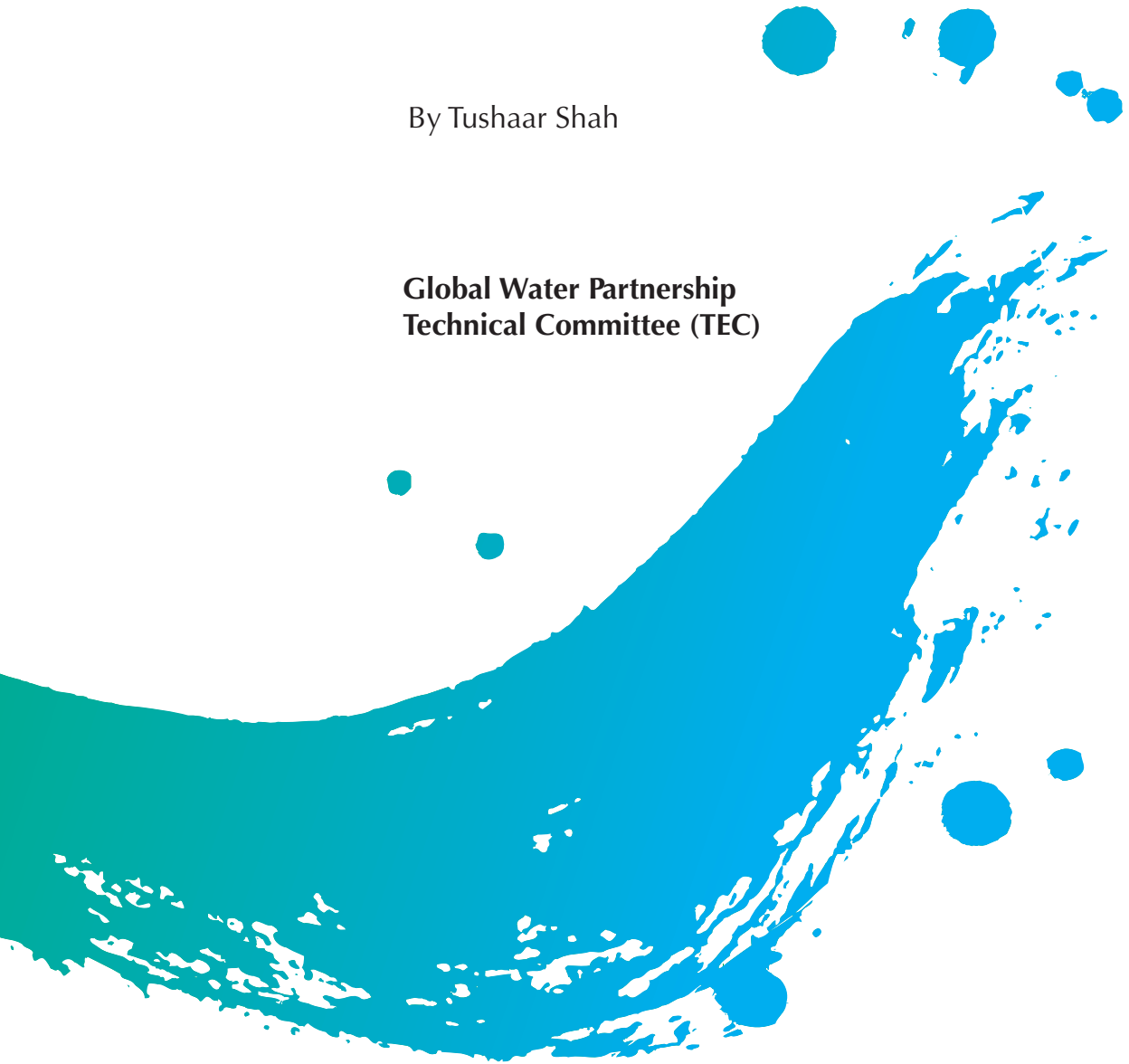


*Increasing water security:
the key to implementing the
Sustainable Development Goals*

By Tushaar Shah

**Global Water Partnership
Technical Committee (TEC)**



The **Global Water Partnership's** vision is for a water secure world.

