



**Building Water Infrastructure for Sustainable
Development – Innovative Partnerships**

Address by:

Abel Mejia
Sector Manager, Water Department
The World Bank

ASCE International Roundtable Discussion

Meetings of the

American Society of Civil Engineers
Annual Civil Engineering Conference

Thursday November 1, 2007
8:30 am to 12:00 pm
Great Hall West
Buena Vista Palace Hotel

-CHECK AGAINST DELIVERY-

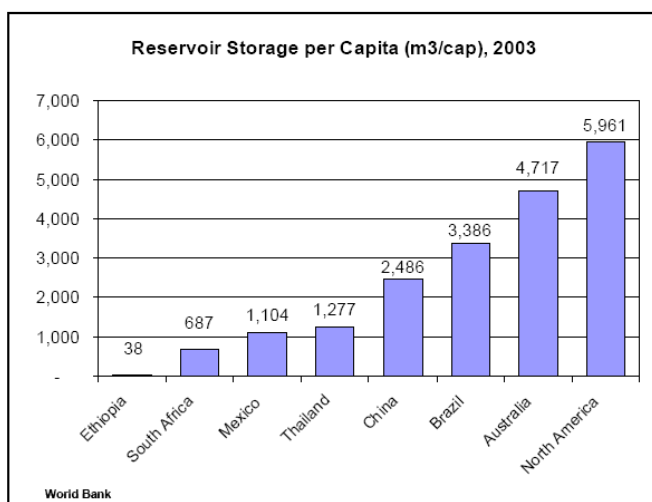
Buena Vista Palace Hotel
1900 Buena Vista Drive, Lake Buena Vista, Florida 32830-2206 USA
Reservations: 1 866 397 6516

Water Infrastructure for Sustainable Development

This paper document has been prepared by the World Bank Water Anchor staff to facilitate discussion at the International Roundtable on Building Water Infrastructure for Sustainable Development, ASCE Annual Conference, October 31 – November 1, 2007, Orlando, Florida, USA. The findings, interpretations, and conclusions expressed herein do not necessarily reflect the views of the IBRD/The World Bank and its affiliated organizations, or those of the Executive Directors of The World Bank or the governments they represent.

1. Introduction and Context

Water has historically played a strong role in the economic and cultural development of many great civilizations. More than ever before this continues to be the case in the twenty-first century as we witness the critical nature of water resources in developed and developing nations alike. What is unique about water in this time, however, is the disparate influence that it respectively plays in industrialized nations of North America and Western Europe, and other transitional economies found in Africa, South Asia, and Latin America. While developed nations are characterized by impressive stocks of large scale water infrastructure, the reverse is true for developing nations where there are significant shortcomings in the physical capital required for water management. This is clearly exemplified by the divergence in reservoir storage per capita between wealthy and poorer countries. While North America leads per capita storage at 5,961 cubic meters, Ethiopia's storage capacity is less than one percent (0.63%) of this at only 38 cubic meters.



Investments in water development and management remain an urgent priority in many developing countries today. In some – often the poorest – the challenge of managing their water legacy is almost without precedent. In addition to these existing challenges, the impact and implications of climate change on the variability and availability of water resources will be disproportionately felt in developing countries that lack the infrastructural capacity to cope.

Yet, if these challenges are not met in a systematic and measured way, the targets of sustainable growth and poverty alleviation cannot be achieved as agreed under the 2001 Millennium Development Goals.

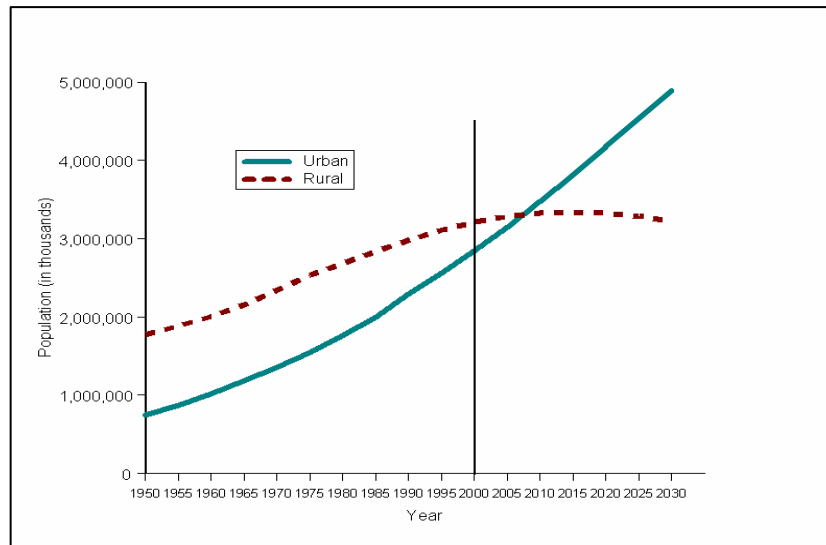
This paper attempts to enhance the discussion and strengthen the understanding of the relationship between water resources management and development¹ in enabling

