages followed by loss of soil fertility in the affected areas.

In India alone, almost US$ 5 billion of government revenue a year is spent on water subsidies for irrigation. This equals 10% of overall government tax revenues in India and represents a very significant drain on the budget by diverting funds away from alternative uses much more in line with a poverty reduction strategy. In the Indian state of Rajasthan, for example, the state pays 75 % of the operating and maintenance costs of irrigation, and these costs amount to 18% of the state's recurrent budget, see the World Bank (2003b). Clearly, there is considerable scope for efficiency gains in the irrigation sector and at the same time considerable scope for reallocating significant amounts of state funds to recurrent expenditures and or investments either in the water and sanitation sector or to other tasks defined as priority areas in the PRSP.

## 9. WATER POLLUTION AND SANITATION IN A MACRO-ECONOMIC PERSPECTIVE

China is the largest of all developing countries with some 20% of the world population. It is therefore of interest to see if recent attempts at estimating such external water pollution costs are significant in a macroeconomic perspective.

Recent research undertaken for the China Council for International Cooperation on Environment and Development (CCICED) by a team of international and Chinese experts have found that the most dramatic effects of water pollution are on the mental and physical health of children from drinking water and eating food contaminated by untreated industrial and municipal wastewater, see Warford and Yining (editors) (2002), chapter 3.

It is estimated that 1.5% of all deaths in China, or 64,000 persons per year, can be attributed to water pollution related to diseases. However, having valued these premature deaths moderately in economic terms, the highest costs of water pollution damages appear to come from IQ loss in children from ingestion of water and food contaminated with lead, mercury and other heavy metals. It is estimated that each year 7 million children are affected, losing on average 6.5 points on the IQ scale. Two other major water pollution impacts are non-fatal cancers and congenital abnormalities, whereas non-fatal hepatitis and diarrhoea/enteritis are relatively minor externality costs, according to these analyses. The total welfare loss from the impact of water pollution on health alone is estimated to US$ 13.4 billion for the late 1990s. This is equal to 1.3% of China's GDP.

Non-health damages are also likely to be significant, but so far estimates are less complete. Damages to crops are likely to the most important of these in a developing economy where agriculture constitutes a major economic and employment sector. A World Bank estimate of 1997 place such non-health water pollution costs in China at US$ 2 billion, equal to 0.2% of GDP. With this approach, total water related externalities amount to 1.5% of China's GDP.

An estimate of income lost as a result of water pollution was carried out for 1992 by Xie Guang and published in Smil and Yushi (1998). It estimated these external costs as follows:

| | |
|---|---|
| Impact on human health: | |
| As a result of contaminated food | 2.42 billion Yuan |
| As a result of contaminated drinking water | 16.87 " " |
| Impacts on industrial output | 13.78 " " |
| Impacts on crop yields | 1.38 " " |
| Impact on livestock and fisheries | 1.16 " " |
| Total water pollution externalities (1992 prices) | 35.61 billion Yuan |

The research carried out for CCICED on environmental water resources costs of rice production in Hunan and Hubei, see Norse et al (2001), apply a different method of estimation. They have estimated the costs of removing nitrogen from drinking water supplies to obtain an acceptable drinking water quality and arrive at an annual all China estimate for the mid 1990s of 1 – 3 billion Yuan (US$ 0.1 – 0.4 billion). Eutrophication from mineral fertilisers on fisheries is estimated at 5 billion Yuan, or US$ 0.7 billion per year, while flood damage from wetland drainage is estimated at 4 billion Yuan, or US$ 0.6 billion. Pesticide induced loss on farm workers come to a large extent from water poisoning and is estimated to between 1 – 3 billion Yuan (US$ 0.1 – 0.4 billion), while soil erosion damages – for the most part water related in rice production – amount to 1 – 2 billion Yuan (US$ 0.1 – 0.25 billion). In total their range of estimates is 11 – 15 billion Yuan per year, equal to US$ 1.5 – 2 billion. In principle, these costs should be incorporated in the above overall estimates, but if one were to apply the same analytic approach to all other sources of water pollution and less efficient uses, one could well end up with a higher or lower total estimate.

Regional level studies attempting to assess the environmental cost of water pollution have been undertaken. One example is a study to assess the environmental cost of water pollution in Chongqing, China. A team of Chinese and Norwegian researchers estimated the resources cost, i.e. real resources spent or production possibilities foregone because of water pollution. The study concluded that the cost of water pollution equaled 1.2 percent of Chongqing's GDP (Yongguan et. al).

Another way to look at the macro impacts of water quality and sanitation comes from analysis related to a cholera epidemic in Peru, see Moss et al (2003), p. 57, where the costs of not providing for safe water and sanitation were not considered. Peru spent up to US$ 1 billion to fight off and treat the effects of this epidemic. It is estimated that US$ 100 million – or a tenth of what was actually spent – could have prevented the epidemic in the first place. Add to these monetary expenses the value of lost working days of life due to disease and deaths, and the benefit cost ratio of preventive action by means of investments in water and sanitation would have taken on astronomical figures.

Studies of schoolchildren in Tanzania (Bhargava (1997)) have established that water related diseases from intestinal parasites such as hookworm and schistosomiasis are important impediments to child development and performance in school and therefore there later ability in the labour market and therefore to escape lasting poverty.

Having established the significant negative contribution of water and sanitation mismanagement on health and education, and through that, more generally on economic welfare and growth in the above case studies, one can regroup countries in the same purchasing power parity (PPP) categories (low income, medium income, etc.) according to the infant mortality rates, see J. Sachs (2001) table 5, p.23. This health indicator is closely related

to and could serve as a proxy for access to safe water and sanitation. Sachs shows the GDP growth rates of several dozen developing countries during the period 1965-1994, grouping the countries according to their initial income levels in 1965 and their infant mortality rates in the same year. The study found that for any given initial income interval, countries with lower infant mortality experienced higher economic growth during the two-decade period. As an illustration, for the poorest countries (those with below US$ 750 per capita annual income in PPP-adjusted 1990 US$ countries with an infant mortality rate between 50 and 100 per 1000 live births enjoyed annual average growth of 3.7%, whereas similarly poor countries with an infant mortality rate greater than 150 had average annual per capita GDP growth of only 0.1%.

Expanding the above analysis to include additional explanatory variables of economic growth within a given country category, suggests that each 10% improvement in life expectancy at birth (another variable strongly correlated with availability of safe water and sanitation) is associated with a rise in economic growth of at least 0.3 to 0.4 percentage points per year, holding other growth factors constant!

A recent econometric study by Bloom and Sachs (1998) found that *more than half of Africa's economic growth shortfall relative to high-growth countries of East Asia* could be explained statistically by disease burden, demography and geography, rather than by more traditional macro-economic policy variables and political governance.

Sachs (2001) provides the best WHO estimate of how many annual deaths due to diseases could be avoided if the proposed WHO actions in developing countries were implemented. The number is 8 million equivalent to 330 million disability adjusted life years (DALYs) by 2015 compared what is considered a reasonable baseline estimate. Making the conservative assumption that each DALY is valued at one year of low income country per capita income in 2015, i.e. US$ 563, the direct economic savings would be US$ 186 billion per year in 2015. This alone amounts to more than three times annual official development assistance from the rich countries. The real number would of course be much higher (a) because this valuation is much more conservative than what is conventionally used, and (b) it does not take into account the growth inducing impact (see documentation above) of improved health in the form of e.g. increased life expectancy and reduced infant mortality. Much of these saving would be the result of measures to reduce the incidence of water borne diseases and causes of death.

In sum, health status – which is strongly correlated to the water and sanitation situation – seems to explain an important part of the difference in macro-economic growth rates, even after controlling for macro-economic variables.

## 10. MACRO-ECONOMIC IMPACTS OF WATER RESOURCES MANAGEMENT

The precise linkages between infrastructure and development are complex and still debated; do infrastructure investments increase as a result of growing GDP, or does GDP grow as a result of infrastructure investments? Clearly, many infrastructure investments are political "white elephants" far removed from the intentions stated in e.g. PRSPs. What is known, however, is that good infrastructure raises productivity and lowers production costs, but must expand at a rate to accommodate growth. Simple statistical correlation suggests that a one percent increase in the stock of infrastructure is associated with a one percent increase in GDP

across all countries in the world. That same 1990 global database showed that household access to safe water only increased by 0.3 percent when GDP grew one percent, thus underlining the established concept of access to water as a vital necessity, see World Development Report 1994, figures 1 and 1.2.

More recently, similar water access and GDP-data from developing countries only (adjusted for purchasing power parity (PPP)) suggest an almost one to one relationship with indications of reduced income elasticity among the higher income developing countries (personal correspondence from Jenna Davis, MIT). For sanitation, the relationship is less clear. There is a much larger spread of the data around the mean. When disaggregating developing country data into urban and rural sectors, both water and sanitation appear with apparently low-income elasticities; i.e. a one percent increase in GDP is associated with a much smaller increase in urban access. However, the data are widely spread around the mean values. In rural areas, the correlations are even weaker, and for sanitation it almost non-existing.

These findings are in line with the conclusions in the World Development Report 1994, p. 26: "*Although coverage tend to be correlated with GDP, efficiency and effectiveness of infrastructure are not. Plots of coverage against performance in water show little relationship across a wide sample of low- and middle-income countries. Moreover, there is no close correlation between a country's efficiency of provision in one sector (e.g. water) and another (e.g. roads). These findings indicate that efficiency and effectiveness of infrastructure provision derive not from general conditions of economic growth and development, but from the institutional environment, which often varies across sectors in individual countries.*"

A final finding from this recent cross-section MIT-study of all developing countries, and which is of importance for water and sanitation policy advise and PRSP-preparations, is that there appears to be no correlation whatsoever between access to water and to sanitation on the one hand, and per capita water resources available.

That mismanagement of water resources causes health-, environmental- and economic losses on a scale that impedes efforts at implementing poverty reduction strategy programs (PRSPs) is forcefully documented by the above examples. The 1994 World Development Report focused on the role of infrastructure in development. It concluded that, although there is great variation in performance between countries and sectors, there are great payoffs from increasing the efficiency of infrastructure provision. Three types of gains are expected outcomes of such reforms: Reduction in subsidies (i.e. reduced fiscal burden that constrains governments ability to implement development programs and PRSPs), technical gains to suppliers, and gains to users.

In 1990, the estimated annual fiscal burden due to subsidies incurred from mispricing of water resources, power and railways, amounted to USD 123 billion, or 10% of total government revenues in developing countries, or, five times annual development finance for infrastructure. Water sector subsidies constituted almost USD 20 billion of this total.

In addition comes USD 55 billion of annual savings to service providers from raising technical efficiency to best practice levels. This amounts to a quarter of annual infrastructure investments, and twice annual development finance for infrastructure. Purely, for illustration, if these technical infrastructure losses could be redirected for three years, at current costs in 1990 of roughly USD 150 per person for water systems, the one billion without safe water could be served. By achieving such efficiency, service provision would adjust more in

response to demand. It would enhance overall economic growth and competitiveness of the economies. Clearly, such results would not occur unless good governance and substantial capacity building takes place in government and public utilities, which again shows the importance of linking reforms, investments and management of operations closely in the PRSPs. Creating a conducive policy environment should be the dominating way of mobilizing higher revenues for new investments and for attracting inflow of new and additional resources for investments.

By the same logic, well designed and implemented investments and management plans for water resources will have significant positive impacts that are measurable in macro-economic terms and at the same time facilitates implementation of the national PRSPs.

Such effects have been documented in the case of multipurpose dams; see Bhatia, Scatasta and Cestti (2003) whose findings are presented below. In order to trace such development effects properly, they prepare and estimate key variables of a hypothetical "without the dam" benchmark in a careful way, and then compare the various development indicators with the dam in place to the benchmark numbers. Since multipurpose dams (i.e. dams that supply water for irrigation, households and industry, produce power, and provide flood and drought control, and improves the water quality compared to the benchmark) take a long time to build and make operational, one needs data from a year or a period of years once the dam is fully in operation.

Such data have recently been prepared for the Bhakra Multipurpose Dam System in Northern India. The project is a joint venture between several Indian states and an example of inter-state cooperation for the economic and social advancement of that region of India. The construction started in 1948 and was completed in 1963. The study chose 1979-80 as the basis for comparing the with and without scenarios for reasons of data availability and appropriateness of timing in the lifecycle of the dam system.

In order to estimate the macro- and poverty effects, a social accounting matrix for the Punjab for 1979-80 was used. The aspects addressed were: Changes in the area irrigated, changes in the supplies of electric power, changes in yields and production technology (primarily changes in fertilizer use and the use of high yielding variety seeds). The indicators capturing the effects of the dam, would include gross output levels and value added by sectors of production, trade, as well as disaggregated household incomes and their distribution between self-employed rural households, agricultural labour, rural non-agriculture households, rural other households and urban households. Furthermore, the study disaggregated households into those directly affected in the Punjab, and those indirectly affected, e.g. poor migrant workers from other states attracted by job opportunities created by the activities resulting from the dam project.