Our mission is to advance governance and management of water resources for sustainable and equitable development.

Global Water Partnership (GWP) is an international network, created in 1996 to foster an integrated approach to water resources management (IWRM). IWRM is a process which promotes the coordinated development and management of water, land, and related resources in order to maximise economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

The Network is open to all organisations that recognise the principles of an integrated approach to water resources management endorsed by the Network. It includes states, government institutions (national, regional, and local), intergovernmental organisations, international and national non-governmental organisations, academic and research institutions, private sector companies, and service providers in the public sector.

GWP's Technical Committee is a group of internationally recognised professionals and scientists skilled in the different aspects of water management. This committee provides technical support and advice to the Partnership as a whole. The Technical Committee has been charged with developing an analytical framework of the water sector and proposing actions that will promote sustainable water resources management.

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**Increasing water security: the key to
implementing the Sustainable Development Goals**

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FOREWORD

The new UN Development Agenda and the Sustainable Development Goals (SDGs) adopted in 2015 embodies universal aspirations for achieving a better, more just, equitable, peaceful, and sustainable future and invites us to accept and embrace comprehensiveness and interconnectedness.

The Agenda fully recognises that water is embedded in all aspects of development – food security, health, and poverty reduction – it is essential for economic growth, and it sustains the natural ecosystems on which everything else depends. The inclusion of the ‘water goal’ (SDG6) puts responsibility for water management and increasing water security in the hands of the water and water using sectors. The Agenda champions the need for an integrated approach to water resources management and provides a ‘green light’ to countries to implement their IWRM plans.

This GWP Technical Committee Background Paper is a timely response to the SDGs. It reviews the IWRM approach and its evolution over the past 25 years towards increasing water security – its successes and disappointments. It is essentially a simple idea which has gradually gained international acceptance, yet putting it into practice has not proved to be easy. IWRM has not been without its critics. Those who have tried to operationalise it have often applied a ‘one-size-fits-all package’ which does not recognise the unique nature of physical, social, economic, political, and environmental circumstances which determine how a country puts IWRM into practice. So it is not surprising that the outcome was often disappointing.

But there are also successes and based on these experiences this review concludes with some strong proposals for successful implementation. It suggests a framework to guide implementation based on the stage of a country’s economic and social evolution with each stage requiring different inputs and actions that are appropriate to a nation’s needs and capabilities. It also suggests a balance is needed between learning from rich countries and adapting to local conditions. The next step is to provide more detailed guidance for wise implementation of IWRM and in turn SDG6.

This paper is an important contribution to the literature on integrated water resources management and to GWP’s work in this area. I am grateful to the author, Tushaar Shah, member of the GWP Technical Committee, and to Eelco van Beek who provided valuable advice on linking the paper to the UN Agenda and the SDGs.

I would like to acknowledge other GWP Technical Committee members for their invaluable comments and suggestions during the drafting stages. I am very appreciative of the editing support provided by Melvyn Kay, and my thanks to Danka Thalmeinerova for reviewing the manuscript.

Dr Mohamed AIT KADI
Chair, GWP Technical Committee

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ACRONYMS

DWM	Developmental water management
GDP	Gross domestic product
GWP	Global Water Partnership
GWP TEC	GWP Technical Committee
IUCN	International Union for Conservation of Nature
IWRM	Integrated water resources management
MDG	Millennium Development Goals
MOM	Management, operations and maintenance
OECD	Organisation for Economic Co-operation and Development
PPP	Purchasing power parity
SDG	Sustainable Development Goals
TVA	Tennessee Valley Authority
UNEP	United Nations Environment Programme
WFD	Water Framework Directive
WWC	World Water Council

EXECUTIVE SUMMARY



As governments begin to implement the United Nation's new development agenda up to 2030 and recognise the importance of water security in sustainable development, it is timely to critically review the key role that integrated water resources management (IWRM) can play in increasing water security.

Water features in almost all the 17 Sustainable Developments Goals (SDGs) in the United Nation's new development agenda up to 2030. Embedding water in this way demonstrates its central role in all aspects of development and its importance to achieving the SDGs. The inclusion of the 'Water Goal' (SDG 6) puts responsibility for water management and increasing water security in the hands of the water and water-using sectors. It also champions the need for an integrated approach to water resources management as the means of equitably sharing limited water resources among many, often conflicting, demands from people, industry, agriculture, and the environment when demand exceeds supply.