¹ The term "water resources management" is understood here to include both the management and development of water resources; this appears not to be a widely understood meaning. Water resources development refers explicitly to investments that control and deliver water resources.

responsible economic growth and poverty alleviation – fully mindful of the fact that water infrastructure is just one of many aspects that must be weighed and understood in managing water resources.

2. Challenges to Delivering Water to the Poor

It is known that the lion's share of population growth in the developing world is projected to occur in urban areas and the bulk of new households requiring water services will reside in urban settings. It is projected, for example, that by 2030 some 4.9 billion people will live in cities while rural populations will decline by 30 million.



World Population growth 1950 – 2030
(source: National Research Council Panel on Urban Population Dynamics)

Directly related to this urban growth, however, is the expansion of informal low-income settlements which now house up to 70% cities population in the developing world. Much needed attention must also be given to smaller cities as national governments increasingly decentralize and transfer responsibilities for services and tax revenue to local authorities. A core challenge that must be addressed to allow for effective service delivery in both large and small-medium size cities is the lack of land rights and lack of effective 'voice' for the poor to articulate their needs.

The perception is that the development banks are not always effective in delivering water services to the poor. Why is this and how can engineers help?

These conditions present a variety of challenges in delivering water to the poor and span both upstream and downstream issues, encompassing the spectrum of water storage and regulation, hydropower, irrigation and drainage, in addition to water supply and sanitation, environmental flows, wetlands, etc.

With ever increasing demands on the world's surface and *groundwater* resources in many countries, there are significant impacts on aquifers due to inadequately-regulated and managed groundwater pumping and/or pollution from urbanization, industrial development, agricultural activities, and mining enterprises.

Irrigated areas in developing countries have doubled over the past 40 years and irrigated yields have risen two to fourfold. Although the pace of irrigation expansion is slowing, the

contribution of irrigated agriculture is expected to increase and supply close to 60 percent of world food demand over the next 25 years. Meeting these demands given rising constraints to water availability, competition for limited water from other sectors, and environmental pressures requires increasing the productivity of water—that is, gaining more yield and value out of each unit of water.

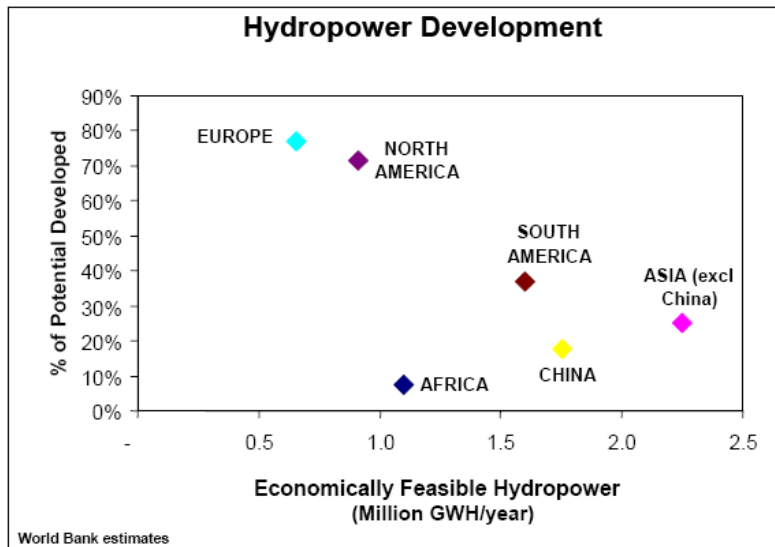
Turning to *water supply and sanitation*, it is known that 1 billion poor people lack access to safe water supply and 2.6 billion are without basic sanitation. Some of the challenges include that the poor already pay a high price for water and are disproportionately affected by poor utility performance. To this extent, the World Bank is working with utilities to develop innovative ways to address the constraints to service provision in low-income areas. What is clear is that providing better WSS services to the urban poor requires concerted action within broader citywide initiatives.

