Investing in infrastructure: The value of an IWRM approach

Taking an integrated approach to water development and management can help countries attract financing for infrastructure, get the most benefit from those investments, and ensure their sustainability. It may also reduce the need for additional infrastructure by improving water efficiency. But the popular perception of Integrated Water Resources Management (IWRM) has focused on its management aspects and overlooked its application to water resources development.

IWRM is an approach that considers both 'hard' (infrastructure) and 'soft' (institutional) investments together. Neither hard nor soft is effective alone. Too great a focus on the hard investments can result in infrastructure that cannot be maintained or managed in a way that contributes optimally to economic growth and poverty alleviation. Too great a focus on soft investments can leave populations without essential services or protection from climate variability.

What do we mean by 'water infrastructure'? The term applies to all the physical works that are required throughout the water cycle. This includes structures for water control, abstraction, storage, treatment, conveyance and distribution and on through sanitation, reuse, recycling and disposal. It includes both small-, medium- and large-scale infrastructure serving urban, industrial, agricultural and rural users as well as the natural environment.

Box 1: Five key lessons

- Achieving the Millennium Development Goals, managing water resources to promote economic growth, transforming vulnerable societies into resilient societies—all of these desirable outcomes require appropriate investment in water resource infrastructure.
- Putting an IWRM approach into practice should include any essential infrastructure needed for development. However, hard investments in infrastructure must be coupled with soft institutional investments, including an appropriate policy and legal environment, robust institutions and adequate participation from stakeholders.
- The balance between infrastructure investment and institutional investment is situation-dependent—with the weight of the former being the greatest in low-income countries without much in the way of existing infrastructure, and the latter being the greatest in middle or high income countries that have already invested heavily in infrastructural development.
- Undertake a comprehensive options assessment at each stage of the infrastructure project life cycle from planning, implementation, operation and maintenance through to de-commissioning.
- Take a very long-term view of water resources infrastructure, paying attention to climate variability and change, the dynamic nature of society's values and needs and the time-bound nature of benefits and costs.

Global Water Partnership

Water infrastructure is crucial for many sectors—energy, agriculture, industry, etc.—and for the management of water resources—preventing or mitigating the impacts of floods and drought and coping with existing climatic variability and future climate change. It embraces economic, social and merit goods. Because its benefits and costs are often far-reaching and are not limited to a single sector, water infrastructure planning demands a broad-based, long-term approach that weighs investments in terms of economic efficiency, social equity and environmental sustainability—the three E's of IWRM.

Learning from history

Both how we manage water and how we develop it for human use have social, economic and environmental consequences. The World Commission on Dams and the Comprehensive Assessment of Water Management in Agriculture have shown that a great deal can be learned from the middle-of-last-century boom in large-scale water development—a time when many water infrastructure investments were driven by short-term economic or political imperatives alone.

These investment often had far-reaching negative outcomes for people (most often the poor) and for the environment (and thus for present and future generations). Both the World Commission and the Comprehensive Assessment concluded that we need to change the way we approach decision-making on infrastructure in order to maximize and share benefits while reducing costs. Part of this change involves recognising the very long-term, and hence difficult to enumerate, benefits derived from water infrastructure.

Some other specific areas for change include:

Plan water infrastructure investments within larger and long-term development strategies that include investments in energy, roads, schools and other types of infrastructure as well as reforms in policies and institutions. Taking an integrated long-term view enables planners to combine investments in water infrastructure with investments in other sectors to yield maximum social and economic benefits. To ensure the sustainability of those benefits, it is also important that planners take into account the cumulative long-term effects that infrastructure has on the water resource itself. This type of integrated planning requires inter-ministerial cooperation at the highest national planning levels and capacity building within the institutions that must carry out the analyses and implement the infrastructure.

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Adopt a needs driven approach to infrastructure. This requires integration across seasonal, annual, decadal and longer timescales in order to address climatic variability and change and to recognise the dynamic nature of human needs. It also requires recognising the role of infrastructure in protecting the broader society from risk in relation to floods and droughts.

Undertake comprehensive options assessments for meeting water-related development needs—assessments that weigh technology choices, structural and non-structural options, construction and rehabilitation, and large- to small-scale infrastructure. Assess the social, economic and environmental impacts of each option and define selection criteria.