In the past, when water was plentiful and the rules of water sharing were relatively simple, water infrastructure and top-down, supply-led solutions dominated water resources management. The IWRM approach is now shifting attention away from infrastructure towards the natural environment, demand management, stakeholder participation, and the need to integrate water resources management both within the water sector and as an inseparable part of a nation's social and economic development.

The Global Water Partnership (GWP), among others, has developed and promoted IWRM over the past 25 years as a means of increasing water security. Many countries have already taken up this approach, at least in terms of planning and in legislation, but few have taken the next step to implement it. Implementation is the theme throughout the SDGs and so this provides a 'green light' for nations to put their IWRM plans into practice.

While IWRM is disarmingly simple in concept, implementation has not proved to be easy. There is no 'one-size-fits-all' strategy. Each country has its own unique set of physical, social, economic, political, and environmental circumstances that will determine how a country puts IWRM into practice. IWRM is also not without its critics and those countries that have already moved from planning to implementation report mixed results. Some say it is successful while others have found many inadequacies and disappointments.

As the pressure to implement IWRM grows, questions will arise: How should countries proceed when there are few guidelines beyond the GWP ToolBox?

What lessons come from those who have experience of implementation? And what are the implications for achieving SDG 6?

This paper offers a timely and critical review of the IWRM approach to increasing water security: its successes and disappointments. It suggests that most disappointments stem from funding agencies and governments failing to recognise that IWRM is a means to an end and not an end in itself. Funding agencies ‘sold’ the concept as a ‘fixed package’ (the ‘IWRM Package’) to developing countries comprising water governance practices gleaned from contemporary experience in rich countries. Implementation of this package was expected to produce rapid changes in institutional settings and stakeholder behaviour. But changes were far slower than expected. Most crucial was that many of those implementing the package failed to adapt it to local circumstances.

This review suggests we should learn from the disappointments rather than abandoning IWRM. We should not ‘throw the baby out with the bathwater’. So what does this mean in practice? Two important lessons emerge. The first is that implementation must be gradual and nuanced. Forcing the pace on developing countries has so far proved counterproductive. The second is that countries at different stages of socio-economic evolution have different needs and capabilities and it is essential to reflect this in the approach taken.

Over the past few decades, a great deal of academic thinking and criticism has gone into IWRM. It is now time to move from theory to practice. As a first step a framework is suggested for guiding SDG 6.5 (and IWRM) implementation and the interventions that may help to improve the all-round working of water economies. Such interventions relate to the various stages of economic and social evolution. Each stage will require different inputs and actions that are appropriate to a nation’s capabilities and needs. Four different stages of evolution are identified: fragile economies (stage I), emerging economies (stage II), middle income countries (stage III), and rich countries (stage IV). Interventions in six key areas are also identified for each stage: capacity building, institutional reform, policy and legal regime, investment priorities, management of ecosystem impacts, and water pricing and cost recovery.

Elaborating these inputs and actions will be the next step in providing more detailed guidance and promoting the wise implementation of IWRM and, in turn, SDG 6.

Putting IWRM into practice in different countries is about finding a balance between learning from how rich countries manage their water economies and adapting to local conditions. If there is too much focus on the former, reforms may come unstuck because organising water economies in poor countries is very different. But if poor countries only revel in their exceptional circumstances, they may forfeit the opportunity to learn from the mistakes and successes of others and waste time and energy in ‘re-inventing the wheel’.

1 SUSTAINABLE DEVELOPMENT GOALS AND IWRM

In September 2015, 193 member states of the UN General Assembly signed up to a new development agenda that will drive sustainable development actions up to 2030. Building on the successes, gaps, and lessons from the Millennium Development Goals (MDGs), this new agenda sets out 17 Sustainable Development Goals (SDGs) and 169 Targets.