In light of the global move to sustainable development, do large scale infrastructure projects still play a catalytic role in a country's economic development? What are the alternatives?

Hydropower provides about 20 percent of the world's electricity, and 90 percent of all electricity generated by renewable sources. While approximately 70 percent of hydro potential has been harnessed in Europe and North America, only about 20 percent has been tapped in the developing world. Given the considerable untapped potential in developing countries, failure to scale up the hydropower option has risks and costs that cannot be ignored. At present, 1.6 billion people worldwide do not have basic electricity service, with access rates falling as low as 3% in some African countries.

Large scale water infrastructure, such as dams, reservoirs, and canals, are integral to water storage for various uses such as drinking, irrigation, and hydropower. At the same time, these structures control floods and maintain stream flows. The benefits accrued from such infrastructure increases the reliability of water services that underpin economic production, encourage investment, and spur growth. Yet such infrastructure is often highly inadequate, not maintained or non-existent in many developing countries and impinges on their ability to improve services to both urban and rural populations.

The risk of natural disasters plays an important role in the vulnerability of developing countries. Flooding, in particular, affects more people worldwide than any other form of natural hazard and has an important impact on the social, economic and environmental conditions in many developing countries. The impact of flooding is often times most severe on those people dependent on agriculture for their livelihoods, which amounts to nearly 75% of the 1.3 billion people living on less than \$1 per day.



Yet experience in the broader infrastructure sector shows that the private sector alone cannot meet funding needs nor is it positioned to fully manage regional implications and the complex opportunities and externalities of hydropower development.

3. Looking towards 2015

It is known that over 1 billion poor people lack access to safe water supply and 2.6 billion are without basic sanitation. Although the world is on track to reach the MDG drinking water target of halving the fraction without access to an improved source by 2015, there are large regional and intra regional disparities. Furthermore, at the current rate of investments, the world will not reach the MDG sanitation target by more than half a billion people: access to improved sanitation has increased from 37 percent in 1990 to 52 percent in 2004; whilst the goal is 69 percent coverage by 2015.

Increasing access to water supply and sanitation is more than just installing pipes, pumps, and toilets. To be sustainable, good policies, accountable and capable institutions, and special attention to reach the poor are required.

If the global community is to successfully overcome these challenges and attain the objectives prescribed under the Millennium Development Goals (MDG) as was committed at the Johannesburg Summit in 2001, a more concerted, concentrated and collective effort must be put in motion. With multiple countries in South Asia and Africa currently not on track to reach the MDG targets and plans that often only exist as documents that are neither country-owned nor actively implemented, the World Bank's strategy for the water sector highlights three priority actions:

- Focusing the Bank's Business. Priority in five areas: extending WSS services to the poor; improving operator performance; increasing rural access to sustainable WSS; better management of the water resource base, and expansion of irrigated land.
- Improving the development impact. Use a mix of lending and non-lending instruments to improve governance, ensuring financing sustainability, improving service delivery, targeting interventions to the poor, and improving health outcomes.
- Coordination of Development Assistance. Progress in expanding access and improving the quality of water supply and sanitation services requires action across the Bank; and with partners at the country, regional and global levels.

4. Water, Poverty, and Growth

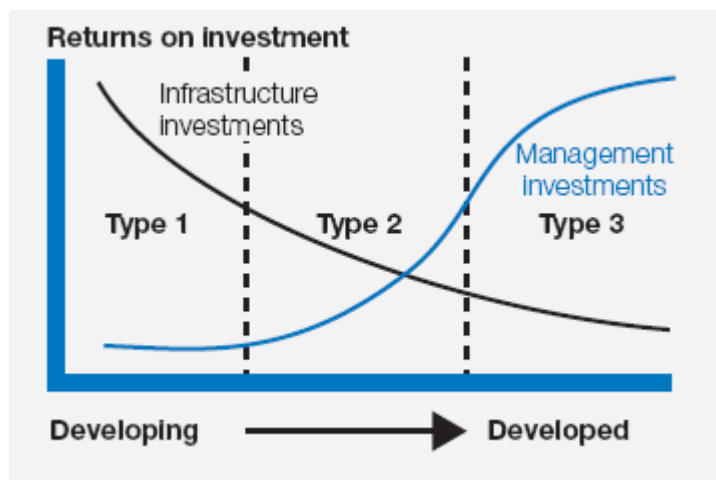
Learning from Experience

It is important to underscore that the development of hydraulic structures necessary for service delivery, growth and poverty alleviation are frequently complex, and highly dependent upon specific physical, cultural, political and economic circumstances.