Consider the full extent of infrastructure life-cycle costs (social, economic, environmental) *and* benefits and their distribution among different segments of society (equity). The core development focus is on livelihoods, sharing benefits, and the maintenance of environmental services. This often requires improving policies, legal requirements, and assessment procedures and capabilities.

Gain public acceptance for infrastructure proposals by involving stakeholders in decision-making. The result is projects that are better tailored to stakeholder needs, higher levels of stakeholder commitment to maintaining infrastructure, and a better balance between the three Es. This requires institutional investment in creating participatory processes, communication, capacity building and mechanisms to build consensus and resolve conflicts.

Adopt a multiple-use approach to designing and managing community water supplies. This means taking into account the potential water sources available (e.g. groundwater, surface water, wastewater), and the quantity and quality of water needed for domestic use, crops, fish, livestock, and other income-generating activities as well as the environment.

Take a multi-purpose approach to infrastructure for water supply, energy, irrigation, and reuse/recycling. Multi-purpose infrastructure is a broad development choice rather than a single water oriented issue. It offers greater and broader benefits at a lower cost compared to constructing and operating multiple single-purpose installations. It requires appropriate financing structures and institutions that can take a broad overview of water resource development and management.

Recognise the potential that the sharing of water resources can have on peace, development and security. According to the Transboundary Freshwater Dispute Database, cooperative water events outnumber conflict events; however, the two dominant issues in conflicts are water quantity and infrastructure. The presence of treaties between countries reduces the risk of conflict and can harness benefits from infrastructure along different parts of a shared watercourse.

Box 2: Agenda 21: A more integrated approach to water management *and* development

The idea of taking an integrated approach to water development and management is not new. Agenda 21, the action plan from the 1992 Earth Summit held in Rio de Janeiro, anticipated many of the water challenges we face today and advocated an integrated approach as part of the answer:

> Water resources development and management should be planned in an integrated manner, taking into account long-term planning needs as well as those with narrower horizons, that is to say, they should incorporate environmental, economic and social considerations based on the principle of sustainability; include the requirements of all users as well as those relating to the prevention and mitigation of water-related hazards; and constitute an integral part of the socio-economic development planning process. *(Agenda 21, Chapter 18, Paragraph 16)*

The idea, which crystallised into IWRM, was to foster a more balanced and inclusive approach to water decision-making—one that considered social equity and environmental sustainability along with economic efficiency (the three E's).

Getting the balance right

What is the right balance between investment in infrastructure and investment in institutions? The answer depends fundamentally on context. Different combinations of hard and soft strategies are required for different situations.

Grey and Sadoff (2007) see the relative importance between infrastructure investment and institutional investment (in the widest sense) as a function of a country's stage of development. Developed countries (most having the advantage of a temperate climate) have achieved the water security that is essential for economic growth by investing in infrastructure to harness their relatively abundant water resources for human use. As the focus shifts to improving management of these already developed water resources, their investments in infrastructure decline and those in institutions increase.

On the other hand, developing countries may initially require higher levels of infrastructure investment relative to institutional investment in order to achieve water security. That is not to say institutional investment is not needed—in countries with relatively scarce water resources it is absolutely critical—but rather it must be accompanied by

major investments in infrastructure to mitigate floods and droughts; grow food; produce energy; and supply water for homes, cities, agriculture, and industries.

For many developing countries, institutional investment is clearly not going to be enough, particularly for meeting the Millennium Development Goals (MDGs). The UN Millennium Project Task Force on Water and Sanitation identified sound management and development of water resources as a fundamental component of the whole MDG programme. In its report *Health, dignity, and development: What will it take*, one of the five guiding principles it proposed to correct the disappointing progress towards meeting the MDGs was: "There must be deliberate planning and investment in sound water resources management ***and infrastructure***." (p 12; emphasis added).

The challenge, particularly for poorer countries that are hampered by water scarcity, is threefold:

- find financing for investments in infrastructure and for operation and maintenance,
- wring the most benefits from those investments through good management, and
- put into place mechanisms to ensure sustainable choices.

An IWRM approach that integrates both hard and soft components can help with all three of these challenges.

Who needs more water resources infrastructure?