That irrigated area, agricultural output and power output increased perhaps ten-fold compared to the before-the dam situation, is obvious, but no indication of the real macro-economic impact. The "with " and "without" comparison for the selected operating year of 1979-80, on the other hand, provides such objective basis for estimating the various macro- and distribution effects, and in this case these effects and positive and significant. The study found that the aggregate gross output in the region was 30-34% larger than it would have been without the project, and especially the agricultural output growth due to the project was high (46-66% above the "without" case). Likewise, the aggregate regional value added was

estimated to be larger by 30%, with direct agriculture and electricity value added being 54% higher.

Dividing the aggregate (direct plus indirect) value added with the direct (agriculture and power production) value added, gives the multiplier of the dam system project. This analysis found that for every Rupee of additional value added directly by the project in agriculture and electricity sectors, another 0.9 Rupees were generated in the form of downstream or indirect economic effects. In the project area (i.e. Punjab) this meant a multiplier of as much as 1.9 reflecting inter-industry linkages as well as consumption-induced effects. By adding indirect and induced effects of remittances sent by hundreds of thousands of agricultural workers from the Punjab and contributions of the dam towards "Food for Work" programs in the analysis, the multiplier would be much higher.

The income distribution impact findings have direct PRSP relevance. It was found that the income level of agricultural labour households was 65% higher with the dam than without it. These relative gains from having the dam were clearly higher than gains to other rural households and even more so compared to urban households. Not surprisingly, around two thirds of the difference in income between the "with" and "without" case for self-employed rural households and agricultural labour households is due to higher output and value added in sector that are directly affected by the dam, namely agricultural crops and electricity. The rest of the increased income comes from changes in the value of output and value added of sector that are indirectly affected (through inter-industry linkages and consumption-induced effects). For urban households the situation is completely reversed. More than 80% of the difference is accounted for by changes in outputs of sectors such as agro-processing, manufacturing of textiles, etc., which are only indirectly affected by the dam.

The same- or alternative and more appropriate macro-economic analytic models for the given situation and data have been applied to estimate the value-added multiplier- and where possible distribution effects of several other dam projects of national scope and impact, see Bhatia, Scatasta and Cestti (2004). The highest such multiplier was found for the *Sobradinho Dam in Brazil*, where the estimated multiplier ranges from 2.0 to 2.4 depending on what assumptions are applied to the supply of labour and capital. In the case of the *Aswan High Dam in Egypt*, the value added multiplier value is much smaller and range between 1.22 and 1.4. A similar multiplier was found for the *Bunga Village check dam in India*, while for the *Muda Dam in Malaysia* the multiplier was estimated to be 1.83. For two dams in the USA, the Grand Coulee and the Klamath, the estimated value added multipliers are in the 1.5 – 1.7 range (see Bell et all 1982, Bhatia and Scatasta 2003a).

The income distribution and poverty impacts could only be estimated for the Aswan High Dam and the Bunga Dam for comparison with the impacts of the Bhakra Dam. The impact analyses found that the poverty reduction impact was considerably higher for the multipurpose Bhakra Dam, and only for this project did the rural poor gain significantly on the richer population segments in relative terms; see Bhatia (2003, 2004).

Pritchett (2001) has found that for India that irrigation infrastructure has a major impact on returns to investments in education. Returns to investing in five years of primary schooling compared to no schooling in Indian districts where agricultural conditions were conducive to adoption of "Green Revolution" technologies was as high as 32%. However, in districts where conditions were not conducive to such irrigated agriculture, estimated returns to such schooling were negative. At the same time, it has been found that in unirrigated districts in

India 69% of people were poor, while in irrigated districts this share drops to 26%. (it should be noted, however, that information about these respective poverty shares before irrigation investments took place were not known).

A comparison of economic development indicators has been carried out in China between counties where rural hydropower projects have been implemented and the rest of the country, see Chinese Ministry of Water Resources (2003), p. 22. From 1995 to 2000, the GDP of 335 counties with completed primary electrification doubled with an annual growth rate of 15.3%, which is twice that of the national average. The annual average income per farmer increased 8.1% per year, which is 2.7% more than the national average. In these communities about 30 million people changed their mode of living from marginalized farming to become off-farm labourers in industry or the services sector.

Economy-wide analysis of policy reforms have also been used to show that significant gains are available if there is willingness and ability to undertake such reforms. In the case of *Morocco*, Diao and Roe (2000), pp. 141-165, have shown that combining water sector reforms with trade reforms can facilitate the implementation of the latter. This can happen because by opening up for trade in traditional water rights, those farmers who have benefited strongly from traditional market protection (subsidized water, fertilizer, etc) of their non-competitive crops, and who are the ones to lose as a result of agricultural market liberalization, are the ones who can compensate much of their losses by selling water rights at a market price to those farmers who are prepared to switch to more competitive crops under the new trade and water price regime.

In the trade reform case studied in Morocco, it was found that the effects of the trade reform on total trade and GDP without at the same time establishing water rights market, provided for substantial overall efficiency gains to the economy (around 10% long run increase in GDP, more than 25% increase in total imports and more than 30% increase in total exports).

However, the opposition to such one sided trade reforms is strong due to the skewed distribution of benefits and losses of the reform. Those who have traditionally benefited under the old distorted trade constrained regime where significant public revenues were paid out in the form of subsidies to certain categories of farmers, stand to lose significantly unless they are prepared and have the possibility to change technology and grow more water efficient and higher yielding crops. By providing these farmers the right to sell or lease their water rights at market price to those prepared to grow the more profitable and competitive fruits and vegetables instead of traditional water demanding soft wheat, individual and group losses relative to the post-reform losses without a water use market can be counterbalanced, and overall macro-economic and welfare indicators enhanced beyond what were the results of the trade reforms alone, while water will be used in a more sustainable way. In other words, combining such reforms provide for a so-called “win-win” situation.

Although industry uses relatively modest volumes of water compared to agriculture in all developing countries, industry often provides a larger share of value added. It is therefore of interest to industrial water productivity across country categories. This has been done for every country in the world by WWDR(2003), table 9.1 and figure 9.3., and the findings are as follows:

- For any given volume of water used by industry, the high income users derive more value added per cubic meter of water used than lower-income states;

- Lower income states can achieve similar water productivities as developed countries, but do so only at significantly smaller total volumes of water used by industry;
- As total water consumption by industry increases, water productivity appears to fall in each income category; and
- Economic growth from "low-income" through "lower-middle-income" to "upper middle-income" countries appears to have been achieved largely by additional consumption without significantly increased water productivity. It may therefore be limited by the availability of the resource.

The overall conclusion based on these macro-economic impact studies where a baseline has been carefully established and the period of analysis likewise, is that such water sector investments and reforms can have considerable direct and indirect economic effects on the regional and even national economies.

## 11. THE CASE FOR INCREASED WATER AND SANITATION SECTOR (WSS) FINANCING

The current water and sanitation sector spending in developing countries is around US$ 25 billion annually (roughly the same amount as is being spent on irrigation), according the various sources reviewed above. Domestic public funding contributes almost US$ 16 billion, or 60% of the overall WSS-spending, most of it coming from taxes and user fees, and this is distributed with 80% on water and 20% on sanitation. External public sector flows makes up most of the remaining 40%. Private investments make up only 5%. However, this average picture does not apply to Africa, where the aid dependence (official development assistance) is close to 70%, see WHO and UNICEF (2000).

It has been argued above that there are good reasons to assume significant positive externalities, and significant contribution to achieving PRSP goals and MDGs. Therefore one would expect high economic returns to WSS spending. WHO and UNICEF (2000) have carried out studies of the cost-effectiveness of drinking water supply and sanitation options in relation to diarrhoeal diseases control. Their studies conclude that disinfection at point-of-use consistently is the most cost-effective intervention everywhere, and interventions targeted at key behaviors such as improved hand washing would also provide a highly cost-effective way of achieving substantial health gains, e.g. when the millions of DALYs avoided are compared to the costs of the interventions.

Lvovsky (2001), p.11-12, provides a convincing empirical case for the above in a World Bank review of available evidence undertaken to assess the effectiveness of measures outside the health sector in achieving health improvements measured in terms of preventing the loss of DALYs. For various interventions, the review concluded with the following estimated costs per DALY saved:

- Hygiene behavior change: USD 20 per DALY saved
- Water connections in rural areas: USD 35 " "
- Malaria control: USD 35-70 "
- Improved stoves (indoor air quality): USD 50-100 "
- LPG stoves and kerosene in rural areas: USD 150-200 "
- Improved quality of urban air: most measures costing over USD 1,000 "

However, WSS spending tend to receive very little attention and priority in PRSPs and development budgets. In response to making development aid budgets and allocation recipient oriented, donors also tend to allocate rather little for the WSS sector. Germany appears to have had the highest WSS share of their total ODA, amounting to around 10%, which is about twice the EU average. The EU average, again, is about twice that of Norway's ODA share, and significantly higher than that of Norway's "likeminded" countries, even when allocations through multilateral institutions is included.

Recent reviews by the EU, the World Bank and the Camdessus report, of the need for additional WSS allocation for the purpose of reaching the MDGs, find that the allocation shortfall is in the range of US$ 9 – 49 billion annually. Whatever is the most appropriate number in this range, it represents a substantial increase over the present US$ 16 billion spending, and it is quite clear that only a small share of this can be mobilized by donors. The main challenge is thus how to mobilize the needed capital for investments, operations and maintenance from users and foreign and domestic investors from the public and private sector.

## 12. COMMUNITY-MANAGED URBAN SANITATION PROGRAMS: SCALING-UP OF 'ISLANDS OF SUCCESS'

The scale and depth of the inadequacies in provision for water and sanitation for much of the urban population in Africa, Asia and Latin America and the Caribbean needs particular emphasis. There are two different sets of estimates[3] as to the number of urban dwellers lacking provision for water and sanitation in 2000 drawn from the UN-Habitat study. For sanitation, "improved" provision is access to a private or shared toilet with connection to a public sewer or a septic tank, or access to a private or shared pour-flush latrine, simple pit latrine or ventilated improved pit latrine. As staff from the World Health Organization stress, "improved" provision does not greatly reduce the risk of faecal-oral diseases (Prüss 2002). On the basis of these definitions, most of the urban population in Africa, Asia and Latin America have "improved" provision for sanitation, and it is possible to claim that there were significant improvements in the number of people gaining access to improved water and sanitation during the 1990s.

The second set of estimates, drawn from the UN–Habitat study, uses definitions for "adequate" provision for sanitation which demand better quality and more convenient provision – levels of provision that *do* greatly reduce the risk of infection from faecal-oral diseases. This includes hygienic, well-maintained, easily accessed toilets that are used by all family members; and safe and convenient disposal of wastewater. Adequate provision includes (Bartlett 2003) levels of provision that meet the needs of children, which are often not met with "improved" provision. If the criteria by which provision is judged are changed from "improved" to "adequate", a much larger urban population is found to lack provision. For instance, 50–60 per cent of the urban population in Africa lack adequate provision for sanitation, more than three times the number lacking "improved" provision. In addition, trends over time look much less impressive, as the growth in the number of urban dwellers reached with "adequate" provision during the 1990s is much less than the number reached with "improved" provision.

[3] UN–Habitat (1996, 2001, Environment & Urbanization, October 2003)

Estimates of the "scale of need" and of the funding required to address this depend heavily on which of these definitions is used. The task of halving the number of people lacking provision for water and sanitation between 1990 and 2015 (as called for by the Millennium Development Goals) is far larger and more complex if this is based on the number lacking "adequate" provision rather than the number lacking "improved" provision. For example, in 2000, the total number lacking adequate sanitation were between 850 to 1130 million, much larger than the 400 million lacking improved provision. In Asia alone, the number of people lacking adequate sanitation were between 600 to 800 million in 2000.

One of the targets of MDGs is to have achieved by 2020 a significant improvement in the lives of at least 100 million slum dwellers. Approximately one-third of the urban population globally live in these conditions. Typical slums in developing countries are unplanned informal settlements where access to services is minimal to non-existent and where overcrowding is the norm. Slum conditions result in placing residents at a higher risk of disease, mortality and misfortune. 94% of the world's slum dwellers live in developing regions, which are the regions experiencing the most rapid growth in urban populations and with the least capacity to accommodate this growth. Where available, trend data indicate that this problem is worsening. UN-HABITAT estimates that there are currently 924 million slum dwellers in the world and that without significant intervention to improve access to water, sanitation, secure tenure and adequate housing this number could grow to 1.5 billion by 2020.

A number of countries in Africa and Asia have developed programs under which they have encouraged people's efforts to the construction of private toilets. Such efforts have included country level or city-level programs of hygiene education and the need for washing of hands. A number of programs provided low cost sanitation alternatives including pour-flush latrines and VIP latrines. In a number of cases, loans and credits have been provided through micro-finance institutions for construction of latrines. Reviews of these programs are available in a number of publications of the Water and Sanitation Program (WSP) and other international organizations.