In the early 1990s the World Bank strongly supported the expectation that private investment would help to improve infrastructure services in the developing world. Over the course of the decade, private investment in infrastructure did expand but was concentrated in selected countries, before peaking in 1997 and entering in a period of steady decline. Since 2001, annual investment commitments from private operators have been between US\$1 to US\$2 billion a year. This is well below the peak level of the late 1990s. Nonetheless levels of private investment have gradually increased, but there remains a growing infrastructure investment gap across many developing countries. With growing demands from its client countries as a result of this the World Bank has since re-engaged in infrastructure investments.

In light of these processes a great deal of controversy has grown around water infrastructure development, and particularly large-scale water infrastructure. Although there are important social and environmental factors that must be carefully weighed in water resources infrastructure development to ensure successful project structuring and implementation, certain interest groups have taken the position that water resources infrastructure development is bad for the poor, for project-affected people and for the environment.

Contrary to these perspectives there is a growing consensus that water investments provide a wide range of productive opportunities for agriculture, hydropower and industry, and can be seen as drivers of growth. Water resources management and development can also serve to protect societies from the destructive impacts of water, and meet basic human needs for sanitation, hygiene and household uses that are essential for poverty alleviation.



Rates of return on investment by development of water infrastructure.
Source: World Bank, 2003.

If properly conceived, structured and implemented there is no fundamental constraint to designing water investments that ensure local communities and the environment share real and early benefits while still allowing the economy and society at-large to benefit from the growth made possible by these investments. The great challenge that has so often gone unmet is to understand fully the range of costs, benefits, rights and responsibilities across all stakeholder groups, and to identify, design and implement

projects that deliver their desired results.

This will be reliant on the idea of a minimum platform of water infrastructure and institutions which are central to water security. Below a minimum platform, a society is vulnerable to water-related shocks and therefore water is an obstacle to growth. But when a minimum platform has been achieved, a society is sufficiently resilient to shocks and water strongly underpins, rather than undermines, economic growth. What is clear is that the proper balance and sequencing of investments will be dynamic and highly context-specific across regions and countries,² and getting this balance right will be crucial for moving towards the growth agenda and sustaining growth that may be hampered by hydrology. This is exemplified in the above graph with the 'S Curve', depicting a 'tipping point' at which time appropriate investment requires moving away from infrastructure and towards management reforms. These are associated with different types of investments in water, which respectively play an important role in moving a nation along the 'S Curve'. The table below details the differences in investment types that a nation may opt for as it moves away from physical infrastructure and towards water service delivery reforms.

When is investment in capacity building more important than the physical project?

		Nature of Intervention	
		Broad	Poverty-targeted
Affecting water	Resources, development and management	Type 1 Broad regionwide water resource interventions For example, multipurpose river basin development and aquifer management	Type 2 Targeted water resource interventions For example, watershed management in degraded areas with poor farmers
	Service delivery	Type 3 Broad Impacts through water service delivery reforms For example, reform of water supply utilities and water user associations for irrigation management	Type 4 Targeted improved water services For example, rural water supply and sanitation projects

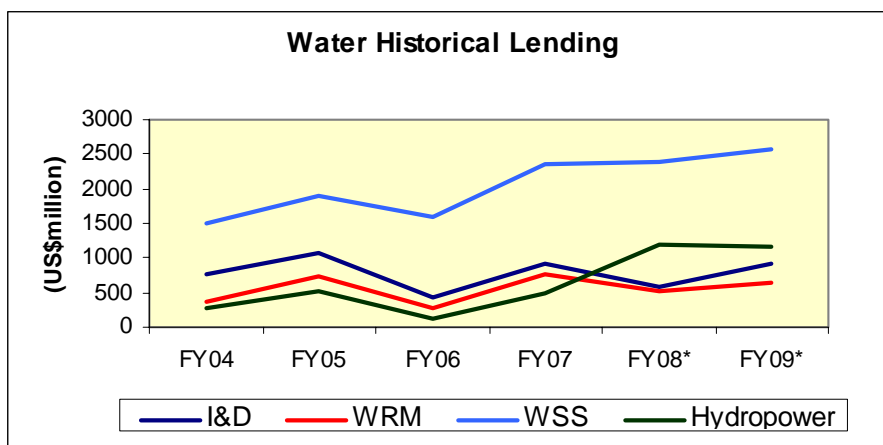
Source: World Bank, 2003.

5. The World Bank's Investment Portfolio in Water

The water portfolio includes investments in water resources management, the environment, water supply and sanitation services, irrigation and hydropower. It also supports improved management through enhancing technical knowledge, building institutions and nurturing government policies.