Water, which was highlighted as the greatest risk facing humanity in the 2015 World Economic Forum report (WEF, 2015), is embedded in almost all the SDGs, recognising that water management is an integral and inseparable part of the development agenda, in particular in those sectors dealing with food, energy, and the environment. But in recognising that water is now everyone's business there is a danger of water becoming no one's responsibility. This dilemma was resolved by the inclusion of a dedicated 'Water Goal' (SDG 6) which champions the need for an integrated approach to water management. Indeed, SDG 6.5 mandates nations to 'implement integrated water resources management (IWRM) at all levels, including through transboundary cooperation as appropriate' (Box 1). This is a major breakthrough and means that water resources management now has equal weight among the SDGs. It recognises the critical importance of managing water resources for sustainable development, and the need for the water and water-using sectors to collaborate and move beyond their traditional fragmented 'silo' approach to an integrated approach to water resources management.

This desire for full integration has far-reaching implications. It means that the Water Goal will only be achieved if other goals are successful, and in turn, other SDGs will only be achieved if the Water Goal is successful.

Box 1. The 'Water Goal' and means of implementation

SDG 6: Ensure availability and sustainable management of water and sanitation for all
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all

6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations

6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and substantially increasing recycling and safe reuse globally

6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity, and substantially reduce the number of people suffering from water scarcity

6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.b Support and strengthen the participation of local communities for improving water and sanitation management

Means of implementation

SDG 17: Strengthen the means of implementation and revitalise the global partnership for sustainable development

The IWRM concept has gradually gained prominence over the past 25 years as the demand and competition for limited water resources has increased, our knowledge of water's impact on the environment has grown, and more complex institutions have developed to negotiate and coordinate water allocations among different users. Water resources management has traditionally been dominated by water infrastructure and top-down, supply-led solutions to water problems, particularly when water was plentiful and the rules of water sharing were relatively simple. IWRM now focuses attention on the natural environment, demand management, stakeholder participation, and the need to manage water resources as an integral part of a nation's social and economic development. It is shifting attention from integrated infrastructure development for maximising socio-economic benefits towards water governance and environmental protection.

Many governments and international organisations, including the UN, have already embraced IWRM as a means of managing limited water resources among many competing and often conflicting demands for water among people, industry, agriculture, and the environment. Many countries have already taken up this approach, at least in terms of planning and in legislation, but few have taken the next step to implement it. A UN survey of 133 countries (UNEP, 2012) reported that 82 percent had embarked on water management reforms, 65 percent had developed IWRM plans, and 34 percent were at an advanced stage of implementing them.

The SDGs now provide a ‘green light’ for nations to implement their IWRM plans. But putting IWRM into practice is not easy. There is no ‘one-size-fits-all’ strategy. Each country has its own unique set of physical, social, economic, political, and environmental circumstances that will determine a country’s pathway towards increasing water security.

As the pressure to implement IWRM grows, questions will arise: How should countries proceed when there are few sources of guidance beyond the GWP ToolBox on how to implement IWRM (www.gwptoolbox.org)? What lessons come from those who have experience of implementation? And what are the implications for achieving SDG 6?

This paper offers a timely and critical review of the IWRM approach, how it has developed over the past 25 years, its successes and disappointments as countries put it into practice, and provides indicative guidelines for the types of interventions that may help to improve the all-round working of a country’s water economy.

2 EVOLUTION OF IWRM TOWARDS WATER SECURITY



How do societies increase water security? The stock response to this question in the past was through techno-centric supply-side interventions implemented from the top down by fragmented bureaucracies. This involved mostly technology, engineering, and public investment in water infrastructure. Over the past 25 years or so IWRM has emerged as an alternative approach for communities and societies seeking to increase their water security.

GWP, as one of the champions of this approach, has strived to promote and plan for IWRM through advocacy, knowledge sharing, and networking. GWP defined IWRM as:

“a process which promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems”. (GWP, 2000)

IWRM is not a new idea, and may have its origins in the establishment of the US Tennessee Valley Authority (TVA) in 1933 (White, 1998) (Table 1). TVA worked across traditional sector boundaries to improve public health, navigation, flood control, power generation, water supply, and regional economic stimulus. Other, early examples of integration include the Ruhr River Association in Germany and the River Basin Authorities in the UK. Developing countries such as India adopted the TVA model, if in a cosmetic fashion, by creating basin organisations such as the Damodar Valley Authority. The TVA inspired IWRM thinking, which ruled the global discourse until well into the 1970s, and was about maximising beneficial socio-economic impacts of new water infrastructure projects. Environmental issues, water rights and pricing, and institutional integration were on the margins of this thinking. However, in 1957 a report on integrated river basin development to the UN Secretary-General (United Nations, 1970, revised edition) emphasised that:

