

Global Water Governance in the Twenty-First Century

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Growing pressure on the world's water resources is having major impacts on our social and economic well-being. Even as the planet's endowment of water is expected to remain constant, human appropriation of water, already at 50 percent by some measures, is expected to increase further (Postel et al. 1996). Pressures on water resources are likely to worsen in response to population growth, shifts toward more meat-based diets, climate change, and other challenges. Moreover, the world's water is increasingly becoming degraded in quality, raising the cost of treatment and threatening human and ecosystem health (Palaniappan et al. 2010). Furthermore, the physical availability of freshwater resources does not guarantee that a safe, affordable water supply is available to all. At least 780 million people do not have access to clean drinking water, some 2.5 billion people lack access to safe sanitation systems, and 2–5 million people—mainly children—die as a result of preventable water-related diseases every year (Gleick 2002; UN 2009; WHO and UNICEF 2012).

There is growing recognition that the scope and complexity of water-related challenges extend beyond national and regional boundaries and therefore cannot be adequately addressed solely by national or regional policies. In a recent report, the United Nations notes that “water has long ceased to be solely a local issue” (UN 2012a, 40). In particular, widespread water scarcity and lack of access to water supply and sanitation threaten socioeconomic development and national security for countries around the world. Additionally, people around the world share and exchange water directly and indirectly through natural hydrologic units and systems and through global trade (i.e., “virtual water,” discussed below). Furthermore, climate change and the growing presence of multinational companies within the water sector play a role in globalizing water issues (Hoekstra 2006).

Over the past sixty years, a number of efforts have sought to address the many challenges facing the water sector. Early efforts to address these challenges were almost entirely based on developing large-scale physical infrastructure, such as dams and reservoirs, to produce new water supplies. Amid a growing recognition that technology and infrastructure alone were not sufficient to address persistent water management concerns, discourse about water governance began to emerge in the early 1990s. In its first World Water Development Report, the United Nations strongly stated that the “water

crisis is essentially a crisis of governance and societies are facing a number of social, economic and political challenges on how to govern water more effectively” (UN 2003b, 370). In this chapter, we describe some of the major global water challenges and identify key deficiencies in global water governance in addressing these challenges. We conclude with several recommendations for improving global water governance in order to better address major water concerns in the twenty-first century.

Global Water Challenges

As described below, the scope and complexity of water-related challenges extend beyond traditional national and regional boundaries. Such challenges require broader thinking and more comprehensive solutions.

Water Scarcity

Water scarcity is a major challenge, affecting every continent around the world. Water scarcity occurs when water demand nears (or exceeds) the available water supply. Several groups, including the World Resources Institute and the International Water Management Institute (IWMI), have developed tools to promote a better understanding of where and how water risks are emerging around the world. The IWMI, for example, estimates that 1.2 billion people—nearly 20 percent of the world’s population—live in areas of physical water scarcity, where water withdrawals for agriculture, industry, and domestic purposes exceed 75 percent of river flows. An additional 500 million people live in areas approaching physical scarcity. Another 1.6 billion people live in areas of economic water scarcity, where water is available but human capacity or financial resources limit access. In these areas, adequate infrastructure may not be available or, if water is available, its distribution may be inequitable (IWMI 2007).

But water scarcity isn’t solely a natural phenomenon; it’s also a human one. Numerous human activities—such as untimely water use, pollution, insufficient or poorly maintained infrastructure, and inadequate management systems—can result in or exacerbate water scarcity. As noted by the United Nations, there are adequate water resources to meet our needs, but water “is distributed unevenly and too much of it is wasted, polluted and unsustainably managed” (UN 2012b).

Widespread declines in groundwater levels are one symptom of water scarcity. Groundwater is an important source of freshwater in many parts of the world. Some areas, however, have become overly dependent on groundwater supplies. In the past two decades, advances in well-drilling techniques have significantly reduced the cost of extracting groundwater. Driven, in part, by these technological advancements, groundwater withdrawals have tripled over the past fifty years (UN 2012a). In some areas, the rate of groundwater extraction now consistently exceeds natural recharge rates, causing widespread depletion and declining groundwater levels. A recent analysis of groundwater extraction by hydrologist Yoshihide Wada and colleagues (2010) finds that depletion rates doubled between 1960 and 2000 and are especially high in parts of China, India, and the United States. Much of the groundwater extracted supports agriculture (67 percent), although it is also used for domestic (22 percent) and industrial (11 percent) purposes.