As the largest external financier in the water supply and sanitation (WSS) and irrigation sectors in developing countries the World Bank's current WSS project portfolio is US\$8.5 billion, the irrigation portfolio is US\$4.2 billion, while the total amount of WBG support of hydropower and hydropower-related project components that is currently active is US\$3.15 billion.

² SIWI,2005a.



The highest levels of investments are found in the water supply and sanitation sector where some US\$2.3 billion was invested over the past year, followed by US\$778 million in water resources management and US\$912 million in irrigation and drainage. While Africa and East Asia are the two primary regions in which WSS investments are made, Eastern Europe and Central Asia lead in water resource management lending, and South Asia for irrigation and drainage. What is increasingly apparent is the need to scale up investments in not only hydropower but also to place strong emphasis on expanding current irrigation development in Africa.

Is money the only obstacle to delivering clean water to the poor?

While the World Bank continues to expand its portfolio in water, it is important to place the institution's contributions to the sector within the global context. The Global Water Partnership, for example, estimates that US\$75 billion is invested in water resources in developing countries each year. In order to create water security this amount should increase to US\$180 billion per year. And while the World Bank is the largest external financier in the water sector, lending for water-related projects over the past five years averaged \$3.5 billion, which represents 16 percent of the total World Bank's lending.

6. Hindrances to Growth: Corruption in the Water Sector

It a recent study, the financial costs of corruption in infrastructure maintenance and investments have been estimated to be US\$18 billion per year (Kenny, 2006). More specifically, World Bank estimates indicate that 20-40% of global water sector finances are lost to corruption. This will translate into approximately US\$20 billion in lost development finances over the coming decade that should be utilized to increase access to improved water and sanitation services.

Recent studies, done by the World Bank administered Water and Sanitation Program (WSP), show just how significant corruption can be in diverting resources. In a survey in South Asia, 41% of customers reported having paid a bribe to utility staff during the last six months to get a falsified consumption reading, while 20% of households with illegal connections admitted that they were paying bribes on a regular basis to utility staff. Conversely, Estache and Kouassi concluded from a study of 21 water companies in Africa that nearly two-thirds of their operating costs were due to corruption.

Despite these alarming figures, corruption in the water sector has only recently begun to receive due attention and preliminary analysis of impact, but compared to other sectors the issue still remains outside the focus of sufficient levels of policy dialogue.

In response, the World Bank has begun to take its anti-corruption and pro-good-governance work to the sector level. In particular, it is now working to develop tools to help its staff working in the water and sanitation sector to detect and prevent corruption—not just by addressing national- and project-level issues, which have been the past focus of most World Bank anti-corruption efforts—but by addressing sector-level issues.

For example, several of the most recent studies and activities include; i) an assessment of mechanisms of consumer accountability which examines the degree to which urban utilities are answerable to their customers for their performance, the use of resources, and policy decisions; ii) a scoping study of how the World Bank can better engage with civil society organizations throughout the project cycle to improve delivery of water and sanitation services; and iii) the development of a unique on-line tool – International Benchmarking Network for Water and Sanitation Utilities (IBNET) which provides the opportunity for local benchmarking initiatives to undertake international comparisons.

Water Fits the Definition where Corruption Flourishes Best

In his widely cited formula, Klitgaard (1988) points to the importance of monopoly power:

$$\text{Corruption (C)} = \text{Monopoly (M)} + \text{Discretion (D)} - \text{Transparency (T)}$$

The conditions in which corruption flourishes are often exacerbated by a lack of checks and balances. This results in insufficient accountability mechanisms characterized by institutional weaknesses in both public and private water utilities and regulators responsible for sectoral oversight.

One of the most prominent issues that may hinder the potential development of the water sector is that of procurement and tendering. The unclear or non-existent division of responsibilities for formulation of procurement policy, monitoring of compliance, and development and enforcement of sanctions in addition to insufficient levels of capacity and salary in staff responsible for tendering committees or bill collection, for example, combine to create environments in which improper influence may be exerted.

The engineering professional community and the World Bank have been pressing the anti-corruption agenda for several years. What are the specific issues related to water projects?

In light of the diverse country conditions in which project development takes place, standardization of materials, technical specifications, and required quantities is problematic. To this extent, corruption has multiple entry points and has many faces. Some commonly noted practices are:

- Creating excessive barriers to entry that deter multiple bids
- Including unnecessary elements in planning and cost estimates;
- Skewing bid specifications to favor particular contractors;
- Building into the tender the necessity to renegotiate the contract; and
- Executing substandard quality work, or falsifying claims at the expense of project durability
- Falsifying bids and quotations
- Bid rigging or collusion among contractors
- Non-adherence to project specifications.