During the last two decades, there are reports of a number of successful experiences or 'Good Practice' cases of community involvement and management in providing public sanitation services to the poor slum-dwellers as well as for meeting the needs of floating populations in cities. Such experiences have provided sanitation and health benefits to millions of urban poor in Asia, Africa and Latin America. However, these experiences have covered only a small proportion of the total populations who need such services and there is an urgent need to support programs where such efforts can be 'scaled-up' to cover much large number of people in different regions over time.

Such an effort would depend on an analysis of the institutional and financial constraints to scaling-up of these 'islands of success'. There is a need to understand what succeeds and why and what does not succeed. In particular, a detailed analysis of financing aspects and financial viability is required to assess the financial sustainability of such efforts over time and the possibilities of their 'scaling-up' in other regions.

This section presents a review of some of these experiences based on available literature; both published and unpublished, culled out from a number of papers and websites. Very few case studies provide data that can be used for detailed analyses of financing and financial viability of such investments and experiences. Hence, there is an urgent need to carry out specific analysis of some of these programs including those that did not succeed.

For each of these experiences, where ever available, some data are presented on the extent of coverage of sanitation services provided; sources of finance; financial viability of the institutions providing services; constraints to 'scaling-up' and key lessons learnt. Appendix A of this paper provides more details for each of these experiences along with sources of data and assumptions and references for further work.

- The eight experiences from Asia, Africa and Latin America analyzed here are:
- Sulabh International's Program of Community Toilet Complexes in India;
- SPARC- assisted programs of Community Toilet Blocks in India;
- Orangi Pilot Project in Karachi in Pakistan;
- Bangladesh urban sanitation program in Dhaka and Chittagong.
- Ouagadougou Strategic Sanitation Plan in Burkina Faso;
- Strategic sanitation program in Kumasi, Ghana;
- Sanitation programs in Luanda, Angola ; and
- Condominial system in urban sanitation, Brazil

### 12.1. Sulabh community toilet complexes (CTC) in India[4]

*Sulabh* community toilet complexes (CTC) in India have succeeded in providing clean toilets and bathing facilities to urban poor at nominal charges. There are around 6000 community toilets providing toilet-cum-bath services to around 3 million people in 625 towns on a pay-and- use basis. A key aspect of Sulabh's program is its inclusion of facilities for bathing and doing laundry. Their public toilets are staffed by an attendant 24 hours a day and supply powdered soap for hand washing, bathing, and laundry. Some special toilet complex facilities have also provided telephone services and primary healthcare. Free services are offered to women, children and the disabled. This is very important for the homeless and the very poor who live under crammed conditions.

*Potential for Meeting Sanitation Needs of the Poorest*: According to one estimate, there were 2500 CTCs in India in 1990. If this is true, only 3500 new Complexes have been added over a 13-year period, giving an average of 270 new units per year in the entire country. Although the Sulabh public toilet complexes have provided much-needed services to millions of poor people, the growth in the number of units per year is much less than the requirements in urban areas. For example, Sulabh currently maintains 294 toilet complexes in Delhi of which Sulabh has also constructed more than 100, the others were originally built by other agencies such as Municipal Corporation of Delhi, Cantonment Board etc but are currently maintained by Sulabh. Compared to this, as many as 7000 such units are needed in Delhi alone to meet the needs for 3.5 million slum population who do not have access to private or public toilets. The number of such units required is 150,000 complexes (compared with 6000 today) to meet the sanitation needs of currently unserved urban population in India. Thus, the scaling-up effort is quite substantive and it would be important to analyze the factors that support such investments as well as identify factors that constraint rapid multiplication of such complexes. There is an urgent need to analyze the management and financing constraints that have inhibited the growth of such complexes. Further, there is a need to assess what legal, regulatory, institutional and policy changes may be required to accelerate the setting-up of CTCs in Indian mega cities and towns.

[4] For further details on Sulabh and other case studies summarized here, see R. Bhatia (2004)

*Multiple Benefits of Sanitation, Energy and Water Supply:* Of the 6000 community toilet complexes working in the country, only about 100 units (less than 2 percent) have installed additional plants that generate biogas (from human waste) that is used for lighting, cooking, space heating and for pumping water for the complex. The use of human excreta for biogas and its subsequent use as a versatile and clean energy source provide excellent synergy benefits of environmental improvement, resource use and availability of energy for productive purposes. This seems like a perfect win-win-win situation if proper policies encourage investment in biogas plants and user equipment. Since biogas can be used for pumping of water for the complex, this can solve a basic problem of CTCs in dry areas where water supply acts as a constraint in setting up of clean toilet and bath complexes. In this context, it becomes essential to understand the constraints that inhibit the installation of biogas plants along with a community toilet complex.

Sulabh Model of Management and Financing of CTCs: There are three distinct management approaches Sulabh has adopted in respect of CTCs. In the first case, Sulabh constructs and maintains the CTC for public use on a pay-for- use basis. The land and funds for construction of public toilets –cum-bath complexes are provided by the local bodies or any other sponsoring authority[5]. It raises its resources by charging the sponsoring authority 20 percent of the project cost as implementation charges. The money thus collected is used for running Sulabh organization. Second, in some municipalities, Sulabh has taken over these complexes from city officials for contracted period of 30 years, relieving the municipal authorities from the task of operating and maintaining them. This has vastly improved the quality of facilities available to users. Often these comfort stations are the cleanest ones in town, even in major cities like New Delhi, Bombay, Calcutta and Madras[6]. In the third case, Sulabh also helps local communities (e.g. temples, churches, schools, hostels) set up, operate and maintain the community toilet complexes, run on a pay-and-use basis.

*Affordability of "pay-and- use" facilities for users:* Sulabh runs the public toilets-cum-bath complexes on "pay and use" basis without putting any burden on public exchequer for their maintenance. Sulabh undertakes maintenance of these complexes for a period of thirty years, free of cost to the local body/sponsoring authority. Children in slums and other weaker sections of the society who do not have the capacity to pay are allowed free use of these facilities. All other users currently pay Re 1 for toilet and Re 1 for using bath facility.

It has been stated that such public toilets are beyond the reach of slum dwellers since the use of these will cost Rs 150 per family per month (Burra, Patel and Kerr 2003). This assessment is not correct since the Sulabh CTCs charge Re 1 per use from the male users only and women and children are allowed free use of the facilities. If this is taken into account a family may have to pay Rs 30 to 40 per month for using facilities that are not available anywhere else in the neighborhood.

*Constraints to Scaling-Up of the Sulabh CTC Program:* Sulabh International Social Service Organization (SISSO) is registered as an NGO (Non-government Organization) under the Registration of Societies Act of 1985. Although Sulabh can accept grants and donations, its current organizational structure is such that it cannot raise loans from banks or financial intermediaries such as Indian Renewable Energy Agency (IREDA). From the perspective of Sulabh, they are not interested in raising loans and constructing CTCs and take the financial

[5] Several business houses, multinational corporations and public undertakings are setting up Sulabh toilet facilities specially in metropolitan cities.

[6] See: Water Supply and Sanitation Collaborative Council, Geneva.

and management risk. Sulabh is not interested in setting-up a private company that raises loans, constructs CTCs and then manages these over time. Given the difficulties of obtaining land and financial risks (see below) of investing in CTCs (even when land is free of cost), Sulabh is not interested in expanding its activities. Instead, Sulabh's activities depend on the request for setting up the facility that generally comes from the civic authorities themselves who also provide the land and the finances for construction. Under this arrangement, Sulabh has no incentive to scale-up the number of CTCs constructed during a year.

*Management Capacity of Sulabh:* Since Sulabh views this activity as a part of its social service activities of providing education and employment to children of scavengers, they are not unduly concerned about the number of CTCs they construct in a year. Further, Sulabh has been approached by a number of religious and charitable organizations, colleges and hostels to build CTCs for them. Under the situation, the management capabilities of Sulabh act as a constraint to the setting-up of more CTCs or installing biogas plants in existing CTCs.

*Financing Needs of Scaling-Up of CTC Program*: Apart from the institutional issues discussed above, the scaling-up of CTCs also depends on the financial viability of these public complexes. Financial issues of replicability of the Sulabh program are discussed below with the help of a case study for meeting the needs of public toilets for slum population of Delhi.

The estimated 1999 population of Delhi was 12.7 million of which an estimated 40 percent or about 5.1 million people live in slums. It is estimated that currently about 30 percent of the Delhi slum population, that is about 1.5 million people, have access to some sort of public toilet facility. The remaining 70 percent of the slum population, or 3.56 million people, currently do not have access to toilet facility and they need to be provided this facility.

According to available estimates, average capital cost of establishing a seat with bath facilities in a community toilet complex is Rs 50,000. Assuming that each seat will provide toilet facilities to about 50 persons per day, this gives an estimated capital cost of Rs 1000 per person in a large complex. Providing such facilities through a scaled-up program of Sulabh CTCs to the entire population of 3.56 million will require an estimated investment of Rs 3560 million (or US $ 84 million at 2000 prices). Such financial resources may have to be raised from the central government, state government, municipal corporation and from financing institutions such as Housing and Urban Development Corporation (HUDCO).

*Financial Viability of a Community Toilet Complex:* Assuming that one seat is required for 50 persons in a toilet complex, and a toilet complex will have 40 seats, the population coverage will be 2000 persons per CTC. Annual revenue per CTC is estimated (see details in Appendix A) as Rs 30,000 per month if one-half of all the users of toilets make payments@ Rs 1/user. Another Rs 15,000 may be collected from users of bath facilities@ Rs 1/user. This will give estimated revenue of Rs 45,000 per CTC per month. Operation and Maintenance (O&M) costs for each CTC is estimated at Rs 43,000 per month for each complex. If only one-half of the total population pays for these facilities, the revenues earned will be just enough to cover O&M costs. Hence, it will not be possible to provide any money towards payment of interest and depreciation to cover for capital charges (Rs 33,300 per month @ 20 percent of Rs 2 million of each large CTC).

In the most optimistic case where all users (2000 per day) pay for toilets and 1000 users pay for bathing facilities, the monthly revenue will be Rs 90,000. In this situation, the revenues will be higher than O&M costs and will cover capital charges as well.

The above analysis shows that the financial viability of the CTCs will depend critically on their ability to raise revenues from users or from other sources. Such sources include:

(i) net revenues from setting up of nightsoil-based biogas plants (NSBs) in the complexes and selling of gas and/or electricity generated from this biogas;

(ii) net earnings from shops (e.g. grocery shops or community kitchens or cook shops) that provide benefits to the slum-dwellers and provide revenues to the complexes.

The use of these alternatives to improve financial viability of investments in CTCs have their own legal, regulatory and institutional constraints that are discussed below.

*Improving Financial Viability of a CTC by Adding a Biogas Plant:* In a large toilet complex, human waste or nightsoil can be used to generate biogas that can be used as a clean source of energy. Adding a biogas plant to a CTC helps in resource recovery, disposal of waste and generation of energy. Out of a total of 6000 complexes in the country, Sulabh has installed around 100 biogas plants in large CTCs. Hence, it is possible to have a win-win situation where a CTC with a biogas plant can be used to provide sanitation, bathing services and energy/electricity and water supply. It is important to study the financial, institutional, legal and regulatory constraints in scaling-up of such investments in CTCs with biogas plants.

Financial viability of adding a biogas plant depends on the estimates of revenues generated from the sale of biogas or from the savings generated in the use of biogas when it replaces LPG or kerosene in cooking or diesel in electricity generation. As per details of costs and revenues given in the Appendix A, additional capital cost (Rs 150,000) of a biogas plant will be recovered in five to six years (assuming subsidies on biogas plants continue)

Legal and Regulatory Issues: Sulabh does not face any legal problems in its work because the request for setting up the facility generally comes from the civic authorities themselves who also provide the land and the finances for construction. The major problem they see in extending the facility to all slums comes from the classification of slums as legal or illegal. Sometimes the municipal authorities do not permit them to extend this facility to illegal slums.

Since land and the CTC is owned by the funding agency, it may be difficult for Sulabh to raise financial resources by renting premises to shop owners. Although such revenues can improve the financial viability of a CTC, this may require a change in the contracts between Sulabh and funding agencies.

Further, the possibilities of raising revenues from setting-up of a biogas plant within the CTC may be restricted due to current regulations or ban on the sale of biogas and the sale of electricity generated from a biogas plant. The location of a biogas plant within the CTC complex may mean that there will be some social resistance to using biogas for cooking that is seen to come from a toilet complex.

*To recapitulate*:

- The current program run by Sulabh needs to be "scaled-up" significantly if it has to meet the unserved population among the 300 million current residents in urban areas and another 200 million who will be added to urban population over the next 15 years.

- There are significant institutional, management and financial constraints to "scaling-up" of the Sulabh program both over time and across regions.

- The financial sustainability of the program is based on 100 percent subsidies in capital costs and revenues raised from the users cover only a part of the O&M expenses in most complexes. Even where biogas units can be added, the financial viability depends on the availability of capital subsidies to the extent of 75% of capital costs.
- It is absolutely necessary for the complexes to raise revenues by renting space for advertisements or for grocery shops or other activities or by adding biogas plants. Since land and the CTC is owned by the funding agency, this may require a change in the contracts between Sulabh and funding agencies.