In addition to its other functions, water resource infrastructure is necessary to address water scarcity in countries with highly variable climates, thus enabling water to contribute to economic and social development and at the same time reducing vulnerability to climate change (See Box 3). Infrastructure helps overcome the problem of water being in

Figure 1: Seasonal Storage Index and Current Surface Storage as a Percentage of SSI

The Seasonal Storage Index (SSI) gauges the volume of storage needed to satisfy water demand based on the average seasonal rainfall cycle. Calculating current surface storage as a percentage of the SSI reveals those countries most in need of infrastructure to ensure water availability for growing food and meeting other critical needs. (For a more complete list see original source.)

	Seasonal Storage Index (km^3)	Current Surface Storage as % of SSI		Seasonal Storage Index (km^3)	Current Surface Storage as % of SSI
Burundi	2.64	0%	Senegal	22.3	7%
Malawi	18.98	0%	Ethiopia	40.99	8%
Rwanda	1.38	0%	Albania	2.64	21%
Sierra Leone	2.21	0%	Bangladesh	62.28	33%
Guinea-Bissau	2.48	0%	Guinea	3.71	51%
The Gambia	2.14	0%	Swaziland	0.98	59%
Nepal	29.86	0%	El Salvador	5.45	59%
Haiti	3.73	0%	Mauritania	1.34	66%
Bhutan	0.4	0%	Tanzania	5.5	76%
North Korea	23.32	0%	India	356.6	76%
Eritrea	2.75	3%	Algeria	6.6	91%
Vietnam	27.64	3%			

Source: Brown, C and L Lall (2006) "Water and economic development: The role of variability and a framework for resilience" *Natural Resources Forum* 30, p 312

Box 3: Ethiopia, GDP and rainfall variability

"The persistent correlation between rainfall and GDP growth in Ethiopia is striking—and troubling. The effects of hydrological variability emanate from the direct impacts of rainfall on the landscape, agricultural output, water-intensive industry and power production. These impacts are transmitted through input, price and income effects onto the broader economy, and are exacerbated by an almost complete lack of hydraulic infrastructure to mitigate variability and market infrastructure that could mitigate economic impacts by facilitating trade between effected (deficit) and unaffected (surplus) regions of the country".

Source: World Bank. *Water Resources, Growth and Development.* Prepared for the Panel of Finance Ministers The U.N. Commission on Sustainable Development, 18 April 2005.

the wrong place at the wrong time—a common cause of scarcity. For poor countries with adequate but underdeveloped water resources, the priority is to:

- harness more water for human use by storing it,
- ensure it is of appropriate quality, and
- transport it to the point of use.

Many of these countries currently have only a fraction of the water infrastructure of developed countries with comparable climatic variability.

Water storage per capita—a commonly used indicator of water infrastructure availability—only reveals part of the story, since it does not take into account climatic variability nor the water storage capacities provided by nature, for example via groundwater or wetlands. The Seasonal Storage Index, developed by Brown and Lall (2006), corrects for some of these shortcomings by taking into account seasonal and interannual rainfall variability. When compared to actual storage, this indicator gives a picture of which countries have the largest storage gap (see Figure 1), i.e., which countries most need water infrastructure (the hard option) to manage variability in time and space and to adapt to climate change.

Hydrologically challenged countries need an integrated approach to ensure that infrastructure investment does not simply redistribute scarcity—for example, from one basin to another in the case of poorly planned interbasin transfers or from one user to another as sometimes happens when infrastructure planning is not firmly grounded in an understanding of basin hydrology and the interconnectedness of water users within a basin.

In addition, IWRM advocates an approach to infrastructure that addresses environmental and social concerns through proper involvement of stakeholders, environmental assessment and resettlement plans, and attention to issues and concerns of indigenous people.

Attracting infrastructure financing

Procuring adequate financing is an on-going problem, first to develop water resources infrastructure and second to keep the sector financially sustainable. Some observers have suggested that to meet the MDGs total financing for the sector (largely services) will have to double. However governments have failed to invest adequately and official development assistance for both water resources and water services has generally declined.

The downward trend in financing for water projects can be attributed in large part to the following factors:

- the frequently high environmental and social costs associated with large-scale infrastructure projects;
- lack of human capacity, transparency, and stakeholder participation in decision-making; and
- a poor track record in terms of sustainability and returns on investments.

In developing countries, this trend has been aggravated by poor policies on the part of both donors and recipients. Corruption has also played a role by reducing the efficacy of investments in large-scale infrastructure projects.