All of these factors are non-exclusive but mutually reinforcing and make the water sector particularly prone to corruption. Importantly, corruption inhibits the sustainable development of the sector because heavy damage accumulates over time and disproportionately affects the poor. The resulting consequence of these factors is all too

often unmanageable increases in operation and maintenance costs of providing given levels of services.

Corruption in the water sector not only undermines the delivery and performance of the water supply and sanitation systems but also discourages the much needed investments in key areas that I previously discussed. It decreases both government and water utilities' revenues, and results in ever increasing amounts of resources being required to address the cumulative damage that settles in on water infrastructure over time.

7. Climate Change and Adaptation

Even when investments in institutions and infrastructure are properly designed and implemented, the hydrological variability and extremes that are associated with climate change are increasingly at the heart of the challenge of achieving basic water security. The impact on the water cycle, water availability, and water allocation at the global, regional, basin, and even local level will influence both the supply and demand of water resources, and the associated infrastructure and could have substantial impacts on economic and human health.

As the quantity and patterns of water availability shift, strategies and guidelines for mainstreaming adaptation to climate change into project design will be of high importance. This will particularly be the case in poor countries which lack the institutions and infrastructure to manage, store and deliver their water resources, and where climate change will be superimposed on existing, and in some cases extreme, vulnerabilities. In many of the poorest countries, particularly in Sub-Saharan Africa, the current unmanaged levels of climate variability are many times greater than predicted climate change. While many developed countries are focusing on mitigating climate change, developing countries are more focused on adaptation to current climate variability.³ In all cases, however, adaptive capacity – both social and physical – will need to be enhanced to protect the poorest and most vulnerable populations.

The principal lessons from the experience of industrial countries are, first, that infrastructure (dams, levies and canals) is critical, and, second, that infrastructure investments need to be complemented by previously neglected nonstructural investments (in watershed management, land use planning and information, and systems management, for example). The emphasis in infrastructure-rich industrial countries is now heavily and appropriately focused on nonstructural solutions. Developing countries face three major challenges. The first is that many have stocks of water infrastructure that are much smaller than those of climatically similar industrial countries. There are, accordingly, major needs for priority water infrastructure to be developed following best practice, from a technical, economic, social and environmental perspective. Hydropower, for example can, in principle, make a major contribution to reducing the greenhouse gas intensity of energy production.

Perhaps the most difficult challenge to overcome is that there is uncertainty about the implications of climate change and its influence on diverse geographic locations. To this extent the World Bank is working to link hydrologic variability and climate change to sector investments based on strategic analysis and research.

³ Such differing perspectives have been explored by Falkenmark (2000) "It could be that the developed countries are more likely to think of environment and security in terms of global environmental changes, and developing countries more with the human security implications of local and regional problems."

Proposed Investment Adaptations to Climate Change in the Water Sector

Water Storage:

- Create alternative water supply and storage
- Improve water supply infrastructure
- Enhance natural storage capacity – aquifer recharge

Water Quality:

- Expand water treatment infrastructure
- Establish water purification programs

Water Utilization

- Improve irrigation technology – drip irrigation, rainwater harvesting
- Enhance hydropower capacity

8. Water Investment and International Financing/Aid

Lack of recognition of the significance of water investment has serious consequences and as discussed, hydrological variability will influence poor and wealthy countries alike and require tailored responses. For example, the American Water Resources Association (AWRA) noted in a 2005 letter to the President⁴ that *'recent droughts have resulted in annual losses of over US\$5 billion and drought mitigation planning is moving slowly'*. Elsewhere references are made to annual damages associated with flooding reaching US\$6 billion, and that the ASCE *'continues to give sub-standard grades to (the) aging infrastructure'*. In 2007, AWRA cited other related challenges facing the United States including: increasing demands for municipal and industrial water supply; ports and waterways operating at the margin; loss of critical wetlands; miles of rivers that do not meet water quality standards; impaired coastal waters and estuarine areas; major infrastructure renewal shortfalls; and, continuing conflicts over water use⁵.