Water Quality

While most water assessments emphasize water quantity, water quality is also critical for satisfying basic human and environmental needs. The quality of the world's water is under increasing threat as a result of population growth, expanding industrial and agricultural activities, and climate change. Poor water quality threatens human and ecosystem health, increases water treatment costs, and reduces the availability of safe water for drinking and other uses (Palaniappan et al. 2010). It also limits economic productivity and development opportunities. Indeed, the United Nations finds that “water quality is a global concern as risks of degradation translate directly into social and economic impacts” (UN 2012a, 403).

Water quality concerns are widespread, although the true extent of the problem remains unknown. In developing countries, an estimated 90 percent of sewage and 70 percent of industrial waste is discharged into waterways without any treatment at all (UN 2003a). Asian rivers are the most polluted in the world, and bacteria levels from human waste in these rivers are three times higher than the global average. Moreover, lead levels in these rivers are twenty times more than in rivers in industrialized countries (UNESCO 2005).

Drinking Water and Sanitation Access

The failure to provide safe drinking water and adequate sanitation services to all people is perhaps the greatest development failure of the twentieth century. In an attempt to remedy this failure, the United Nations established the Millennium Development Goals (MDGs), eight targets designed to tackle extreme poverty. At the direction of United Nations member countries, UN organizations and multilateral and bilateral development agencies have been working to achieve these goals by the year 2015. While many of the MDGs are widely acknowledged to be associated with water, including those related to improving gender equality and reducing child mortality, Target 7.C specifically aims to reduce by half the proportion of the population without sustainable access to safe drinking water and basic sanitation by 2015. Although not without their critics, the MDGs have served to highlight the importance of water, sanitation, and hygiene in improving health and economic opportunities (UN 2012a).

By UN measures (which are acknowledged to have important limitations), significant progress has been made in improving access to drinking water. In 1990, 76 percent of the global population had access to an “improved drinking water source”—defined as one that, by nature of its construction or through active intervention, is likely to be protected from outside contamination, in particular from contamination with fecal matter—whereas by 2010, this number had grown to 89 percent (WHO and UNICEF 2012). The global population as a whole is on track to meet the MDG drinking water target; however, global aggregates hide large regional disparities. For example, while India and China have made significant progress, sub-Saharan Africa, where only 61 percent of the population has access to an improved water source, is unlikely to achieve the MDG drinking water target. Additionally, coverage in the least developed countries is worse than in other developing countries. Finally, even within countries, there are disparities between urban and rural communities and between the rich and the poor (WHO and UNICEF 2012).

Despite this progress, access to an improved drinking water source remains out of reach for many people. An estimated 780 million people do not have access to basic

water service (WHO and UNICEF 2012). Additionally, the MDG drinking water target is based on access to an improved supply of water with little or no consideration of whether the water is affordable, whether the water is safe for consumption, or whether that access is being maintained over time. For example, naturally occurring arsenic pollution in groundwater affects nearly 140 million people in seventy countries on all continents (UN 2009). In Bangladesh alone, nearly 70 million people are exposed to groundwater contaminated with arsenic beyond the recommended limits of the World Health Organization (UN 2009).

Far less progress has been made in achieving the MDG sanitation targets. In 1990, nearly half of the global population had access to improved sanitation. By 2010, the percentage of people with access to improved sanitation had increased to 63 percent. An estimated 2.5 billion people still lack access to improved sanitation (WHO and UNICEF 2012). The global population is not on track to meet the sanitation target, and coverage is especially low in sub-Saharan Africa and in southern Asia.

Water and Ecosystems

Freshwater ecosystems are among the most extensively altered systems on Earth. Rivers, streams, and lakes have been subjected to chemical, physical, and biological alteration as a result of large-scale water diversions, introduction of invasive species, overharvesting, pollution, and climate change (Carpenter et al. 2011). An estimated 20–35 percent of freshwater fish are vulnerable or endangered, mostly because of habitat alteration, although pollution, invasive species, and overharvesting are also to blame (Cosgrove and Rijsberman 2000). About half of the world's wetlands have been lost since 1900, and much of the remaining wetland area is degraded (Zedler and Kercher 2005). Freshwater ecosystem conditions are likely to continue to decline unless action is taken to address acute threats and better manage freshwater resources.

Globalization and Virtual Water Flows

Globalization is characterized by the production and movement of goods and services around the world, and water is a key ingredient, either directly or indirectly, in almost every good produced. Consequently, the movement of goods effectively results in the movement of water around the world. Existing patterns of trade, however, are not necessarily water efficient. Many factors are at play when global trade decisions are made, and water is rarely one of them. The concept of “virtual water”—the water embedded in the production of food and other products—has been introduced as a way to evaluate the role of trade in distributing water resources. Some have argued that by allowing those living in water-scarce regions to meet some of their water needs through the import of water-intensive goods, international trade can provide a mechanism to improve global water-use efficiency (Allan 1993). Others, however, have posited that it simply externalizes the environmental burden of producing a particular product. In any case, the facts suggest that countries' relative water endowments are not dictating global trade patterns. Indeed, three of the world's top ten food exporters are considered water scarce, and three of the top ten food importers are water rich (World Economic Forum Water Initiative 2011). Furthermore, globalization increases dependence on others for essential goods and increases vulnerability to external water scarcity (Hoekstra and Mekonnen 2012).