Attracting finance from all sources for infrastructure requires commensurate attention to soft issues, such as policies and strategies in water-using sectors, and to addressing previous deficiencies. As argued in *Water Financing and Governance* (GWP-TEC Background Paper 12), to ensure consistency and avoid weak points, the financing of the whole of the water sector should be addressed from an integrated perspective. In this context, it is critical to identify the full range of economic benefits to support an economic analysis.

Many of the benefits from water infrastructure such as public health, food security, and flood control yield an economic return but not a financial one, and it is often difficult to identify 'users' who might be able to pay. Because of this and because infrastructure requires long pay-back periods, some degree of public financing is generally required. But in many cases this leaves a considerable funding gap that must be filled from other sources.

Central to attracting finance from other sources is the question of governance. Until recently there seemed to be significant liquidity looking for safe, steady, long-term places to invest, as demonstrated by the investments in utilities in developed countries. One reason (among others) investors do not invest in developing countries is that adequate governance systems are not in place so risk is too high. With appropriate governance, private finance can flow to public authorities. Local financing is another option that can be encouraged with good governance.

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The Johannesburg Plan of Implementation from the 2002 World Summit on Sustainable Development concludes that:

> Good governance is essential for sustainable development. Sound economic policies, solid democratic institutions responsive to the needs of the people and ***improved infrastructure*** are the basis for sustained economic growth, poverty eradication, and employment creation. (Paragraph 138, emphasis added).

Procuring sufficient finance is important, but equally important is planning for debt servicing and ongoing costs. Taking an integrated approach to water development and management suggests life-cycle costing, so that the funds needed for operations, maintenance, refurbishment, etc. are identified and planned. In many developing countries, the issue of user pays remains contentious. The analysis of income streams, affordability, and financial sustainability must extend from national, provincial, or local government, through organisations and service providers to beneficiaries.

The importance of scale and context

Integrated water resources management can be applied at any scale. In rural and peri-urban areas, it starts at the household level. It involves women and men using water in an integrated way for drinking and other domestic purposes, livestock, gardening, fisheries, tree growing, brick making, small businesses, etc. *Multiple-use* approaches are household- and community-level IWRM, which can be a cost-effective way to harness water for poverty alleviation and gender equity (see IWMI Water Policy Briefing 18). Such approaches enable synergies among multiple water resources (of varying quantities and qualities) to be realized. However, to optimise benefits there needs to be investment in institutional aspects to support communities and in the infrastructure to deliver the services.

With an IWRM approach it may be possible to prioritise and scale up smaller (but less prestigious) projects. Infrastructure does not have to mean large dams or other large projects; it can also mean smaller, more manageable infrastructure, such as water harvesting or

groundwater development, that can have a more direct impact on poverty alleviation. The boom in small pumps for groundwater irrigation in India is one example—and one which, given the rapidly falling groundwater tables in many parts of the country, highlights the importance of investing in institutions to support sustainable private investment and use.

Along with water supply, wastewater disposal is a pressing issue for many countries. How to optimise sewerage, wastewater treatment and reuse systems in rural and urban settings? Again an integrated, context specific approach to infrastructure planning and design offers the best solutions. While some cases—notably large urban areas—may demand centralised infrastructure, in smaller communities, decentralized systems such as satellite wastewater treatment plants or local treatment combined with reuse strategies may better protect watersheds and water resources and avoid transfers over long distances. The result is lower wastewater flows that are more easily controlled and the ability to exploit different treatment processes and reuse options.

Making sustainable choices

IWRM, promoting as it does the three E's of economic efficiency, environmental sustainability and social equity, provides a framework for optimally resolving the many tradeoffs in infrastructure development. Still, the choices are undoubtedly difficult—compounded by many factors such as:

- a lack of agreed values,
- poorly defined water entitlements,
- incomplete hydrological knowledge (particularly environmental water requirements),
- the supply-driven logic of development banks,
- the malleability of cost-benefit analyses, and
- the overriding political nature of decisions on water infrastructure.

Moreover, the relatively short-term nature of the political cycle does not match the long-term nature of infrastructure development. Thus decisions are made based on immediate political priorities rather than long-term, cumulative costs and benefits.

> “ Often political expediency and limited financing options result in the decision to build new infrastructure rather than rehabilitate, upgrade or improve the management of existing infrastructure.