“Engineering measures [alone] are not likely to bring the desired improvements in level of living. For example, the essential storage and canal facilities of an irrigation project must be supplemented by alterations in

credit, marketing, transport, fertiliser, seed supply and similar services if they are to bring genuine gains in farm production.”

It was at the International Water Conference in Mar del Plata (1977), that the need for institutional integration came to the fore, recommending that:

“Institutional arrangements adopted by each country should ensure that the development and management of water resources take place in the context of national planning and that there is real coordination among all bodies responsible for the investigation, development and management of water resources”.

The 1992 Earth Summit at Rio reiterated concerns about fragmented management:

“The fragmentation of responsibilities for water resources development among sectoral agencies is, however, proving to be an even greater impediment to promoting integrated water management than had been anticipated” (UNCED Agenda 21, chapter 18.6, 1992)

This emphasised the need for:

“... holistic management of freshwater as a finite and vulnerable resource, and the integration of sectoral water plans and programmes within the framework of national economic and social policy, are of paramount importance for action in the 1990s and beyond.” (UNCED Agenda 21, chapter 18.35, 1992)

In 1987, the Brundtland Commission articulated global concerns about sustainable development and the primacy of ecosystem impacts and demand-side management, as advocated in 1992 at the Dublin International Conference on Water and the Environment.

Koudstaal et al. (1992) argued that examining the potential or carrying capacity of the natural environment should come first, rather than development followed later by efforts to minimise adverse environmental impacts. Economies in recession are inclined to attribute more weight to socio-economic development and accept that future generations pay the bill. The authors prescribed three principles that have since dominated the IWRM debate:

- **The carrying capacity of the natural environment** is the logical starting point, rather than accepting environmental deterioration as an unavoidable cost of economic development.
- **Demand management** – formulating and applying incentives aimed at limiting the demand for water by increasing efficiency and reducing waste.
- **Integrated management** – managing water as an integral part of a nation’s social and economic development and not just within the water sector.

In 1992, IWRM emerged from the Dublin Principles set out in the Statement on Water and Sustainable Development and from this GWP developed its publication *Integrated Water Resources Management* (GWP, 2000). This paper outlined how societies improve water security by putting this integrated approach into practice by:

- creating an enabling environment by formulating appropriate policies, enacting legislation, and creating platforms for participatory decision-making
- evolving appropriate institutional frameworks and roles for resource governance and capacity building and
- deploying a range of management and economic tools for efficient resource allocation and sector regulation.

At the time the GWP (2000) authors wrote:

“The concept of IWRM has attracted particular attention following the international conferences on water and environmental issues in Dublin and Rio de Janeiro held during 1992; however, IWRM has neither been unambiguously defined nor has the question of how it is to be implemented been fully addressed. What has to be integrated and how is it best done? Can the agreed broad principles for IWRM be operationalised in practice – and, if so, how?”

The authors introduce various caveats and qualifications including:

“IWRM practices depend upon the context...”

“It is important to stress that there are no ‘blueprints’ valid for all cases”

“Integration is necessary but not sufficient”

“This is an area where the stage of development, financial and human resources, traditional norms and other specific circumstances will play an important part in determining what is most appropriate in a given context”

“The nature, character, and intensity of water problems, human resources, institutional capacities, the relative strengths and characteristics of the public and private sectors, the cultural setting, natural conditions and many other factors differ greatly between countries and regions. Practical implementation of approaches derived from common principles must reflect such variations in local conditions and thus will necessarily take a variety of forms.“

Since this publication, IWRM has been successfully embedded into the thinking of global non-governmental organisations, multilateral financial institutions, UN-Water, the Asian Development Bank, Organisation for Economic Co-operation and Development (OECD), African Ministers’ Council on Water, World Bank, United Nations Economic Commission for Europe, and many other organisations. Many countries too have adopted this approach. However, few countries have seriously taken the next step to implement the plans. They recognise that implementing IWRM is a complex process with no ‘blueprint’ solutions. So the question arises: how do governments put these principles into practice? For those who have tried, did IWRM deliver on its promise?