Climate Change

Rising concentrations of greenhouse gases resulting from human activities are causing large-scale changes to Earth's climate. These climatic changes will have major implications for global water resources. As temperatures rise, the flows of water in the hydrologic cycle will accelerate. In short, climate change will intensify the water cycle, altering water availability, timing, quality, and demand. Indeed, all of the major international and national assessments of climate change have concluded that freshwater systems are among the most vulnerable, presenting risk for all sectors of society (Compagnucci et al. 2001; SEG 2007; Kundzewicz et al. 2007; Bates et al. 2008; USGCRP 2013). A technical report on freshwater resources released in 2008 by the Intergovernmental Panel on Climate Change (IPCC) concludes that "water and its availability and quality will be the main pressures on, and issues for, societies and the environment under climate change" (Bates et al. 2008).

A community's vulnerability to climate change will depend upon the magnitude of the impact and the community's sensitivity and adaptive capacity. As noted by Kenneth D. Frederick of Resources for the Future and Peter H. Gleick of the Pacific Institute (1999), "the socioeconomic impacts of floods, droughts, and climate and non-climate factors affecting the supply and demand for water will depend in large part on how society adapts." The poor and those living in developing countries are the most vulnerable because they have fewer social, technological, and financial resources to enable them to adapt (UNFCCC 2007).

Water-Energy-Food Nexus

Throughout the twentieth century, the close connections between water, energy, and food were largely unknown or were ignored in policy decision making. Water, energy, and food systems, and the governance institutions set up to manage them, were often separated by well-defined silos, and managers rarely communicated with one another. Water systems were often designed and constructed with the assumption that energy would be cheap and abundant, and energy systems were designed and constructed with the assumption that water would be cheap and abundant. Likewise, food systems have been operated as though neither the cost nor the availability of water and energy would constrain production. We now understand that this is no longer true: these critical resources are closely interconnected, and a growing interest in the water-energy-food nexus highlights the need to better understand and manage these interdependencies:

- Agriculture is a major user of water, accounting for 70 percent of all freshwater withdrawals. Agriculture is also a major user of energy, and food prices are sensitive to energy prices and policies on fertilizers, pesticides, and transportation to distribute products. Meeting the food and fiber demands of a growing population that is simultaneously shifting toward a more water-intensive diet will require a rethinking of how water is used.
- Energy is a major user of water. In the United States, for example, thermoelectric power plants account for nearly 50 percent of all freshwater withdrawals (Kenny et al. 2009). Newly proposed energy sources, such as biofuels, are placing additional strains on local water resources and global food systems.

- Large amounts of energy are required to capture, treat, distribute, and use water. Population growth and climate change are prompting some to consider importing water over longer distances, accessing groundwater from greater depths, or developing more marginal, lower-quality supplies that require extensive treatment.

Failure to consider these linkages in policy and decision making can lead to unintended consequences. Biofuels, for example, have emerged as an alternative to traditional, fossil-fuel-based energy sources, and many governments have instituted mandates and incentives to promote biofuel development. The European Union has committed to converting 10 percent of its transportation fuel to biofuels by 2020 (UN 2012a). In 2009–2010, nearly 40 percent of domestic corn use in the United States was for fuel (USDA 2010). However, first-generation biofuels, which represent the vast majority of biofuels produced today, are water and chemical intensive, and their development increases pollution of and competition for limited water resources. Additionally, biofuels compete with food crops for land and water resources, contributing to increased food prices and threats to food security. The impacts of increasing biofuel production make it clear that national decision making is linked to global agricultural output, food prices, and water availability.

The Emergence of Global Water Governance

The importance of governance as a key factor in addressing water-related challenges began to emerge in the late twentieth century amid a growing recognition that technology and infrastructure alone were not sufficient to address persistent water management concerns. Indeed, in its first World Water Development Report, the United Nations issued a strongly worded statement that the “water crisis is essentially a crisis of governance and societies are facing a number of social, economic and political challenges on how to govern water more effectively” (UN 2003b). Early water governance efforts emphasized the local and regional scales, in part because water challenges were largely perceived as local issues. But the scope and complexity of water challenges, as described above, highlight the need for a more comprehensive and coordinated global effort.