Promoting better governance and management helps reduce the risk of inappropriate projects and the corruption that fuels them and the debt that often follows them. Weak governance systems lead to the building of unsustainable, unnecessary infrastructure—white elephant projects that are a drain on budgets and cannot be maintained and thus deteriorate (only to need more investment in rehabilitation). Such projects do not help economic growth or poverty alleviation and exacerbate corruption with inflated costs. Borrowing for inappropriate infrastructure that does not generate a return contributed to the crises reached by the 'Heavily Indebted Poor Countries'. Avoiding such crises again and the spectre of structural readjustment is one reason why approaching management and infrastructure development in parallel is so important.

But historically, countries and their institutions, whether rich or poor, have had a difficult time including better management with the development of their water resources. Often political expediency and limited financing options result in the decision to build new infrastructure rather than rehabilitate, upgrade or improve the management of existing infrastructure.

Without infrastructure, there is no means for overcoming scarcity or of delivering services and meeting human needs. On the other hand, without commensurate implementation of soft or institutional measures, infrastructure cannot perform optimally and may fail completely. Each situation requires a different blend of hard and soft options. The GWP ToolBox can provide guidance and support.

References and related reading

Brown C and Lall L. (2006) "Water and economic development: The role of variability and a framework for resilience." *Natural Resources Forum* 30 306-317.

Clermont F (2006) *Official Development Assistance for Water from 1990 to 2004.* World Water Council Report.

Comprehensive Assessment of Water Management in Agriculture (2007) *Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture.* London: Earthscan, and Colombo: International Water Management Institute.

Global Water Partnership (2000) *Integrated Water Resources Management*. TAC Background Paper No 4.

Global Water Partnership (2002b) *Effective Water Governance.* TEC Background Paper No 7.

Global Water Partnership (2004) *Catalyzing Change: A handbook for developing integrated water resources management (IWRM) and water efficiency strategies.*

Global Water Partnership (2006a) *Taking an Integrated Approach to Improving Water Efficiency.* TEC Technical Brief 4.

Global Water Partnership (2006b) How IWRM will contribute to achieving the MDGs. TEC Policy Brief No 4.

Grey D and Sadoff C (2007) "Sink or Swim? Water security for growth and development". *Water Policy* 9:545–571.

IWMI (2006) "Taking a multiple-use approach to meeting the water needs of poor communities brings multiple benefits" Water Policy Briefing 18. Colombo: IWMI.

Rees J, Winpenny J, and Hall A. (2008) *Financing and Integrated Water Resource Management*. GWP TEC Background Paper 12.

UNESCO (2006) *Water a shared responsibility.* The United Nations World Water Development Report 2.

United Nations (2003) *World Summit on Sustainable Development: Plan of Implementation*. http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIToc.htm

United Nations (1993). Agenda 21: The Final Text of Agreements Negotiated by Governments at the United Nations Conference on Environment and Development (UNCED), 3-14 June 1992. http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21toc.htm

Winpenny, J (2003) *Financing water for all*. Report of the world panel on financing water for infrastructure. http://www.financingwaterforall.org

World Bank. Water Resources, Growth and Development. Prepared for the Panel of Finance Ministers The U.N. Commission on Sustainable Development, 18 April 2005.

World Commission on Dams (2000) *Dams and Development: a New Framework for Decision-making.* London: Earthscan.

Responding to demands from regional partners, the GWP Technical Committee convened a working group to address the perceived gap between infrastructure and IWRM planning. Members included: Ruth Beukman, Alan Hall, Brian Hollingworth, Aly Kerdany, Roberto Lenton, Mike Muller and Humberto Peña. This brief is the outcome of the working group's deliberations, with guidance and additional input from the GWP Technical Committee.

The brief complements a series of policy and technical briefs designed to help countries accelerate their efforts to achieve the action target for the preparation of IWRM and water efficiency strategies and plans set by the 2002 World Summit on Sustainable Development (WSSD). The briefs tackle key issues and potential stumbling blocks in developing and implementing an IWRM strategy or plan. These and related publications, such as *Catalyzing Change: A Handbook for Developing Integrated Water Resources Management (IWRM) and Water Efficiency Strategies*, can be downloaded from www.gwpforum.org or hard copies can be requested from gwp@gwpforum.org.

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