- Given Sulabh's institutional status as an NGO registered under the Societies Registration Act, Sulabh can receive grants and donations and gets an assured income from its remuneration (commission or implementation charges) from the construction of CTCs.

- Since Sulabh is an NGO, it is not qualified to raise its own finances and/or accept loans from the financing agencies such as HUDCO or IREDA or from financial intermediaries such as banks or IDFC (Infrastructure Development Finance Corporation).

- Sulabh is not interested in starting a private sector company which is willing to raise the loans, take the government subsidies and run the CTCs (and/or attached biogas plants) as commercial enterprises taking the financial risks.

- Hence, the number of CTCs added every year is constrained by the total funds available to the municipalities or other local bodies for sanitation. Recently, Sulabh has entered into a contract with HUDCO where a number of CTCs will be constructed and managed by Sulabh where funds will come from special provisions such as slum development funds.

- In sum, it is the public funds for sanitation that constrain the total number of CTCs that are built. The existing institutional structure and lack of financial viability and sustainability are serious constraints to the "Scaling – Up " of the Sulabh model of community sanitation.

### 12.2. SPARC-assisted Community Toilet Blocks in Pune and Mumbai, India

A recent study[7] presents a review of the experience of the Indian alliance[8] of SPARC (Society for the Promotion of Area Resource Centers), Mahila Milan and the National Slum Dwellers

[7] Sundar Burra, Sheela Patel And Thomas Kerr: Community Toilet Blocks. Community-designed, built and managed toilet blocks in Indian cities, Environment & Urbanization Vol 15 No 2 October 2003 . Also see Sundar Burra And Sheela Patel: Community Toilets In Pune and Other Indian Cities, Oct, 2003

Federation in assisting communities to construct and manage Community Toilet Blocks (CTBs) in slum areas of Pune and Mumbai cities in India.

In Pune, a partnership between the municipal government, NGOs and community-based organizations has built more than 400 community toilet blocks with over 10,000 seats at a cost of about Rs.400 million. Assuming that 50 persons use a toilet seat a day, more than 500,000 (or one-half million) people in the slums of Pune (out of a slum population of 1.1 million) have benefited from the programme[9]. They have also demonstrated the potential of municipal community partnerships to improve conditions for low-income groups.

In Mumbai, in 2000, SPARC won the contract to build 320 toilet blocks with 6,400 seats in 20 wards. SPARC set up a project management unit supervised by Nirman, a new non-profit company formed by the Alliance to undertake projects because of the growing scale of the Alliance's involvement. On behalf of Nirman, UTI Bank provided the municipal corporation with the performance guarantee needed to sign the contract, and the project began soon after. The target was to complete the 320 toilet blocks by March 2003. When it became apparent that this deadline could not be met, the World Bank argued against any extension. The Alliance argued that for a project that had taken eight years to design, it was overly ambitious to expect completion in two years! Moreover, this project showed a new way of providing sanitation to very low-income city dwellers. Eventually, the deadline was extended to December 2003. As of July 2003, 180 toilet blocks had been completed and another 110 were underway. This will provide sanitation facilities to about 0.3 million persons (out of a total of over 3 million) in the slums of Mumbai.

*Community Toilets in Urban Areas:* Only 15- 20 percent of slum dwellers today have minimum access to sanitation in any of India's cities. This reflects the problems confronting city governments as they begin to tackle these huge deficits. In most cases the poor cannot pay upfront for the costs for toilet construction, and they should not have to pay for this level of services. In such a deficit situation, the choice becomes one of providing basic access for all, versus good sanitation for some.

Community toilets rather than individual toilets are a preferred option because they can provide everyone, even the poorest, with sanitation. And the costs of provision for everyone can be afforded. Those who are better off can, and will, gradually build individual facilities for themselves. In this way, the pressure on community toilets will probably diminish over time, but everyone will continue to have access. CTBs are community-managed and controlled because the toilet blocks produce a possibility of change that helps develop new leaders, new relationships within communities and new relationships with external agencies.

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[8] SPARC is an Indian NGO established in Mumbai in 1984 that began working with women pavement dwellers. The National Slum Dwellers Federation (NSDF) links together and represents organizations and federations of slum dwellers throughout India; and Mahila Milan ("women together") is the name given to collectives of women slum and pavement dwellers that work closely with the National Slum Dwellers Federation. The community toilet blocks are part of a larger programme of work in which the SPARC-NSDF-Mahila Milan Alliance is involved

[9] The expenditure incurred on the first phase was Rs.22.5 crores or about a hundred times what was spent in any preceding year.

*Community Toilets Blocks in Pune and Mumbai:* In 1999, in Pune, the Alliance (SPARC, NSDF and MM) became one of the principal contractors and constructed 114 toilet blocks (with a total of more than 2,000 toilet seats and 500 children's toilet seats). The Alliance designed and costed the project, the city provided the capital costs, and the communities developed the capacity for management and maintenance. Between 1999 and 2001, more toilets were constructed and more money spent than in the previous 30 years.

The design of the toilet blocks introduced several innovations. Unlike the previous models, they were bright and well ventilated, with better quality construction (which also made cleaning and maintenance easier). They had large storage tanks to ensure there was enough water for users to wash after defecation and to keep the toilets clean. Each toilet block had separate entrances and facilities for men and women. A block of children's toilets was included, in part because children always lose out to adults when there are queues for a toilet, in part because many young children are frightened to use conventional latrines. The children's toilets were specially designed for children's use – including smaller squat plates, handles (to prevent overbalancing when squatting) and no large pit openings

The Slum Dweller Federations/Mahila Milan around India have developed skills of persuasion in showing local governments that an unconventional toilet-building partnership with a well-organized community organization is a realistic, even attractive, proposition for solving big problems that stymie municipalities up and down the sub-continent. These features are:

- sharing costs with a community reduces the city's sanitation cost burden;
- when communities build toilets, the city's construction burden is eliminated;
- when communities maintain the toilets, the city's maintenance costs are eliminated;
- community-built toilets often cost less than those the city builds, so a city's infrastructure budgets can be spread further, increasing service delivery.

These programs also demonstrate that implementation on a large scale requires cooperation with government agencies and/or the organizations responsible for building and managing trunk infrastructure – even if this is only to permit these community initiatives. SPARC chose to manage programs on a much larger scale – a far more complex task that called for a change in the attitude of local authorities to this kind of provision and a change in the relationship between these authorities and the organizations formed by "slum" residents and pavement dwellers.

*Affordability of Toilets for Users:* There has been considerable debate about how best to fund the maintenance of these toilets. The Alliance of SPARC, the National Slum Dwellers Federation and Mahila Milan promoted a system whereby each family pays for a pass costing 20 rupees a month. Although it is difficult to envisage how toilet blocks can be maintained without such payment, some elected municipal council members have been demanding that there be no payments and this has depressed collection rates in some toilet blocks.

*Financing:* Financial sources for the CTBs have varied between one project and the other. In Pune, Municipal Corporation pays for the entire construction, of which one third is its own contribution, the government of Maharashtra pays one third and the central government through HUDCO pays it the other one third. However this economics works because the costs of construction by communities itself is almost half that of the contractor would have taken.

So it is affordable to the Municipal Corporation . SPARC 's bridge revolving fund financed this project, and training for managing infrastructure came from HI (Homeless International UK) and Selavip (Japan) .

In Bombay, the slum sanitation project of 440 million rupees comes from the Municipal Corporation of Mumbai which in turn has taken a loan from the World Bank . SPARC has taken a guarantee from UTI Bank of 15% to execute the project, and HI (Homeless International UK) gives a counter guarantee to UTI.

The Indian government has now introduced a new programme - the Nirmal Bharat Abhiyan – where a 50 per cent subsidy for the construction of community toilets is available to local bodies and public authorities. The community toilets built in Pune and Mumbai influenced this.

*Financial Viability of CTBs:* According to available estimates, in Pune more than 400 toilet blocks were built with over 10,000 seats, at a cost of around 400 million rupees (around US $ 8.9 million) Assuming that each toilet seat was used by 50 persons each day, over 500,000 people benefited at a capital cost of Rs 800 (US $ 18) per person served. If the entire slum population of Pune (1.12 million) was to be served by these CTBs, the estimated cost is Rs 900 million or US$ 20 million.

In addition to the capital costs , there are O&M costs that may range between Rs 20,000 to Rs 30,000 per month that may include payments for employees, cleaning supplies and repair and maintenance. If a family is charged Rs 20 per month and a complex caters to 200 families (or 1000 persons), estimated monthly collections will be Rs 4000 , at the most. This will mean that either the complex will have to be subsidized from outside funds or labor will have to be provided free of cost by the caretaker.

It has not been possible to obtain any data on revenues, costs or financial viability of these CTBs except to say that collection rates have been depressed in some toilet blocks. In the absence of any data, it is difficult to say that the CTBs are financially viable and hence sustainable over time. In the case of doubts about its financial viability and long term sustainability, it is difficult to say how such a program can be "scaled up" to provide sanitation services to millions of urban poor in India.

*To recapitulate*:

1. There are significant institutional, management and financial constraints to "scaling-up" of the SPARC-assisted program both over time and across regions.

2. The available information on financing of projects and financial viability of CTBs is rather scant. SPARC has set up a project management unit supervised by Nirman, a new non-profit company formed by the Alliance to undertake projects. It is not clear under what financial performance conditions, UTI Bank has provided the municipal corporation with the performance guarantee on behalf of Nirman. Although this arrangement seems workable, it is not clear what are the financial risks and who bears the risks.

3. The financial sustainability of the program is based on 100 percent subsidies in capital costs and revenues raised from the users may cover only a part of the O&M expenses in most complexes. Even a payment of Rs 20 per family that may raise a mere Rs

4000 per month for each block is in doubt. Hence, the number of CTBs added every year is constrained by the total funds available to the municipalities or other local bodies for sanitation. In sum, it is the public funds for sanitation that constrain the total number of CTBs that are built.

4. Given the uncertainties about revenues for meeting the O&M charges on a regular basis, the lack of financial viability and sustainability are serious constraints to the "Scaling – Up" of the SPARC-assisted model of community sanitation.

## 12.3. Orangi Sanitation Project, Karachi, Pakistan

Orangi sanitation project is a well-known example of community involvement in providing affordable sanitation services to the urban poor in Karachi, Pakistan[10]. Orangi township, Karachi's largest squatter settlement (katchi abadi) has a population of about 900,000 out of a total population of 10 million in Karachi. Before the Orangi Pilot Project (OPP) was established in the township, there was no proper sanitation system. The Orangi project is a low-cost sanitation programme which enables low-income households to construct and maintain modern sanitation (pour-flush latrines in their own homes and underground sewerage pipelines in the lanes) with their own funds and under their own management. It offers an alternative approach to the problem of developing water and sanitation provision in urban areas from which important lessons can be drawn.

Through developing low cost technologies and cutting costs by eliminating middlemen or contractors, the OPP enabled the affordability of sanitation facilities for the low-income inhabitants of Orangi. Through imparting health education, advising and motivating collective action, the OPP staff got rid of various psychological and sociological barriers that had prevented the households from taking the responsibility of sanitation in their hands. By providing technical innovations and help they were able to provide know-how and affordable sanitation options. Between July 1981 and November 1993, Orangi residents invested more than US$2.2 million on improved sanitation and drainage systems. This has provided 88,000 houses – about 90% of the Orangi residents- with good toilets.

The Orangi project has already been successfully transferred to 42 settlements in Karachi. It offers an alternative approach to the problem of developing water and sanitation provision in urban areas from which important lessons can be drawn. However much more still needs to be done. The Research and Training Institute (RTI) of OPP is currently assisting both government and non-government initiatives in a number of other cities in Pakistan that are seeking to replicate the Orangi sanitation programme.

*Management and Financing Issues:* The OPP is essentially a research institution with the aim of identifying problems and developing solutions which can be implemented by the population in an organized manner. The OPP does not construct infrastructure, but it promotes community organization and self-management on a sustainable basis.

[10] This review is based on a number of references listed in Bhatia (2004).

The OPP started with a study of the problems in Orangi and identified four levels in a modern sanitation system: the sanitary toilets inside the house; the underground sewer lines with house connections and manholes in the house access lanes; the secondary collector drains; and the main drains and the treatment plant. The house owners were convinced and made willing and competent to assume the responsibility for the construction and maintenance of the first three levels which constitutes about 90 per cent of the system. The main drains and the treatment plant were agreed to be the responsibility of the government. It has been reported that some problems arose with the main drains and treatment plants responsibility not being discharged properly.