Despite the need, discussions about global water governance have been limited. One of the few definitions of global water governance comes from a 2008 study that defines it as “the development and implementation of norms, principles, rules, incentives, informative tools, and infrastructure to promote a change in the behavior of actors at the global level in the area of water governance” (Pahl-Wostl et al. 2008, 422). Thus, global water governance focuses on the processes of international cooperation and multilateralism. It comprises formal and informal instruments—including global governmental and nongovernmental organizations, regimes, actors, frameworks, and agreements—created to balance interests and meet global water challenges that span national and regional boundaries. It informs the way challenges are tackled (or not) at the regional and international levels by various players (from governmental bodies to civil society organizations) and suggests opportunities for, and barriers to, meeting global objectives. Global water governance also facilitates interaction and dialogue among key players to inform the development of solutions to problems at local, national, and regional levels to ease global pressures.

Evaluating the Effectiveness of Global Water Governance Today

Current global water governance systems were established during a time when approaches to water resource development and management differed from those encountered today (Jury and Vaux 2007). Persistent and emerging water challenges suggest that an assessment is needed to determine how global water governance efforts can be improved to more effectively address twenty-first-century water challenges and to leverage opportunities afforded by new thinking and innovative technologies. We describe below some key deficiencies and recommend ways in which governance can be improved to better address major freshwater concerns.

Intergovernmental Organizations Lack Clear Leadership and Coordination

A large number of organizations exist to address water challenges at various scales—particularly the United Nations system, multilateral lending institutions, and regional basin organizations—all working on different aspects of water management and service delivery. While global summits and forums have helped to identify major challenges and issue areas, implementation of coherent action is hampered by differing agendas among organizations and agencies that overlap in some areas but not in others.

At the international level, leadership and coordinated action within the water sector could emerge from the United Nations' system of agencies and programs. UN-Water was created in 2003 to serve as the interagency coordinating mechanism to promote coherence and coordination of UN system actions and other nontraditional partners and stakeholders (e.g., public and private sectors and civil society) related to the implementation of the international agenda defined by the Millennium Declaration and the World Summit on Sustainable Development. UN-Water, however, has several deficiencies. In particular, it “does not have a strong mandate,” nor does it make centralized policies (Pahl-Wostl et al. 2008, 427). UN-Water also has its own areas of focus (water and climate change, water quality, water supply and sanitation, and transboundary water), which fail to address the full range of water-related challenges. Additionally, inadequate personnel and funding hamper UN-Water's goal of promoting collaboration among the various agencies and programs that focus on different water-related issues and challenges, among them the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), the United Nations Children's Fund (UNICEF), the United Nations Development Programme (UNDP), the Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO), and the World Meteorological Organization (WMO).

The lack of clear leadership manifests itself in several ways. In particular, bilateral funding agencies are more likely to focus their efforts on their own priorities. For example, the German development agency GIZ has spent considerable resources on addressing the food-water-energy nexus, climate change, and access to water and sanitation. The US Agency for International Development (USAID), on the other hand, is focused on biodiversity, food security, climate change, and water access and sanitation. While all of these efforts are aligned with global priorities, lack of coordination can hinder their effectiveness.

Recommendation: Secure a Sustainable Funding Source and a Stronger Mandate for Coordinating Intergovernmental Organizations

The global nature of water-related challenges requires clear leadership and coordination. Intergovernmental agreements produced at world summits and forums require effective intergovernmental organizations to play the leading role in coordinating action. The United Nations system, as the sole global governance organization with the legitimacy and authority of member governments, must lead. UN-Water offers a potential starting point, given its existing mandate to coordinate action. To fulfill its mission, however, it (or any other intergovernmental mechanism established to coordinate action) must be given the resources and an empowered mandate to do so. This requires governments to fulfill pledges made at previous UN summits (such as the 2002 World Summit on Sustainable Development, or Johannesburg Summit) to ensure that financial resources are made available. It also requires political will from the United Nations to provide a stronger mandate for the organization and the ability to overcome traditional interagency rivalry that hampers cooperation.

Recommendation: Promote Greater Collaboration to Build Understanding and Coordinate Action

To effectively address the interlinked nature of the problems, it is imperative that water-related action be led not from within a silo but rather with a deep understanding of the cross-sector issues—for example, taking into consideration development, energy, biodiversity, climate change, food security, and more. Building this understanding requires close, continuous collaboration among the different organizations and individuals involved. UN-Water's 2013 theme of international cooperation is a positive step in that direction. Government-led efforts to encourage participation by actors through multi-stakeholder processes (such as the parallel meetings at Rio+20, the 2012 United Nations Conference on Sustainable Development) are key to promoting this collaboration. Likewise, the United Nations' current approach to developing the new Sustainable Development Goals is an encouraging development. By instituting a process that brings together development agencies, civil society groups, and the private sector to define water-related goals and potential actions, the UN approach promotes better understanding, which can lead to more coordinated action and better outcomes.