In its letter, AWRA succinctly captured the fact that the focus of industrial countries is correctly on water management, infrastructure rehabilitation and operations, not on water *development* in light of existing infrastructure. In the case of the U.S., after trillions of dollars have been spent on hydraulic infrastructure investment, some \$21 billion per year will be spent over the next ten years to reach US environmental standards. Clearly, the priority focus of the most developed countries can differ from those of the least developed. The result of this given the controversy that often accompanies infrastructure investments, is that little appetite is left among aid policy makers for supporting major water resources infrastructure development in poor countries and tackling the unavoidable tradeoffs that this entails. Opposition, particularly to the financing of dams for storage, hydropower or other purposes, is strongly advocated by many (often western) lobby groups, some of which have access to substantial financial support and can therefore have significant political impact on the aid policies of donor governments and international organizations.

Yet there is very little discussion of the growth and poverty implications of diminished support for water infrastructure in poor countries – in particular of the costs of inaction – and of the moral hazard this entails for donor countries. The debate would benefit greatly from a better understanding of how developed countries have dealt with hydrological vulnerability, and how they have used strategic investments in water infrastructure to

⁴ AWRA, 2005.

⁵ AWRA, 2007

reduce risk, alleviate poverty and catalyze growth. Reliable aggregate data on how developing countries have financed infrastructure investments, however, is not readily available. It would appear that most of the investments in infrastructure in developing countries have been publicly funded, at about 70% of current total spending. The private sector contributes roughly about 20%, while international development assistance finances only around 10%⁶.

The inevitable trade-offs involved in water development cannot be thoroughly assessed without an examination of the potential benefits of growth and poverty alleviation that can be derived from well-designed and well-managed water infrastructure. The lessons learned from these experiences will help inform discussions of feasible alternative paths for water development that maximize benefits while minimizing environmental and social disruption, and safeguarding the interests of project-affected communities in particular.

At the same time, poor countries must not see infrastructure alone as a panacea. Without the development of appropriate water institutions, badly-managed infrastructure will likely not support growth; it (and its associated debt) may even forestall growth. The world is a different place in the 21st Century, and there is no doubt that the costly mistakes of the past can and must be avoided in the future. Water infrastructure, though essential, can and must be developed in parallel with sound institutions and with great attention to the environment and to equitable sharing of benefits and costs. And it can and must be robust and flexible, designed to allow its operation to adapt to changing values and priorities.

9. Conclusions

In an increasingly globalizing world, there are pressures on developing country institutions to adopt developed country priorities and standards. Within this dynamic, however, the immediate and often extreme growth and poverty challenges faced by developing countries may not be fully acknowledged. At the same time, developing countries may not fully appreciate how greatly their values and priorities are likely to shift with growth, and therefore do not recognize this in their planning. Hydraulic infrastructure is characterized by its longevity and by its broad impact on the environments and societies in which it is built. Hamilton and Johnson⁷ point out that much of the infrastructure built in the next 20 years will still be with us in 2050, and that some choices are irreversible or can be reversed only with great difficulty. In virtually all developing countries, demand for water, food and power continues to grow and there is no question that hydraulic infrastructure is needed.

Herein lies the challenge. Can the lessons of developed countries, enhanced by local and indigenous knowledge, provide insights into alternative management strategies and infrastructure designs and operations – or alternatives to infrastructure altogether – that still achieve water security, growth and poverty alleviation but have lower environmental and social impacts? Scale, site selection and operational characteristics need to be assessed from a long-term planning perspective, incorporating anticipated trends and emphasizing adaptability. This will ensure that future generations inherit

Engineering societies have developed policy statements with respect to water, capacity building, and sustainable development. How might these be more directly aligned with those of the Bank?

⁶ World Bank, 2007.

⁷ Hamilton and Johnson, 2004.

institutions and infrastructure that can readily adapt to their evolving values. While no radical alternatives present themselves to the difficult task of managing and developing water resources through an evolving balance of institutions and infrastructure, there has been a steady process of learning and innovation that provides numerous lessons for following this basic path in a more sustainable and balanced way.

Professional societies such as ASCE can provide a forum for discussion of issues related to water infrastructure, growth, and sustainable development among the engineering, the environmental, and the financial communities. They can also facilitate discussion with the policy makers and build awareness among the various stakeholders.

Perhaps the most effective role the society can play in this regard is to help better prepare the engineering community, particularly the next generation of professionals to address the water and infrastructure challenges faced by the global community.

Professional organizations such as ASCE are therefore in a unique position to facilitate compilation, evaluation, and transfer of the water infrastructure experience for sustainable growth and development.

How can engineers work cooperatively with the Bank, what are the specific activities over a 3 to 5 years that would accomplish this program – innovative project approaches, interactive workshops, professional exchanges?