OPP simplified sanitation designs to make them affordable and technically viable so that they could be implemented locally. Through simplifying the design and developing steel moulds for sanitary latrines and manholes, the cost was reduced to one-quarter of the contractor rates. The elimination of the contractors' profits reduced labor costs by a further quarter. The final cost for the proposed system was about Rs.1,000 (approximately US$31) of which one-half was for the investment inside the house and the remainder was for the lane sanitation, for example, laying or renovating sewage pipes. Average earning per household in Orangi is about Rs.1,650 per month against an average Karachi household income of Rs. 2,100.

The Orangi Pilot Project (OPP) has never used credit schemes to finance sanitation and sewerage. The Orangi Project is an underground sanitation system financed, managed and laid by the people. Residents have been increasingly willing to take on the costs and organizational challenge of secondary drains, though several barriers as discussed later had to overcome first. The lane residents are also carrying out frequent maintenance and repair work on their investments.

Through developing low cost technologies and cutting costs by eliminating middlemen or contractors, the OPP enabled the affordability of sanitation facilities for the low-income inhabitants of Orangi. The funds came mainly from the households themselves who were poor though not destitute. Since the household invested their own funds they had incentive to maintain the system and provided finances and management for operations of the system too, making the project financially viable using local funds. The main drains and treatment plants that are the government's responsibility, need to be maintained properly to ensure the success of the efforts of the community members. The project facilitated a self-help approach by promoting community organization and political mobilization through the following three principles:

1.Using modified technology lowered sanitation infrastructure costs: OPP research focused on the technology in order to lower the cost of the sanitation system to such a level that the residents of Orangi could easily participate in its construction. Cost reductions were achieved by simplifying the design and the methods of construction and by eliminating contractors and middlemen. OPP research showed that a family owning a house on a 100 sq.yrd plot could have a sanitary toilet on the plot connected to an underground sewer line in the lane at a cost of Rs.1000.

2. Technical and sociological support was provided to help householders make suitable choices: OPP technicians surveyed the lanes, consisting of 20-40 houses as the basic unit of organization, ascertained levels and prepared maps, plans and estimates, while OPP social organizers explained the benefits of the sewerage system to the house owners and identified

an activist in each lane who could serve as lane manager, and hold meetings, create consensus and settle disputes. The OPP chose the lane, since it is small enough to ensure participation and large enough to ensure economies of scale. The task of the lane manager is to collect the required funds, hire labor and manage the construction process; he also keeps detailed accounts of the costs. In addition, the OPP launched a training programme for small-scale building contractors to develop their skills in implementing the construction without constant technical supervision by the OPP staff.

3. The internal (household and community) responsibilities and external (municipal) responsibilities in terms of the sanitation system were clearly defined and distinguished. The involvement of the residents does not stop with the construction; regular maintenance is very important. Because the lane residents have made a contribution towards the construction of the system, they have the incentives to ensure its sustained operation through regular maintenance. The government was responsible for the main drains and treatment plants.

*Constraints:* Reasons why people are hesitant in organizing for taking the responsibilities for sanitation activities often include many barriers that were also prevalent in Orangi before OPP. Psychological barriers the residents faced as they had always believed that it was the duty of official agencies to build sewerage lines to local residents free of charge. The construction of the underground lines required a high level of community organization for collective action and this did not exist which posed a sociological barrier. OPP brought people together and motivated them to work together and enabled the required collective action. The economic barrier- households could not afford the cost of conventional sanitary latrines and underground sewerage. The technical barrier -although the people could build their own houses, neither they nor the local builders possessed the technical skills required for the construction of underground sewerage lines.

The OPP programs have not been without problems. While the Orangi residents constructed their toilets and sewer lines in the area, the government failed to construct the sewer mains and treatment plant to evacuate the sewage from the area. One of the lessons drawn by OPP is the need to work with both the communities and the government to solve environmental problems in squatter settlements. Waste from the Orangi sewers runs into open waterways that flow to the sea. These waterways are overburdened by waste from Orangi and from Karachi in general and still tend to overflow during heavy rains. The main sewers required to prevent this flooding are the responsibility of the Karachi authorities. OPP has developed designs for main sewers and is lobbying the Karachi Municipal Corporation to build them.

*Conclusions:* With regard to the possibility of replicating the experience for other places in Karachi and elsewhere, the lessons learnt from this project are important.

Through developing low cost technologies and cutting costs by eliminating middlemen or contractors, the OPP enabled the affordability of sanitation facilities for the low-income inhabitants of Orangi.

Through imparting health education, advising and motivating collective action, the OPP staff got rid of various psychological and sociological barriers that had prevented the households from taking the responsibility of sanitation in their hands. By providing technical innovations and help they were able to remove the technical and economic barriers due to which the earlier sanitation options were neither affordable for the households and nor did they have technical know how of.

Households financed and managed the sanitation system without putting any burden on the government or external aid agencies.

## 12.4. Bangladesh Urban Sanitation Program[11]

The Water Aid-Bangladesh Urban Programme begun by the lead partner, DSK (Dustha Shashthya Kendra), has been implemented since 1998 by a group of seven partner NGOs[12] in approximately 168 slums in the Dhaka metropolitan area and in Chittagong City Corporation, the two largest urban areas in Bangladesh. There are approximately 92,000 households in the working area as a whole, of which 27 percent are estimated to have received one or more of the programs services. Programme services include: water points providing supply water through legal connections to metropolitan water authority lines; installation of tubewells; construction of sanitation blocks combining water points and hygienic latrines; community/cluster latrines with septic tanks; household water-seal, pit latrines; construction of footpaths; drainage improvements; solid waste management; and hygiene education.

Local users wholly or partially pay for all physical improvements. Each partner NGO has a revolving fund through which repaid loans can be used for additional programme activities. Planning and implementation of programme activities are expected to be done in ways that ensure maximum involvement of local people in decisions and facility management. Hygiene education methods also utilize participatory communication strategies adapted from several national and international sources.

*Financing Issues:* Beneficiaries of all economic levels were found in a household survey conducted by Water Aid to make more use of hygienic latrines than non-beneficiaries: 65 percent, as compared to 50 percent. Poor households tend to use community latrines, and solvent households, to use private latrines. The per-person, per-use charge for using sanitation blocks inhibits their use by local area residents, so a large percentage of cost recovery seems to be based on commercial sales to passers-by in locations where people are charged per use. There is some evidence that women have less access to hygienic latrine facilities, especially in sanitation blocks, than men. In one case this is because women use an older facility rather than the one constructed by the programme.

For water points, most partner NGOs have worked out methods of covering costs and getting loans paid. For sanitation blocks there are still no firm decisions on how to accomplish these goals and also get enough water to community residents. Supply and demand determines the prospects for success. Even if alternatives are not easily available, poor peoples' financial circumstances can still limit their access to safe water. It is almost 100 percent certain that if they must pay 50 paise per pot, the poor will use safe water only for drinking, if at all. When programme facility users are required to pay on their loan and cover operating costs, they

[11] This summary is based on Suzanne Hanchett, Mohidul Hoque Khan, Shireen Akhter : WATER-AID Bangladesh Urban Evaluation 2001

[12] The seven partner NGOs working with Water Aid are: ARBAN (Association for Realization of Basic Needs); ASD (Assistance for Slum Dwellers); BAWPA (Bangladesh Agricultural Working Peoples Association); DSK (Dustha Shashthya Kendra, an organization specializing in health services for the very poor); PHULKI (an organization working in the Kallyanpur slum; specializing in daycare services); PRODIPAN (a Khulna-based development organization specializing in solid waste management); PSTC (Population Services and Training Center)

need to raise a minimum amount of money each month. Some make up the gap by selling to outsiders, usually charging them the same rates as community residents' pay.

The unclean condition of most observed programme latrines suggests a need for a more intensive effort to educate users about latrine maintenance and health risks associated with inadequate disposal of faecal matter. There also may be a need for improved staff training on latrine cleaning and maintenance. The fact that many programme area residents, especially the poorest, still use hang or open latrines shows that there remains an enormous need for investment in sanitation facilities -- preceded, of course, by motivational campaigns.

*Hygiene Promotion:* Hygiene education is provided in most cases to slum dwellers regardless of whether they use programme water and sanitation facilities. The greatest impact on hygiene awareness, judging from the household survey, has been on hand washing knowledge, understanding how worms infection spreads, using safe water, and covering food to avoid diarrhoeal disease. Hygiene promotion techniques are not discussed to any great extent among Water Aid partners, who use monthly technical coordination meetings for discussion of engineering issues. So the hygiene promotion skills of stronger groups are not being shared with other Water Aid partners.

*Organizational Issues:* Most Water Aid partner NGOs have initiated contact with new working areas through existing credit or other self-help groups, which may or may not form the basis of facility- management committees. In cases where large numbers of houses are rented, ownership of programme facilities may not ultimately come to area residents who pay for them. Eviction is an ever-present danger, even in the most stable slums, if not legally occupied. After Water Aid and local populations have spent large amounts of money, a slum clearance inevitably results in lost programme resources and less money returning to revolving funds. The most significant programme achievement to date is in creating a good working relationship with the Dhaka Water and Sewerage Authority (DWASA). The outcome of these efforts has been a high degree of interest among senior management at DWASA in the programme, and a willingness to approve piped supply connections in slums. The importance of this cannot be over-stated. It opens the door for slum dwellers throughout Dhaka (and Chittagong too) to have the same access to piped supply water which other urban area residents have.

If Water Aid and its urban partner NGOs decide to expand services to include poorer slum area residents, modified guidelines and cost-sharing arrangements will be required. Providing water and sanitation services to the very poor living outside of slums would require entirely new programme strategies.

*Conclusions:* 1. Hygiene education should receive more attention through a monthly coordination meeting and more training by partner NGOs of their new staff. Hygiene educators could play an extended role in monitoring of facilities and services. Owner-users, especially committees of very poor people, need help with learning how to manage accounts. Training someone locally should be a priority, so that owner-users will be able to handle their affairs after a loan is repaid. 2. There should be a goal to ensure that all programme structures will last at least five years. People should be compensated from the programme if engineering or other technical failures interrupt their service. There should be some way of compensating owner-users if a site is evicted and a programme facility for which they have paid is rendered useless. 3. Payment scales should be adjusted to household economic status. Such measures

would ensure full access to programme facilities for all area residents, whatever their economic capacity.

## 12.5. Ouagadougou Strategic Sanitation Plan , Burkina Faso

The Ouagadougou Strategic Sanitation Plan (PSAO) is an integrated sanitation and hygiene promotion programme[13] implemented by the parastatal National Water and Sanitation Office (ONEA). PSAO has assisted thousands of households in Ouagadougou in upgrading their latrines and installing soakaways. The approach included making the households aware of the technical options available to them. Some subsidies are available if needed. The funds for ONEA's promotional work and subsidies for on-site sanitation come from a surcharge levied on water bills. Latrine blocks have been built for Ouagadougou's schools. ONEA has sub-contracted a local NGO (ADRA) and a regional training center (CREPA) in order to implement all these activities. A sewerage system and wastewater treatment works are also under construction to treat sewage from the city center and the industrial area. Recent legislation requires industries to treat their effluents before discharging them into the sewerage system. They will be entitled to low-interest loans to install the necessary pre-treatment processes. To finance this, ONEA will levy another surcharge on water customers connected to the sewerage system. As an integral component of PSAO, CREPA conducted a pilot school sanitation programme. It trained private enterprises in the construction of school latrines and produced a guide on hygiene promotion.

While the programme does have problems, for example in targeting subsidies at the poorest people and in the relationship between PSAO and the local government, it offers a practical example of a city-wide integrated sanitation programme that could be useful in other countries.

*Background:* In 1999, the 900,000 inhabitants of Ouagadougou, Burkina Faso, were mostly using traditional latrines (70%), while some had access to improved pit latrines (18%) or septic tanks (5%). About 7% of the population were without any sanitation and practiced open defecation. Most schools lacked suitable sanitation facilities. Sewage and wastewater from the central market, the main hotels, the hospital, the brewery, the tanneries and the abattoir were discharged untreated into the surroundings. The quantities discharged had risen to more than 20,000 m3/year of night soil and 600,000 m3/year of industrial effluent. Ouagadougou had major problems of water supply, sanitation and wastewater treatment.

The National Water and Sanitation Office (ONEA) was set up in 1985 and became a parastatal in 1996: it is still part of the public sector but financially autonomous from the government. ONEA manages drinking water and sanitation services in Ouagadougou and 50 other centers, with 45,000 customers and over 1,300 public tap stands.

The programme has three main components:

1. On-site sanitation: PSAO selected this as the preferred technology for about 80% of the urban area. Community workers paid by the programme encourage households to upgrade their sanitation facilities by installing one of several options for the disposal of excreta and/or soakaways for sullage disposal.

[13] This section is based on The Ouagadougou Strategic Sanitation Plan: An Holistic Approach to a City's Problem. Blue gold Series. Water and Sanitation Program.

2. School sanitation facilities: ONEA aims to construct latrines for the schools in the city and to provide teachers with educational material about hygiene and sanitation.

3.Off-site sanitation: A conventional sewerage system is under construction to serve the city center and the commercial, administrative and industrial zones.