The Role of Nongovernmental Actors Is Expanding

Today, a study of global governance cannot be limited to merely governmental or intergovernmental processes. The rise and influence of a broad range of new actors, with their own sources of authority and power, are indicative of a more complicated global governance structure. These actors, who come from the private, nongovernmental, academic, and media sectors, act independently or, increasingly, in networks to bring about new thinking and solutions. These new global actors have fostered innovation and performed important functions, such as serving as watchdogs of governmental and private sector activities within the water sector. However, concerns have been raised about some who are engaged in public policy, particularly regarding their legitimacy, accountability, and relationship with existing public governance structures. For example, some of these new initiatives may be undermining government-led efforts, operating outside of local priorities, or, in the case of some privately led initiatives, engaging in policy capture (see, e.g., the discussion of corporate actions regarding water in chapter 2 of this volume). Their

centers of authority or the constituencies for whom they speak has also been a subject of debate. Although it is clear that these actors will continue to play an important role in global water governance, efforts should be made to understand what their role should be and their relationship with government-led efforts.

Recommendation: Explore and Develop Guidelines and Principles to Help Govern Nongovernmental Processes

As more parties become involved, effort is needed to better understand and define the roles and responsibilities of each in order to leverage unique capabilities. For entities that are actively engaging in areas that are in the traditional realm of governments, clear guidance as to how these new processes should interact with existing processes is needed. Realizing that these processes can potentially undermine one another, some organizations, such as the United Nations' CEO Water Mandate, have developed guidelines and principles to govern how the private sector engages in water policy (see, e.g., Morrison et al. 2010). More efforts like these are needed to ensure that civil society and private sector efforts and initiatives complement existing government-led processes where possible.

Some potential overarching principles developed for sustainability standards systems (many of which are global action networks, or GANs) that could serve as starting points for further exploration include the following (Ward and Ha 2012):

Respect the unique roles of governments and states.

Engage public sector actors.

Support sharing of information and resources with public sector actors.

Build on existing public sector and international norms.

Assess and review the range of public sector implications and relationships.

Water Sector Funding Is Inadequate and Too Narrowly Focused

The international community, including the major economies and international organizations, has played a significant role in funding water sector improvements, especially in developing countries. Yet funding remains limited and too narrowly focused. Funding commitments made by major economies at the 2002 Johannesburg Summit and among the Group of Eight countries have thus far not materialized. Additionally, a recent survey conducted by the World Health Organization (2012) finds that overall funding for the water sector is low—and is skewed toward capital expenditures for drinking water systems in urban areas. Expenditures for sanitation, operation and maintenance costs, and rural systems are much lower.

Recommendation: Develop Financing Mechanisms to Support Ongoing Operation and Maintenance Costs

Funding is needed to support ongoing operation and maintenance costs of water infrastructure. Available funding is insufficient to operate and maintain the existing infrastructure or to support the people and institutions needed to manage it effectively. As a result, systems are poorly managed or fall into disrepair, increasing the long-term costs. Additional funding is needed to support the ongoing operation and maintenance of new and existing water-related infrastructure.

New Funders Often Fail to Abide by Environmental and Social Lending Standards

For much of the twentieth century, the World Bank, the Asian Development Bank, inter-governmental agencies, and bilateral donors were the main funders of large-scale infrastructure in the developing world. In recent years, new economic realities and players have emerged. Commercial banks and energy and construction companies in the global South are playing an increasingly important role and are fundamentally changing water resource management. For instance, Pacific Environment's China program director, Kristen McDonald, and her colleagues reported in 2009 that Chinese financial institutions, state-owned enterprises, and private firms were involved in at least ninety-three major dam projects overseas. These and other new players—predominantly energy and construction companies from Thailand, Vietnam, China, Russia, and Malaysia—had not adopted internationally accepted environmental and social lending standards and norms. Furthermore, these new funders forced the World Bank and the Asian Development Bank to reconfigure their own lending practices to further dilute their environmental and social safeguards (Molle et al. 2009).

Recommendation: Establish New Lending Standards and Compliance Strategies

Commercial banks and energy and construction companies play an increasingly important role in financing water resource development projects. In the case of dam construction, for example, these new players do not meet even the World Bank's standards—which are already weaker than the recommendations of the World Commission on Dams. The failure to abide by social and environmental lending standards poses a threat to local environmental and social systems. New environmental and social lending standards are needed to ensure that lending promotes sustainable development objectives. The new players, along with civil society organizations, should be included in crafting and designing these new standards in order to ensure compliance.