10. Bibliography

- American Water Resources Association. 2005. Letter to the President. Accessed on September 14, 2007 from http://www.awra.org/meetings/Tucson2005/Presidents_Letter.pdf
- American Water Resources Association. 2007. Nation Faces Growing and Severe Water Challenges - Government Must Act. Accessed on September 21, 2007 from http://www.awra.org/news/0702_2press_release.pdf
- Brown, Casey and Upmanu Lall. 2006. "Water and Economic Development: The Role of Interannual Variability and a Framework for Resilience." International Research Institute for Climate Prediction, Working Paper.
- Emerton, Lucy and Elroy Bos. 2004. Value: Counting Ecosystems as Water Infrastructure. Gland: IUCN.
- European Community. "2000. Directive 2000/60/EC of the European Parliament and of the Council." Official Journal of the European Communities, L 327/1-72. .
- Falkenmark, M. 2000. Water Security for Multinational Water Systems - Opportunity for Development. Stockholm International Water Institute (SIWI) Seminar, Stockholm, August 19, 2000.
- Hamilton, Kirk and Ian Johnson. 2004. "Responsible Growth to 2050." World Economics, Vol 5, No. 4.
- Hirji, R. and H.O.Ibrekk. 2001. Environmental and Water Resources Management, Environment Strategy Paper No. 2, Washington, DSC, World Bank.
- Intergovernmental Panel on Climate Change (2007). *Climate Change 2007: Adaptation and vulnerability*. Geneva: IPCC Secretariat
- Klitgaard, R. (1998). Controlling Corruption. Berkeley, CA, University of California Press.
- Miller, Barbara and Richard B. Reidinger, eds. 1998. "Comprehensive River Basin Development: The Tennessee Valley Authority" World Bank Technical Paper #416. Washington, D.C.: The World Bank.
- SIWI, 2005a. Driving Development by Investing in Water and Sanitation, Stockholm, Stockholm International Water Institute (SIWI)
- SIWI, 2005b. Securing Sanitation: The Compelling Case to Address the Crisis, Stockholm, Stockholm International Water Institute (SIWI)
- Sperling, F. (ed.), 2003. Poverty and Climate Change: Reducing the Vulnerability of the Poor through Adaptation. Inter-agency report by the AfDB, ADB, DFID, UK, BMZ, Germany, DGIS, The Netherlands, OECD, UNDP, UNEP, and the World Bank.
- Stålgren, P. 2006. Corruption in the Water Sector: Causes, Consequences and Potential Reform. Swedish Water House Policy Brief Nr. 4. SIWI,
- Stockholm International Water Institute. 2005. "Making Water a Part of Economic Development: The Economic Benefits of Improved Water Management Services." A report commissioned by the Governments of Norway and Sweden as input to the Commission on Sustainable Development.
- World Bank. 2007 (forthcoming). Infrastructure Action Plan. Washington DC: The World Bank
- World Bank. 2006. "Managing Water Resources to Maximize Sustainable Growth: A Country Water Resources Assistance Strategy for Ethiopia".
- World Bank. 2005. *Economic Assessment of Policy Interventions in the Water Sector*. Washington, DC: The World Bank.
- World Bank. 2005. World Development Indicators (WDI). Washington. DC: The World Bank.
- World Bank. 2004. *Responsible Growth for the New Millenium*. Washington, DC: The World Bank.
- World Bank. 2003. Water Resources Sector Strategy. Washington, DC: The World Bank.

- World Commission on Dams. 2000. *Dams and Development: A New Framework for Decision-Making*. The report of the World Commission on Dams. London: Earthscan.
- World Commission on Water. 2000. *A Water Secure World: Vision for Water, Life and the Environment*. Paris.
- WHO-CMO, 2001. *Macroeconomics and Health: Investing in Health for Economic Development*. Report of the Commission on Macroeconomics and Health, Geneva, World Health Organization
- WHO / UNICEF, 2005. *Water for Life: Making it Happen*. Geneva, World Health Organization (WHO)
- Zubair, Ahmed, 2005. BBC World News Website, April 8, 2005, Viewed on 23 November 2005, <http://news.bbc.co.uk/2/hi/south_asia/4425451.stm>
- Zwarteveen, Margreet and Nita Neupane. 1996. Free-Riders or Victims: Women's Nonparticipation in Irrigation Management in Nepal's Chhattis Mauja Irrigation Scheme. *Research Report 7*. Colombo, Sri Lanka : IWMI.