These events marked a shift from integrated infrastructure management towards water governance and environmental protection. Inspired by the Dublin Statement in 1992, GWP went well beyond the ideas that TVA embodied. River valley projects successfully illustrated the benefits of inter-sector integration at river basin level to maximise all-round gains from water resource management. They also demonstrated that basin organisations would take a more holistic view of natural resource governance than those based on territorial administrative boundaries.

The IWRM approach also advocated stakeholder participation. Water governance should incorporate goals such as equity, gender, and ecosystem services; above all, it should recognise water as an economic good by assigning primacy to water pricing and full cost recovery. GWP brought the latter to centre stage in the IWRM approach (GWP, 2000).

Table 1. Evolution in IWRM thinking – main events

Period	Trigger	Changing thrust of IWRM thinking
1930s	Tennessee Valley Authority	Integrated management of navigation, flood control, hydropower, erosion control, recreation, health and welfare
1960–1980	Integrated Irrigation Development Projects	Integrate irrigation infrastructure creation with support services such as credit and agricultural extension
1977	UN Conference on Water, Mar del Plata	Emphasised rapid irrigation development to minimise hunger and integration of water resources development into national planning
1987	Brundtland Commission	New emphasis on sustainable development; socio-economic development to be managed without environmental externalities
1992	Koudstaal, Rijsberman and Savenije	[a] Carrying capacity is the logical starting point for water resource development; [b] primacy of demand management to promote efficiency; and [c] integrate IWRM in the nation's socio-economic development
1992	Dublin International Conference on Water and the Environment	[1] water is finite and vulnerable; [b] primacy of participation; [c] centrality of women; [d] water as an economic good
1992	Rio Earth Summit	Primacy of aquatic ecosystem; water as a social and economic good; priority to basic human needs and protection of ecosystems; water should be priced
1996	The Global Water Partnership (GWP) established	Coordinated development of water, land and related resources to maximise socio-economic welfare without compromising sustainability of vital ecosystems
2000	World Water Council 2nd World Water Forum, The Hague	World Water Council mission and vision: Holistic perspective and coordination within and across sectors
2000	FAO	“Sequential Turn of the Water Screw”: [a] get more water; [b] improve efficiency; [c] manage demand
2000	EU	Adoption of Water Framework Directive inspired by IWRM principles
2004	World Bank water strategy	IWRM is accepted but needs a ‘pragmatic but principled approach’
2003–2015	World Water Forum	Continued commitment to IWRM especially in Hague and Kyoto
2014	GWP	GWP vision and mission: for a water secure world by advancing governance and water management for sustainable development. Background Papers published on: The economic value of moving toward a more water secure world (GWP, 2013a) Water Security: Putting the concept into practice (GWP, 2014a)
2015	UN	17 SDGs adopted including the Water Goal SDG 6 and Target 6.5 on IWRM

In 2014, GWP broadened its vision to achieving water security for all (Box 2). This shifted GWP's focus from IWRM, as the means of increasing water security, to the broader end result (GWP, 2014b). IWRM and water security clearly have the same objective – improving the quality of life for everyone.

Both take a broad view of water issues and ask for an integrated approach across sectors and scales (GWP, 2014a). Indeed, Lautze and Manthritilake (2012) wondered if they are in fact the same concept but packaged differently.

But if we are to make progress to increase water security we need to understand what it means in practice. As yet there is no consensus on how we should approach and operationalise what is a real and complex issue. But what we do know is that in order to plan and manage water security we need to identify the various dimensions of security, setting targets and taking action to achieve them (GWP, 2014a).

GWP (2013a) states that any interventions in water systems are costly and so economic analysis has to provide insights into costs and benefits. Estimating costs is the easy part. Estimating the benefits is much more difficult; they are context specific and require a sound understanding of the value of water.