Knowledge and Technology Transfer Efforts Remain Largely Top-Down

Over the past several decades, water-related knowledge and technological innovation have grown tremendously, with new techniques and ideas emerging from governmental bodies, independent research institutions, and academic bodies around the world. The challenge lies in getting this knowledge and technology to places that can implement them. Intergovernmental processes to foster technology and knowledge transfers—mainly through forums such as the annual Water Environment Federation Technical Exhibition and Conference (WEFTEC) and the like—have predominantly been in a top-down manner. There is growing recognition, however, that even innovative technologies that are thought to be highly effective may not be appropriate everywhere. Each technology is developed and crafted according to local circumstances, which can differ dramatically from one region to another. As a result, an off-the-shelf approach to technology and knowledge transfers may not lead to the desired outcome or may lead to unintended consequences. Implementation of Green Revolution concepts to industrialize agriculture in the Punjab region of India provides an example of a top-down, single-focus transfer of knowledge and technology that has led to several unintended consequences, including groundwater overdraft in some areas. Today, the state of Punjab is trying to manage these problems by revisiting and reforming state agricultural policy and regulations using a more bottom-up technology and knowledge transfer approach (Tiwana et al. 2007).

Recommendation: Promote Open-Access Knowledge Transfer

Over the past few decades, there has been tremendous growth in the technologies available for transferring knowledge and information. Geospatial technologies, the Internet, and mobile devices are just a few of the technologies available to improve communication. Although reliance on such technologies must be carefully considered, given the global variations in their application and use, they can provide tremendous opportunity for new ways of getting information to water users and of connecting water stakeholders and researchers with one another and with decision makers. Global institutions can play an important role in facilitating the use and distribution of these new technologies. Extending access to new and emerging scientific findings can enable and empower the local research community to better understand and identify local problems and design or demand specific solutions to improve local water governance (Jury and Vaux 2005; Hutchings et al. 2012). There is also a need for better communication of complicated scientific knowledge to policy makers and decision makers in order to influence development of comprehensive management strategies and inform the policy-making process.

Recommendation: Facilitate Effective Technology Transfer by Engaging Local Communities in the Decision-Making Process

Empowering local communities to identify their water issues and solutions allows them to select an approach that more closely aligns with their social and cultural realities. On-site education and capacity building play a major role in facilitating successful and effective bottom-up or horizontal technology and knowledge transfer. Especially in regions with very limited access to and understanding of state-of-the-art technological solutions, or with limited institutional capacity to provide local technological training, international institutions such as the UNESCO-IHE Institute for Water Education can foster capacity building and educational efforts to facilitate implementation and operational learning of imported technologies. Also, continuous monitoring and performance assessment of a transferred technology can provide an opportunity to adjust and calibrate implementation and operational processes to prevent undesirable outcomes. Global institutions can also facilitate focused research and development investment, especially by those in the developed world with financial resources, to advance technologies and make them more accessible to the developing world.

Recommendation: Improve Understanding and Communication of Risk and Uncertainty

Some uncertainty inherent in hydrologic and water resource management systems is unavoidable. Yet the development of management practices and strategies relies heavily on future supply and demand predictions, which are fraught with uncertainty. Water resource managers around the world use various supply and demand predictions in their decision-making processes. A better understanding of the uncertainties and risks associated with them can lead to the development of more effective planning and management strategies that reflect these limitations. New decision support tools should include an uncertainty assessment component, which would offer an array of decisions and the uncertainties and risks associated with them in order to provide an opportunity for adaptive and flexible management approaches. Effective communication of these uncertainties and risks to policy makers and the general public is also an important element of adaptive and flexible water resource management practice (UN 2012a).

Data Collection Efforts Are Inadequate

Good data and ongoing monitoring activities are the cornerstones of effective water management and governance. We live in an information era, and vast amounts of water data are collected in different ways and at a variety of temporal and spatial scales, from local stream gauges to global satellites. Current attempts at information sharing, such as UN-Water's Activity Information System, Documentation Center, and Key Water Indicator Portal, provide key data necessary to tackle the water challenges identified earlier. Despite these improvements, there are still regions lacking basic water data and information. Even when the data are collected, they are often not widely available or their quality is poor. Efforts are needed to improve the collection, compilation, and reporting of comprehensive water-related data.