Till April 2002 the results were impressive: over 19,000 households have constructed over 28,000 on-site sanitation systems. This programme has reached 26% of the 73,000 residential plots that could be equipped with on-site sanitation.

*Financing:* ONEA generates some of its own financial resources. It has made provision for two sanitation surcharges levied on the cost of drinking water, only one of which is currently in operation:

- One surcharge fully finances the on-site sanitation activities. It is equivalent to 4% of the average water tariff, and effectively constitutes a sanitation tax of US$0.02 per cubic meter of water sold. In 1999, this surcharge generated a revenue of US$0.5[14] million. Of this sum, 65% was collected in Ouagadougou and 25% in Bobo-Dioulasso (the country's second city, with major industrial activity).

- A second surcharge will help industries to finance the pre-treatment facilities that they must now install to meet national discharge standards. It will be channeled into the Fund for Disposal of Industrial Pollution (FODEPI). It will apply to water users connected to the main sewerage system. It should amount to approximately US$0.01 per cubic meter.

ONEA also receives significant aid from external support agencies for PSAO. The support of the French Development Agency (AFD) has risen to US$7 million. A sum of US$0.2 million helped to subsidize the components of the latrines and sanitary facilities. For example 96% of the VIP latrines constructed benefited from subsidies of between 0% and 40% of the cost and 76% of the soakaways constructed benefited from subsidies of between 21% and 60% of the cost.

The average cost of a system is about US$57. The construction of soakaways and the rehabilitation of traditional latrines constitute the greatest part of the work, probably because of the low investment cost compared to the other options offered.

Some of the factors that influence the householder's choice are:

- A standard VIP latrine costs about US$100, which is five to ten times more than a soakaway and two to three times more than the rehabilitation of a traditional latrine.

- The rehabilitation of a traditional latrine requires one working day. The construction of a VIP latrine takes between one and fifteen days.

[14] 1 million FCFA=US$1.5k

World Bank has approved a loan of more than US$4.5 million. Meanwhile ONEA is providing, from its own funds, US$3.6 million for the on-site sanitation component and US$0.4 million for school sanitation.

For the same type of work, the price varies significantly because it is negotiated by the client (head of the household) and the artisan. The factors determining the price can include, for example, the contribution of the household (digging the pit, providing sand, etc.) and the possible additions (such as tiled floors). In 1997, the cost of a latrine fell significantly, apparently because of increased competition among artisans. Soakaways were particularly popular; the programme had to meet a demand of over 150 per month. The other types of components were completed at a rate of about 50 per month.

ONEA entrusted ADRA (Adventist Development and Relief Agency, a Burkina Faso NGO) with the responsibility for community mobilization and hygiene promotion. On average, each field worker contributed to the construction of 100 sanitation installations. The cost of these mobilization and promotion activities per household was about US$25. With finance from ONEA, 100,000 primary school pupils were provided with 170 school latrine blocks. This attained the objectives of the pilot phase, at a cost of US$343,000.

*Scaling up*: PSAO's approach was tested in a pilot phase between 1992 and 1994. This was also an opportunity to test the capacity of the local artisans and small enterprises.

In 1995, the programme was expanded to 30 areas of the city. For the construction of the sanitation components, ONEA used masons, of whom 260 have been trained to date. To achieve that expansion, ONEA embarked on a genuine partnership with the city's artisans. It invited a regional training center, CREPA (Regional Centre for Low-Cost Water and Sanitation), to train artisans in the construction of sanitation components, and appointed private companies to carry out quality control. The artisans' output has risen from 1,000 to 6,000 installations rehabilitated or constructed per year. Following the success of PSAO, ONEA is implementing a similar programme in the second city of Bobo-Dioulasso, and may extend this work to four large towns.

The two lessons learnt are important while scaling up of the programme:

1. In Ouagadougou, most of the households that have had a latrine rehabilitated or a soakaway constructed seem to belong to the middle class, as indicated by their employment or vehicle ownership. To reach the poorest households a large amount of subsidies will be required and targeting these subsidies effectively will be imperative.

2. The maintenance and care taking arrangements for these school latrines were inadequate. The installations were the victims of their own success, in that they suffered from unauthorized use, during the night, by other people living in the neighbourhood. Some latrines were vandalized, and others neglected through lack of maintenance. In future the maintenance of these systems is important for achieving the objectives behind them.

*Conclusions:* The Ouagadougou Strategic Sanitation Approach aims to devise sanitation solutions which are demand responsive, flexible and involve the active participation of all stakeholders. Some features of the approach are:

- The sanitation construction programme is not centrally determined but responds

to household demand.

- Households are offered a variety of options which they can 'mix and match' according to their practices and resources.

- Social development work plays a crucial role, both in understanding the needs of the community and in promoting demand for technically, financially, and socially appropriate solutions.

- Both education and incentives are used to increase uptake of sanitation options.

Putting this approach into practice requires sustainable institutional arrangements, such as the establishment of an agency that can generate its revenue and recover costs from the beneficiaries of sanitation, and thus avoid dependence on central government funds.

This agency defines the overall direction and manages the system of incentives; the social development and construction may be carried out by NGOs and/or the private sector. The development of such sustainable arrangements, rather than the construction of a certain number of works over a specified time, is the key to success in implementing the strategic sanitation approach.

### 12.6. Strategic Sanitation Programme, Kumasi, Ghana

The Kumasi program[15] is well known for its pioneering work to implement a strategy for urban sanitation programs to be replicated in other urban centers in Ghana, the guiding principle of which would be the sharing of costs between the project and end users. Kumasi is the second largest city in Ghana and is located 300 km Northwest of Accra, the national capital. At the beginning of 1990, 40% of the Kumasi's residents used public latrines, 25% used the unhygienic bucket latrines, 5% used pit latrines and 5% 'free ranged'. The remaining 25% who have water closets had septic tanks overflowing into drains. In the recent past a number of pilot activities in the sanitation sector have been initiated. Though some improvements have taken place, it is imperative that these improvements are sustained and expanded.

Pilot activities have been undertaken in the sanitation sector which include schemes at the household level as well as city level. Kumasi Sanitation Project[16], funded by UNDP/KMA (Kumasi Metropolitan Assembly)[17] covered Home Latrine, Public Toilets and Simplified Sewerage Scheme on pilot basis. A public toilet facility has been commissioned with funding from the Metropolitan Assembly, Almere and a support from the beneficiary community. Piloting activities under the MERC scheme commenced in Zone 1 of Atonsu pilot area on July 1st 1998. This phase covers a total of about 540 houses and serves a total population of about 5,481.

[15] This review is based on the following references given in Bhatia (2004)
[16] (1990-1994)
[17] KMA is responsible for the overall development of the Kumasi metropolis and is in charge of the preparation of development and budgetary plans for the city; initiate programs for the development of basic infrastructure and has the responsibility for the provision of municipal infrastructure services; responsible for the development, improvement and management of human settlements and the environment, ensuring a secured and sound conditions for development in the metropolis.

Management and Financing Issues: The stakeholders of the scheme include the KMA, the beneficiary community - Atonsu Zone 4 (Monaco) and the Franchisee. Kumasi-Almere Steering Committee (KASCO) has the overall responsibility for the management of the project. These include policy direction and approval for the disbursement of project funds, conflict resolution through consensus building and monitoring and evaluation.

The KMA, Almere and the Community provide funding for the implementation of this phase. The programme responds directly to the KMA's Five-year Development Plan (1996-2000) and the Ghana Government's poverty alleviation programme in the medium term. The city of Almere has indicated their preparedness to support an extension of the programme to cover two other zones within Atonsu, which will result in an overall coverage of about 70% in the future. To provide the completeness required to maintaining an appreciable public health status in the community, it is imperative that the remaining 30% of Atonsu are covered by a similar exercise. A project proposal has been submitted to ICLEI for Incentive Grant Project (IGP) assistance to cover the unserved 30% of the community. This will provide the completeness required maximizing the impact of the project.

Kumasi has achieved construction of 200 units of household facilities within 6-months as against the 2001 target of 1,700. The dynamics of strategic sanitation planning has been applied under the household latrine programme. Under the Kumasi Sanitation Project (1989-94) beneficiaries were assisted with loans if upfront-payment of 20% was fulfilled. Although loan recovery was satisfactory (75% and more), the management cost of this recovery effort implied that the real recovery is in the range of 50%. Under the Urban IV project, this realization brought about an adjustment in procedures.

Beneficiaries (households) make 50% contributions towards household facilities while the project supports households with a grant of 50%. Households' indicate their commitment by initiating construction up to 25% (or more) cost of the facility before the release of project grant. In this manner the demand-driven requirement of SSP-Kumasi is achieved.

Constraints to Scaling-Up: The Community based Kumasi-Almere MERC Scheme faces challenges. Solid waste service has always been offered for free in Kumasi over the years. The introduction of 'Service Fee' under the scheme particularly in Atonsu has been a challenge since the inhabitants of the area are middle to low income people.

Loans were made directly to tenant landlords for the installation of shared sets of latrine units. Repayment was to be made by the landlord over a 2-3 year period. The landlord would either add an amount to the rent or collect it separately. Collection of loan payments in this way has proved problematic. It has lead to over billing of tenants and lapses to the regular payment schedule. Landlords sometimes retain funds until all tenants have paid up or use the money as working capital. As of May 1993, over 40 per cent of the 224 loans disbursed in the 3 pilot areas were in arrears. Collection is further complicated by the fact that the responsibility for debt collection does not lie with a single financial institution but rather a combination of project staff and the community steering committee which adds to overall loan administration costs. Finally the financial situation in the country combining inflation and distorted credit markets has exacerbated the situation.

It is also a pilot scheme involving 'Private Sector Participation' (PSP) in the waste management service delivery in the city and hence its success or failure will have an important impact on future policy. Since this is the beginning of PSP in solid waste service,

the challenge to providing effective operational monitoring which is an important factor for success has been highly significant. This was initially underestimated which affected the service level adversely.

The use of non-standardized household bins under the service has affected the level of service and hence the success of the scheme considerably. At present, households' use must furnish their own containers, which in practice means a variety of boxes, baskets, bowls, buckets, etc. These have been found to be vulnerable to rain, to being knocked over by stray animals and to physical disintegration thus affecting the service level. 60-litre bins with lids are now being procured for distribution to participating households.
One major problem is the 10% contribution to be provided by KMA and other assemblies. That level of financing is beyond KMA's traditional revenue sources. The participating assemblies like KMA are being bailed out by allocation from the District Assemblies Common Fund (DACF) which is a central government's revenue source. In future projects requiring substantial inputs by the KMA (and other assemblies), levels of contribution should be linked to achievable targets of traditional revenue allocations by the cities.

Another concern, which needs addressing, is the contract award threshold set by the Ministry of Finance and Economic Planning, for Tender Boards like that of the KMA. The levels are comparatively lower than a number of Urban IV project component's cost.

*Conclusions:* The follow-up to this project may cover community infrastructure upgrading in more low-income and deprived areas of Kumasi, as without doubt sustainable development and its' impact are more appreciable if community involvement and maintenance management roles are enhanced. The direct involvement of cities in project identification, planning and execution as in Urban IV supports the government's decentralization policy. Capacity building has also helped Kumasi in the preparation of a Five-Year Development Plan (KMA-FYDP: 1996-200) and thus will shorten future project preparation schedules. Kumasi project was based on the guiding principle of which would be the sharing of costs between the project and end users.

## 12.7. Sanitation Program, Luanda, Angola[18]

In the decade after independence, the urban sanitation infrastructure in Luanda, the capital city of Angola, was extremely inadequate due to lack of investment and maintenance. The Department of Urbanism (within the Ministry of Construction) and Development Workshop Angola started a pilot project named Project Sambizanga in one area of the *musseques* of Luanda to improve water and sanitation infrastructure in the slum areas. This area was the *comuna* of Ngola Kiluanje in the *municipio* of Sambizanga with a population of 10,000 at that time. Project Sambizanga began the efforts in water and sanitation expansion which were carried on even after the project ended. In the period subsequent to Project Sambizanga, Development Workshop Angola aimed to apply the lessons learned through two separate programs, one to replicate and extend the supply of public water and the other to extend the provision of family latrines.

[18] This section is based on Alan Cain, M. Daly and P. Robson: Basic Service Provision for Urban Poor, the Experience of Development Workshop in Angola. Working Paper 8. Working Paper Series on Poverty Reduction in Urban Areas. International Institute for Environment and Development, London

Development Workshop programs aim to develop and rigorously test the technology and models of service delivery mechanisms, to serve for further replication. The latrine programme assisted in building of 5,000 on-site family sanitation units between 1995 and 2000. The programme was aimed to achieve near total sanitation by covering 90% of families of specific residential areas in order to maximize health benefits. This approach was adopted as opposed to offering latrines on demand dispersed over a large area. The objective of the programme was to increase the access of underserved peri-urban households of Luanda to basic services namely water supply, on-site family sanitation and solid waste removal. Mobilizers mobilized community members by providing them with hygiene and sanitary practice education as well as technical advice in choosing their onsite sanitation systems. Families built their own latrines using the latrine slab provided by Development Workshop.
*Financing:* Project Sambizanga received support during its several phases from One World Action (UK), Inter-Pares (Canada), British Overseas Development Agency (ODA), UNICEF, the Netherlands Cooperation and the Swedish International Development Agency (SIDA). The peri-urban Emergency Sanitation Project 1995-1991 was funded by CIDA, SDC and Emergency Sanitation for IDPs, in partnership with One World Action- funded by European Union and Netherlands Cooperation.