Recommendation: Develop a Centralized Global Water Data Portal

The rational management of water is predicated on the availability of comprehensive data. Capacity needs to be developed in all countries to collect, manage, and analyze water information. Some of the key data needed include precipitation, runoff, virtual water flows, groundwater levels, and overall water demand and supply. Where resources are inadequate to collect and compile these data, they should be provided through international aid or other mechanisms. Also, as developing countries undergo economic transitions, monitoring and reporting need to be integrated into new laws. These efforts would benefit from a centralized global water portal in which to assemble the reported data, especially where local governments lack the financial or technological capacity to provide such services. Finally, international data protocols, standard data formats, and sharing arrangements are needed in order to increase comparability of data worldwide.

Recommendation: Leverage New Data Collection Technologies

New local data collection and monitoring efforts are emerging that engage stakeholders through crowdsourcing, or reporting of information through electronic devices. Mobile connectivity is outpacing fixed landline phones and access to computers, especially in many developing countries that lack telephone network infrastructures. New monitoring efforts that use cell phones and other RSS technologies, such as the WASH SMS Project, capitalize on the widespread and rapidly growing use of mobile devices throughout the world to facilitate the flow of information between communities, governmental entities, and service providers (Hutchings et al. 2012). These data can provide timely information on local water systems, including the availability and quality of water. Small-scale, local data collection and reporting efforts such as these should be encouraged.

Lack of Transparency and Accountability Limits the Effectiveness of Water Sector Investments and Fosters Corruption

The water sector lacks transparency and adequate participation from key stakeholders, especially in marginalized communities, and this in turn leads to an accountability deficit and can result in ineffective or inefficient management strategies and investments. A 2008 report by Transparency International and the Water Integrity Network finds that a lack of transparency and participation contributes to rampant corruption across the water sector, including in water management, drinking water and sanitation service provision, irrigation, and hydropower development. The water sector is especially prone to corruption because of the complex system of agencies responsible for its management

and delivery; the growing presence of private actors and informal providers that operate in legal gray zones (where the actors are the de facto water service providers allowed to operate by governments but who may not have official license); and the large sums of money required for infrastructure investments. Addressing the issue is especially challenging because of the general focus within the sector on technological solutions rather than governance. The report further finds that the poor and most vulnerable are the most likely victims because they are more exposed to the informal sector (where corruption is more prevalent) and have limited resources and avenues to voice their concerns. This, in turn, exacerbates corruption because those most affected by it are unable to call for greater accountability (Transparency International and Water Integrity Network 2008).

Recommendation: Adopt New Standards, Codes, and Best Practices for Water Resource Development and Management to Promote Greater Transparency and Participation

Water resource development and management are guided by a series of standards, codes, and best practices. These standards, codes, and practices, which include both mandatory and voluntary initiatives, must provide a regulatory framework that brings about greater transparency, promotes participation and oversight to tackle corrupt practices, and develops best-practice guidance where regulatory frameworks are weak or poorly implemented. Both governments and GANs can play a key role in their formulation. For example, Kenya has adopted a human rights-based approach to the water sector that places an emphasis on transparency and participation. Likewise, the United Nations' CEO Water Mandate released its *Corporate Water Disclosure Guidelines: Public Exposure Draft* in an effort to promote greater transparency in the private sector's water use and allow stakeholders to better evaluate this use. These efforts are encouraging; however, more can and should be done.

Recommendation: Promote Capacity Building and Increase Participation in Water Management

To bring about greater participation in water management and better implementation of frameworks that promote transparency, serious effort is needed to build the capacity of governmental officials and civil society groups, especially community-based organizations. Governments and GANs can provide technical know-how and financial resources to ensure that local governmental officials and community-based organizations, two groups with an intimate knowledge of local problems, can be key advocates for change. For example, the Freshwater Action Network focuses much of its effort on providing capacity building to its civil society members in order for them to engage in decision-making processes, call for greater transparency, and hold governmental and private sector actors accountable.

Recommendation: Empower Communities through Long-Term and Short-Term Education and Outreach Efforts

Education and outreach promote greater understanding about a particular issue and can help facilitate change by redefining acceptable behaviors and social norms. Knowledge is power; hence, it can empower communities, especially the poor and most vulnerable, to demand change and accountability. While education and outreach efforts often occur at the local level, global efforts can provide educational tools, platforms, and strategies

for planning effective educational programs. For example, the UNESCO-IHE Institute for Water Education, established in the Netherlands in 2003, was developed to educate and train professionals and build the capacity of sector organizations, knowledge centers, and other institutions in developing countries and countries in transition. These efforts are needed at every scale. Household- and community-scale efforts can promote behavioral changes, facilitate grassroots support and demand for better regulations and enforcement, and bring about transparency and accountability. Education and capacity building at larger scales can promote effective interventions at the watershed, national, and international levels to develop better standards, regulation, and enforcement.

There Has Been a Failure to Adopt Broad-Based Agreements on Transboundary Watercourses

Many rivers, lakes, and groundwater aquifers are shared by two or more nations, and most of the planet's available freshwater crosses political borders, ensuring that politics inevitably intrude on water policy. Indeed, international river basins cover about half of Earth's land surface, and about 40 percent of the world's population relies on these shared water sources. Since transboundary watersheds traverse political and jurisdictional lines, heterogeneous and sometimes conflicting national laws and regulatory frameworks make management a major challenge, particularly when no single national government has authority over another. As such, transboundary water management often requires the creation of international guidelines or specific agreements between riparian states.

While the value of transboundary watershed treaties has regularly been demonstrated, there are political and financial constraints that make their adoption difficult in many parts of the world. In 1997, the General Assembly of the United Nations adopted the Convention on the Law of the Non-Navigational Uses of International Watercourses. This UN convention sets forth principles for equitable and reasonable utilization of international watercourses and for equitable participation. More than a decade after its adoption by the vast majority of the General Assembly, however, the convention has not yet obtained enough signatures to enable it to enter into force and effect. As of February 22, 2013, thirty countries had ratified or acceded to the convention; thirty-five signatures are needed for the convention to enter into force.¹

Recommendation: Bring into Force the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses

As much as we hope that treaties will be developed in all transboundary watersheds to foster cooperation and collaboration among all riparian states, political and financial constraints make this difficult in many areas of the world. Therefore, adopting an effective international legal framework is a critical step in addressing future challenges. The 1997 United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses represents an important contribution to the strengthening of the rule of law regarding the protection and preservation of international watercourses, and it should be brought into force.

1. See International Water Law Project, Status of the Watercourse Convention as of 22 February 2013, http://www.internationalwaterlaw.org/documents/intldocs/watercourse_status.html.

Existing Interbasin Agreements Lack Flexibility

Global climate change will pose a wide range of challenges to freshwater resources, altering water quantity, water quality, and system operations and imposing new governance complications. For countries whose watersheds and river basins lie wholly within their own political boundaries, adapting to increasingly severe climatic variability and changes will be difficult enough. When those water resources cross borders and implicate multiple political entities and actors, sustainable management of shared water resources in a changing climate will be especially difficult and will require active coordination, engagement, and participation of all the actors sharing the basin. In particular, most transboundary water agreements are based on the assumption that future water supply and quality will not change. Moreover, most treaties and international agreements fail to include adequate mechanisms for addressing changing social, economic, or climate conditions (for an early analysis of this problem, see Goldenman 1990 and Gleick 2000).

Recommendation: Improve Flexibility of Existing Interbasin Agreements

No two water treaties are the same. Each is developed under unique circumstances, addresses different concerns, and has a particular set of constraints. Additionally, climate change will affect each basin differently. As a result, each treaty must be evaluated to determine what flexibility mechanisms currently exist and where significant vulnerabilities remain. This process should be started before a problem arises so as to improve the atmosphere for cooperation and negotiation. Additionally, transboundary watershed countries should consider incorporating provisions into existing treaties to allow for greater flexibility in the face of change, including (1) creation of flexible allocation strategies and water quality criteria; (2) agreement on response strategies for extreme events, such as floods and drought; (3) development of clear amendment and review procedures to allow for changing hydrologic, social, and climatic conditions or in response to new scientific knowledge; and (4) establishment of joint management institutions that can, for example, facilitate a climate vulnerability and adaptation assessment (Cooley and Gleick 2011).

Conclusions

Throughout the twentieth century, water governance efforts emphasized the local and regional scales, in part because water challenges were largely perceived as local issues. However, there is growing recognition that the scope and complexity of water-related challenges extend beyond national and regional boundaries and therefore cannot be adequately addressed solely by national or regional policies. Discussions about global water governance, however, have been limited. Water governance studies that have taken a broader perspective have largely focused on transboundary water resources. Global water governance has also been discussed within the context of other, more prominent global governance challenges (notably climate change and energy) and within discussions of global development objectives. However, there has been little to no discussion about global water governance that looks more holistically at global water challenges and the structures and approaches needed to meet these challenges.

In this chapter, we have defined global water governance, identified key deficiencies in global water governance, and offered recommendations for how it can be improved to better address major water concerns in the twenty-first century. We noted that the global dimensions of water governance are difficult and complex issues. Such governance and the institutional structures that accompany it are complicated by local, regional, and national factors. Indeed, there is no single practice or policy that will “solve” the water challenges facing the world today. This chapter, however, provides several paths forward to more efficient and effective water governance in an effort to promote a more robust and sustainable approach to solving water problems in the twenty-first century.

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