Families built their own latrines using the latrine slabs provided by Development Workshop. Slabs were produced in a central workshop run by Development Workshop. The user household is responsible for the latrine construction which involves digging the hole, lining the pit and building the cabin. The lining of the pit is often done by a professional mason paid by the household itself. The average time taken to build a latrine is four days. Apart from building, the maintenance of the latrine is also the responsibility of the user household.

*Scaling up:* It was hoped that after elections in 1992, the macro- economic situation would improve, thereby improving the affordability of the latrines without the need of any subsidy. However after the elections, Angola experienced its worst phase of conflicts. Government capacity to fund sanitation worsened, as did the economic conditions for the poor. The number of people increased in Luanda and most did not have access to sanitation facilities. The need and demand for on-site sanitation remains high and needs to be fulfilled. Community mobilization and health education, in cases where the households can afford the costs of latrines, has encouraged households to invest in latrines. However they did so when they were assured of the technical feasibility, affordability and benefits of the systems being installed. Research into exploring and developing sustainable and cost-effective technical options has been a part of the Development Workshop and the others involved in the programme.

Throughout the 1990s Development Workshop was the only agency that provided sanitation programme in peri-urban area in Luanda. A number of local NGOs have been subcontracted to implement geographically defined latrine projects where they undertake family mobilization, construction supervision and promotion of health education. These NGOs are trained by Development Workshop. By 2001, 15 local NGO family latrine projects had been completed in peri-urban areas of Luanda[19]. Development Workshop has also transferred the improved latrine technology to local partners in provinces of Huila, Huambo, Zaire, Moxico, Kuanza Sul and Kuanza Norte by providing assistance in building local slab production workshops and in training production technicians and social mobilizers. Development

[19] See Cain et al.

workshop has assisted the National Directorate of Water in developing a national strategy for improved latrine programs involving local NGOs and local government agencies.

Schools in Luanda do not have functioning sanitation systems, though the need for them is clear. Latrines have been built in ten schools and their performance is being monitored and adapted.

*Conclusions:* In order to enable scaling up of the program of sustainable basic service provisioning, the following lessons emerge to the forefront:
1. Research into sustainable and cost-effective technical options for sanitary systems need to continue to come up with affordable sanitary systems that the poor can afford. The new technologies need to be diffused and shared among local networks of Development Workshop to promote increased adoption.

2. Continued mobilization and community organization effort to improve the hygiene related behavior of the households and communities will be required.

3. Subsidies need to be targeted specifically towards the poorest sections who will not be able to afford the systems even the low cost options.

4. School latrine programs need to be given their due attention.

5.Political stability and political will both are important. Political stability enables the conditions in which the households' affordability improves thus enabling them to invest into sanitation systems. Political will promotes technical innovation into low cost alternative technologies to emerge and be promoted

## 12.8. Condominial system in urban sanitation, Brazil[20]

Brazil's urban slums, *favelas*, have serious water and sanitation problems due to poverty, overcrowding and physical reasons like being situated along forbiddingly steep hills or mired together in muddy swamplands. With World Bank financing, Brazil completed PROSANEAR I , a pilot program that developed a new approach of community participation and low-cost technology of delivering water and sanitation services to the urban poor in 60 low-income settlements in 17 cities in Brazil. Over five years (1992-97), PROSANEAR I provided 900,000 poor people with water supply and one million people were connected to sewerage systems at less than $98 per person for water connections and less than $140 for sewerage.

*Scaling up:* PROSANEAR worked so well by combining two approaches- cost effective, appropriate technologies and community participation. In order to provide safe water and sanitation facilities to millions of urban poor in Brazil similar programs need to be continued. About 21 million Brazilians do not have access to safe water, and more than twice as many (44 million) lack access to sewerage networks or septic tanks. Most of them live in *favelas* and earn less than US $ 300 per month. There are lessons learned on how to scale-up the program described below.

[20] [20] This review is based on PROSANEAR. A Program of Community Participation and Low-Cost Technology Bringing Water and Sanitation to Brazil's Urban Poor. Yoko Katakura and Alexander Bakalian. Water and Sanitation Program. September 1998.

*Background:* In 1982, Brazil launched a small pilot program called PROSANEAR. The Ministry of Interior managed the pilot program , which was financed by federal funds. The program experiments with different types of low- cost technology to extend water and sanitation services to urban poor, but with only limited success. The program faced various technical and financial difficulties and was about to be abolished by the late 1980s. However the World Bank and Caixa Economica Federal(CEF) reviewed the experience and fond some valuable lessons and decided that the program could be successful if earlier work was combined with some new innovative approaches. Thus, in 1992 Brazil launched PROSANEAR I with help from a US $100 million loan and some technical guidance from the World Bank.

The five principles of PROSANEAR I were community participation; appropriate technology at low cost; environmental protection; cost recovery and house connections. Priority was given to favelas in cities of more than 50,000 people; families who earned less than $300 per month of which 40% earned less than $ 100 per month and residents agreed to pay for the water and sewerage in accordance with tariff schedules maintained by water utilities.

*Condominial System:* In most cases the Condominial system was chosen as the cost effective option for sewerage collection. It is a beneficiary-centered urban sanitation alternative developed in the early 1980s in northeastern Brazil. It is called condominial because it treats a block of houses like a "horizontal" apartment building, with sewer lines passing through or near each lot. Households connect to the block line through small collection boxes. The users connect to a common block feeder line that is located within residents' private lots , making the feeder network collective and the responsibility of maintaining it, till it reaches the public sewer, that of the users.

*Financing:* As discussed above PROSANEAR I projects were jointly funded by the World Bank(50%), the local water companies, state or municipal government(25%) and the Caixa Economica Federal or CEF(25%). PROSANEAR I financed investments in water supply, sewage collection, sewage treatment as well as complementary investments such as bathrooms and in-house connections. The program also financed community mobilization and participation efforts and technical assistance. Operation and maintenance responsibilities were left to the community members in some cases and in some bases were hired out to private contractors. The construction costs for sewerage systems on average are $104 per capita. In most cases the users paid for the services they received and also for the subsequent operation and maintenance expenses.

*Cost recovery and subsidy rules:* One of the lessons of the project is that cost recovery and subsidy rules must be set in a clear and transparent manner. Although PROSANEAR I promoted cost recovery through tariffs and connection fees, it did not indicate how much of the cost the communities should pay, and how much should be shouldered by water companies or local governments. Furthermore, although water companies charged monthly tariffs for the water and sewerage services, these weren't high enough to cover the real cost of building, operating, and maintaining the new systems. PROSANEAR I tariffs were often set lower than the subsidized tariff already charged to poor users of conventional water and sewerage systems. Since the previous tariff had been set too low, the subsequent PROSANEAR tariff was also too low for full cost recovery and sustainability of the new services. In these cases, three solutions were tried: cross subsidizing the PROSANEAR tariff from the water agencies' other consumers, subsidizing directly from local governments, or thoroughly reviewing the existing tariff structure. The first two solutions were the most

common, but these solutions in general lacked transparency. The third option was beyond the scope of the project, and rarely happened.

*Lessons Learned:* PROSANEAR I programs enabled the provision of water and sewerage services for around million people in urban slums of Brazil that are geographically and socially difficult. PROSANEAR I achieved its success by combining two approaches- cost effective, appropriate technologies and community participation. The lessons summarized in the report are : (i) Community participation must start at the very beginning of project implementation (ii) Cost recovery and subsidy rules must be set in a clear and transparent manner (iii) Formal long terms arrangements for operating and maintaining the systems must be an integral part of the design and (iv) all feasible technical options and their costs must be discussed with the communities.

## 13. COPING STRATEGIES

Having established the macro-economic case for taking water and sanitation issues seriously, this study aims to identify and suggest coping strategies first of all for countries faced with extreme climatic variability so that they will be able to adopt policies and undertake investments that will buffer the adverse effect of water shocks on their economies and facilitate their transition away from the vicious poverty trap.

### 13.1. Foreign aid and water sector development

The World Commission on Water estimates that the annual current investments for water is about USD 70 billion, of which USD 17 billion is for hydropower, USD 28 billion for water and sanitation and USD 25 billion for irrigation. 90% of this comes from domestic sources. Only 5% comes from the World Bank. Another major development agency, DFID of the UK spend around 2.2% of its bilateral aid directly on water –related activities. In addition, some of the budget support (20% of DFID's bilateral aid program) is also identified as used on water activities, but this is less than one percent. However, one cannot exclude the possibility that some of the budget support frees up funds for other uses (fungibility of money), such as e.g. investments in the water and sanitation sector. Furthermore, water issues are also addressed as part of projects where the primary aim is e.g. is health or education issues. When all such indirect water related DFID aid is taken into account, it would total like 7% of DFID total bilateral aid. Similar percentage shares for water related investments might reasonably be assumed for other donors as well. With overall global ODA amounting to some USD 50 billion annually, this would mean that foreign aid for water related investments are just marginal as a global average. At the same time it estimates that in order to reach the MDGs this annual investment level should increase to USD 180 billion.

While the private sector has taken on a huge financing role for infrastructure in developing countries since the early 1990s, investments in water, sewerage and hydropower have remained at a very modest level; 5% for water and sanitation and another 5% for hydropower. Equally important, those private investments that have taken place, have occurred in low-risk economies in East Asia and Latin America. And even here, these private investments only cover a small fraction of the estimated needs, World Bank (2003b).

### 13.2. Getting the house in order.

Typical of virtually all countries facing such a natural legacy is that they also tend to face a deficient governance legacy and macro-economic management legacy. The latter two have been reinforced by the former, but taking the former as a given, a lot could be undertaken to improve on the latter two that would greatly facilitate measures to cope with the adverse impacts of the natural legacy thus establish much improved resilience to such shocks.

Measures and instruments identified in the past as appropriate and relevant for establishing a strong and resilient economy in general, are the same that must be in place in order to provide the enabling environment that contains the necessary incentives for domestic capital to invest in the home country and for foreign investors to look to these markets for long term stable and low risk returns. The huge water sector gap between actual investments and operating and maintenance budgets on the one hand, and actual capital mobilization for such uses on the other, clearly diagnoses broad-based reforms towards good governance, sound macro-economic policies and a functioning financial sector, as necessary conditions for getting the water and sanitation sector onto a sustainable development path.

These recommendations are repeats of what has been uttered many times over, but they are no less relevant because of that. What may constitute a new water sector strategy contribution from a macro-policy perspective, could be a PRSP where the governance- and macro-policy reforms *are not imposed* as one-sided aid-conditionalities that need to be met as a condition for receiving aid, loans and technical assistance for sector investment and operating programs. The new development contract between the country in need of such water sector assistance and those providing capital, management capability and technology, should simultaneously address the macro- and governance reforms and sector investments for coping with water shocks resulting from their natural legacy and the sanitation deficiencies that causes so much loss of life and suffering.

Such a coping strategy obviously must be designed so as to provide for careful monitoring of progress on all elements of the strategy, and it must be developed by the country in question with close support and technical assistance from those intending to assist in its implementation, and in such a way that it pays to adhere to the agreed plan.

It would appear that there is no other way one could mobilize the huge domestic capital and know how base available in many of these countries along with foreign investors looking for new opportunities with safe and predictable returns. The investment amounts identified by the various global water studies are so large that it is totally unrealistic that aid flow increases can solve but a minor portion of these problems. It is therefore urgent that the affected nations themselves come to grips with the problems that so far have caused domestic and foreign investors to refrain from entering these economies with capital for investments. Once the general conditions for such investments are made attractive, the water sector should be made among the most attractive once to invest in since this is a sector where there should be minimal conflict between the PRSP and the goals of domestic and foreign investors.

### 13.3. Creating resilience to climatic shocks

Development of water storage infrastructure and more focus on watershed management are options that a country could explore, either individually or, in the case of international rivers, in cooperation with upstream or downstream riparians.

All major water sector reviews in recent years (see list of references below) have found a striking disparity between the water storage capacity per capita in rich and poor countries facing somewhat similar climatic variability. Low income tropical countries – particularly those in sub Sahara Africa – tend to experience more climatic variability than most other countries, and at the same time have the least per capita water storage and buffer capacity to deal with extreme natural events. As a result, the losses due to disasters of a given magnitude become much more devastating and the capacity to restore and repair which was minimal at the outset is severely impaired.

With such natural events happening irregularly, but with high statistical certainty, investing in enhance resilience to handle such events should be a high priority task in most PRSPs, and as such a recipient-targeted investment area for donors and foreign investors to focus their activities on in order to reach the MDGs. It is now well established from comparing outcomes of such natural events and from outbreak of waterborne epidemics in cases with and without precautionary preventive action, that the cost of ex post repair and rehabilitation in the "without cases" virtually always is a large multiple of the ex ante preventive action costs combined with the repair and rehabilitation costs in the "with" case.

However, recent reviews of the available PRSPs reveal that such projects and investment opportunities are rarely found in the present PRSPs. In order for the foreign investors and donors to participate in establishing such resilience building water storage infrastructure and complementary institutional and technical capacity to build, manage and monitor its functioning, recipient governments must agree to this being a priority issue and take ownership of revised PRSPs and investment programs that address such tasks.

### 13.4. Creating local awareness of how to use and not use water resources

In many of the poorest countries and poor regions of other developing countries where availability and use of water appears to be an impediment to social and economic development, it might be necessary to focus development cooperation on basic education and awareness raising about how to and how not to manage the local water resources for consumption, food production and as a recipient for excreta and waste. It is important to have in place programs that target those in the community to whom the rest of the local population listen and respect, and after having convinced and trained them in what is good water management and use practices, have these respected citizens convince their fellow citizens that what has just been taught is the right way to manage the water resources for the best of the community. Such programs must be carried out at the village level by locals, but experience shows that when properly done, it can have a tremendous impact on the villagers' water use behaviour, and thus on the prevalence of typical water-related diseases and health hazards. Such programs should complement the "hardcore" storage and piping infrastructure investments so as to enhance the benefits from these capital-intensive projects.

### 13.5. Focus on the role of "*virtual water*"

Structural shifts away from water-intensive agriculture and industries could decrease economic vulnerability to water shocks. Equally and sometimes even more important, structural shifts towards developing the sectors where the country or a community within it has a comparative advantage and relying on "*virtual water*" for providing the country's power supply and food basket could drastically reduce the apparent water crisis and need for diverting national resources as well as FDIs and foreign aid for costly water supply projects.

In spite of the extreme tensions over the rights to shared waters of aquifers and rivers in the Middle East (the Nile, but in particular Jordan, Tigris and Euphrates), "v*irtual water*" is already a dominating factor in the food supply of the Middle East. The fact is that more water "flows" into the Middle East each year as "*virtual water*" contained in food imports than flows down the Nile into Egypt for agriculture!

An example worth serious review as regards the scope for transfer to other river basin management settings is the Southern Africa Power Pool where seven countries have established interconnections among themselves, thus lessening the vulnerability of energy supplies to the hydrological variability faced by each of the participating countries, and at the same time reducing generation capacity and reserve requirements. This cooperative model is equally interesting from a food security perspective.

As shown above, reforms that remove impediments to food trade and supported by water regime reforms that open up for trade in water use rights can provide substantial macro-economic gains while being distributionally and environmentally benign both nationally and globally. However, political resistance to change must be overcome, and reforms could be facilitated where they are most needed by offering a package of water and sanitation technology and investments along with technical and advisory assistance in preparing and implementing the complementary trade reforms and those needed in the water and sanitation sector for double dividends to materialize and PRSP targets to be reached. Once the concept of "*virtual water*" is adopted and actively integrated into national planning and PRSPs, the population carrying capacities of water scarce countries and regions can be massively increased relative to today's populations without representing a growth constraining factor.

The "Virtual water" approach is equally relevant to local markets in order to enhance effectiveness and achieve "win-win" solution, or expand the "economic pie" to be shared. Again the basic concept is that of "virtual" as opposed to "real" water. What is required is to broaden the perspective from merely focusing on m3 of H2O to the substance or rights to water and the values added that could result from adopting this broader strategic approach. With this approach, water can be allocated among competing uses to those activities that provides for the largest value added from using the water. The key to this way of viewing water as a resource is always to think in terms of the value of water in alternative uses and allocated it maximum value added. Once this is achieved, one could – if there is will and ability to do so – reallocate the gains so that all parties stand to win by this option compared to the old set of alternative water uses. The surplus may then be used for achieving the water-sector MDGs!

Overall, the challenge is to identify a diverse portfolio of policies and investments to strengthen the economies to become more resilient to the risks of variability. Strategies might include improving water resources management such as promoting conservation and efficiency gains, e.g. demand management, and developing source and storage solutions, putting more emphasis on food and energy security (the capacity to secure a food and energy supply through trade or production) rather than food and energy self-sufficiency (producing in-country all the food and energy needed), encouraging trade and agricultural production patterns that are less vulnerable to variability, and seeking employment and growth in less water-dependent sectors.

## 13.6. Water and the poor: Equity and efficiency hand in hand

It is now well established that the poor are the least likely to have reliable service or access to new water connections and sanitary services, e.g. World Bank (2002, 2002a, 2003, 2003a, 2003b) and UNWWDR(2003). Instead, the poor continue depend on traditional sources of supply, which are often afflicted by declining access and quality. The latter caused by contamination from poor sanitation and industrial effluents.

Not only do the poor have the least reliable and accessible service of public water, they also end up paying much more than the rich and the not so poor. The reason is simply that public water supplies do not reach the poor. This is typical in many poor urban areas and squatter areas in metropolitan areas in developing countries where public water is so heavily subsidized so that there is no revenue for the maintenance of a reliable supply to poor areas of the network. Short of cheap public water, the poor end up captive to water vendors as their only supplier. These water vendors charge as much as ten or twenty times or more than the public charges for those with connections (for water which the poor cannot access). Studies have found these excess cost ratios hurting the poor to be as high as 20 in Ecuador, 16 in Peru, 10 in Columbia and Turkey and 5 in Ivory Coast, see World Bank (2002) and UNWWDR (2003).

The budget share for water across income groups is declining, thus reflecting that water is a basic necessity, see e.g. Hansen et al (2002). In one of the poorest areas of China, it was found that most rural households do not pay for water at all, and those who pay, only use 0.4% of their budget for water. In urban areas where most households have access and pay for water, the budget share is also very low. If a water tariff increase were to take place, the distribution effect would indeed be somewhat regressive, but at the same time, the public utility would be able to provide a much more reliable and higher quality water delivery service, which may well be of great value to the poor, and worth the extra cost to them.

It is therefore fundamentally untrue to claim that the poor cannot afford to pay the costs of public water supply if it were to be extended to their residential areas. The main obstacle to extending such networks is often that the residents are squatters or others without formal ownership or lease rights to the land the live on, or that real estate owners have plans to remove the poor and develop the land for other more profitable purposes. The main excuse, however, has often been that for social and welfare reasons one cannot afford to extend the public networks to where the poor live, because cannot afford to pay the cost of water supply. Considering the real world alternative these residents actually face and have to adapt to, they would be more than happy to pay the full cost of the water they need, but the relevant authorities should be imaginative about modes of financing and paying for water to residents in such areas so as to simultaneously secure both equity and efficiency in the water market. In fact, if already connected consumers in the richer parts of the community were to pay the full cost of their water, experience from many developing country cities has shown that overall water for consumption could drop by as much as 20% and waste of freshwater would also be significantly reduced. Both effects would free up public resources, which could be reallocated in accordance with the country's PRSP, and at the same time it would be an environmentally benign measure.

Detailed reviews of the efficiency and equity experience with alternative ways of generating public sector resources to finance sustainable infrastructure development, including water and sanitation is found in the Pagiola et al (2002). Incentives to promote reforms, leverage resources and improve targeting with regard to water supply and sanitation is discussed in detail in Mehta (2003).

## 13.7. Community-managed Urban Sanitation: Scaling- up of 'Islands of Success'

Although a number of community–managed urban sanitation programs have provided services to a few millions, there is an urgent need to scale-up these efforts to meet the MDG goals of meeting the demands for over one billion residents in cities and towns. Such 'scaling-up' would require actions at a number of levels in the international organizations and central and local governments in developing countries.

First and foremost is to recognize that the financing needs for meeting the MDGs for adequate urban sanitation (to more than one billion urban residents) are likely to be much more than estimated for providing improved sanitation. Governments, local bodies, international lending institutions and bilateral aid agencies have to understand and accept that far greater funds are required for meeting the MDGs than the resources available in the past.
Governments and local bodies should consider additional taxes on water use and/ or property taxes that are specifically marked and allocated to provisioning of sanitation services to the poor. Financing for sanitation will require special funding provisions as well as providing sufficient funds through poverty reduction support credits (PRSC).

Second, additional financial resources have to be raised through financing mechanisms for leveraging resources through private sector participation and/or through greater community resources. The design of financing mechanisms for leveraging resources while linking with domestic credit markets would require emphasis on risk management and partial risk guarantee framework; funding for project preparation and implementation and resources for efficient management (see Mehta (2003).

Third, the greatest challenge for community sanitation systems has been low tariffs, generating revenues that are too low for cost recovery and financial sustainability of existing or new services. Targeted subsidies are required to provide access to and use of sanitation facilities by the poor. Such subsidies are in the nature of capital cost sharing or per capita ceilings on basic services. Cross-subsidization or direct support from the local governments may be helpful in some cases. From the experience of many projects, it is important to recognize that cost recovery and subsidy rules must be set in a clear and transparent manner.

Fourth, for the governments to provide legal and institutional support to a number of NGOs who are assisting communities in providing sanitation services. For a long-term sustainability of investments in urban sanitation, the community schemes have to raise revenues from users who are too poor to contribute enough to cover even the O&M costs. Other sources of revenues have to be found to meet O&M costs and a part of the capital costs. For example, in India, NGOs assisting communities can raise revenues from their toilet complexes by renting space or selling biogas and thus reduce their dependence on government funds and subsidies. However, this will require changes in policies and regulations for NGOs and funding organizations such as the municipalities or international donors/banks. If necessary, new organizational forms should be promoted that involve communities in planning and supervision and at the same time provide sustainable management accountable to the communities. Further, it is imperative to enable these NGOs, or to create new organizations, to raise financial resources from the market or financing institutions.

Fifth, though there are claims for a number of success stories or 'islands of success' or 'good practice' cases in community-managed water and sanitation systems, the available

documentation is rather inadequate in providing data on coverage (i.e. number of people benefited), methods of financing, financial viability, sources of revenues, cost recovery etc. It is imperative that a detailed evaluation study of these experiences (including those that did not succeed) is carried out that provides necessary data on financial aspects and on how to scale-up both over time (financial sustainability) and over space (new regions/areas)

## 13.8. The politicians: Both the main obstacle and the solution

All of the above coping activities require political commitment and decisions. The political leadership at local, national and international levels is at the same time the main obstacle and the solution to the successful achievement of the MDGs.

An important instrument for the low-income developing countries in the strive to succeed here is their development of and commitment to national poverty reduction strategies (PRSPs) in the developing countries. Much technical assistance from donor agencies is now directed to accelerate this process. This process provides a promising mechanism for incorporating the fight against disease by means of improved water and sanitation into a more comprehensive development strategy, because it impels governments and civil society to look across a range of policies in the closely interlinked fields of health, education, water and sanitation, environmental management, gender relation, and other areas to tailor-make the most effective and equitable national solutions. For example, safe water and sanitation, backed by proper hygienic behaviour such as hand washing and the use of soap, could dramatically reduce the incidence of many diarrheal and other waterborne diseases that kill millions of children each year. At the same time, it is well known that such behavioural change require literate mothers, and this again means a dramatically increased emphasis on the education of children in general and girls in particular.

Two deeply concerning observations emerge in this context. The first is that very few national PRSPs prepared so far actually identify, target and make significantly increased commitments to such actions as priority issues. Second, the local capacity to undertake and implement the PRSPs is not at all in place, and the PRSPs do not explicitly make commitments to appropriately deal with this shortcoming. As a result, the likelihood of achieving the MDGs becomes small. Clearly, the politicians bear the responsibility for the outcome.

There should be no shortage of information and “best case” example to convince politicians of what works and what does not in different settings. However, politicians understand that re-election depends in many cases on their having “delivered” something to their constituents in general, or interest groups they are aligned with. Consequently, there is enormous immediate political value in keeping water prices and the direct fees associated with other water services (e.g. sewer connection fees) as low as possible. This political setting characteristic and its practical “no reform” outcome are at the core of the obstacles to reaching the MDGs, and has to addressed in the open if such societies are to find a way to solve the problem of under funded and under performing water systems, see Moss et al (2003).

The poor seldom have much say in such development debates. In fact, the poor are rather invisible and often end up with no more than lip service, such as promises of water free of charge, which always turns out to be a non-performing promise.

Politicians, however, eager to contribute to reaching the MDGs, should seek popularity in order to be re-elected, by carefully preparing an agenda focusing on the fact that the poor are

willing and able to pay the full price of water, simply because the real world alternative they face is so much worse! The decision makers should carefully prepare such projects so as to convincingly show that the distorted, subsidized prevailing alternatives are ineffective, inefficient and non-sustainable. Some of the water charge revenues recovered with such a program could even be used to compensate some of the richer water users who now have to pay much more, simply to facilitate their transition to the new water price regime, and perhaps find out that the reform is of a win-win nature.

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