Box 2. Water security is increasingly viewed as the *sine qua non* for sustainable development

Water security has been defined as:

“the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustainable livelihoods, human wellbeing and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters and for preserving ecosystems of peace and political stability” (UN-Water, 2013).

“availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies” (Grey and Sadoff, 2007).

Overall, IWRM as the process for achieving water security has brought to the fore and popularised a much broader idea of ‘water governance’. Durham et al. (2002) commented, “It is difficult to overstate the extent to which IWRM has become the norm or even, one might say, the orthodoxy in water resources management”. Schulze (2007) wrote “Integrated Water Resources Management (IWRM) has been accepted as the water management regime for the 21st century ... it has incorporated something dear for each, achieving universal acceptance”. Garcia (2008) added “Like a mantra, no national, regional, or international organisation fails to promote ‘some’ IWRM concept”. Thus according to some authors, a kind of IWRM evangelism had overtaken the global water discourse.

3 PUTTING IWRM INTO PRACTICE

3.1 The successes



Many rich countries have successfully adopted IWRM or its component parts. In Italy's Adda basin, participatory and integrated planning adopted under the EU Water Framework Directive was "extremely effective" (Gandolfi et al., 2007). In the US, Montana's Clark Fork River Basin Task Force was "highly proactive in promoting a progressive agenda focused on integrating water management, water supply, land use, and economic change" (Shively and Mueller, 2010). Participatory river basin management on the Em River in south-east Sweden provided a good example of the IWRM ideal (Joensson, 2004). The Em River Stakeholder Association became an effective vehicle for participatory management for water economising, fish migration, storm-water characterisation, and nutrient reduction.

Even in the developing world and countries in economic transition, the IWRM approach has taken root in affluent areas and markets in the Caribbean (GWP, 2014c), Central Asia (GWP, 2014d), and Central and Eastern Europe (GWP, 2015a). Exploring alternative pathways to water demand management received new support in many countries. But basin-level organisations remained skeletal and ineffective in many countries, though some, such as China's Yellow River Conservancy Commission, became powerful, effective, and modestly successful in improving the environmental flows in the main stem of the Yellow River (GWP, 2015b).

Water user associations managing irrigation systems, full cost recovery of water service fees, and an evolving suite of regulatory provisions for water use and pollution have become standard in Turkey, Mexico, Chile, and Colombia. Mexico and Spain experimented with Aquifer Committees similar to the groundwater districts in several states of the US. Chile experimented with in-depth water rights reforms.

For a long time, China saw the solution to its water woes in large infrastructure projects, such as the Three Gorges Dam and the south to north water transfers. However, China's 'Three Red Lines' policy, announced in 2010, which focuses wholly on demand-side management, has the unmistakable stamp of IWRM thinking (Moore, 2013; GWP, 2015b).

In Morocco, in the 1990s, having exhausted most of the supply-side options, the government launched IWRM-style water reforms that culminated in a comprehensive water law in 1995 followed by a World Bank loan for IWRM implementation. Demand-side water resources management in a participatory framework has emerged as the dominant theme in Morocco's water resources policy during the new millennium (World Bank, 2013).

South Africa's water reforms offer a textbook example of IWRM which has worked well for commercial farmers, though less so for smallholders. Namibia, another affluent southern African country, found that "implementation of integrated water resource management is a responsible way of managing urban water supply in arid regions" (van der Merwe, 2000). However, van de Merwe suggested that IWRM emphasised 'smart' infrastructure development as a sustainable resource management strategy. He also asked "What is needed: good water resources management or IWRM?" He suggested that the water demand in Namibia's capital, Windhoek, could be cut by one-third by reusing wastewater through dual pipe systems, reclaiming water for potable use, and artificially recharging groundwater, all in an integrated manner.

3.2 Pre-IWRM thinking vs. IWRM thinking

In all these countries, IWRM thinking has both challenged and helped to dislodge conventional thinking about the progression of water resource interventions (Figure 1). A country newly embarking on an economic development pathway would first focus on infrastructure to develop its water resources and provide basic water services. If most of the population was too poor to pay for water services, then public utilities would subsidise the cost. At this stage, managing water demand and creating rules and institutional processes have low priority as does meeting nature's demand for water. It is only when new water resources are nearly exhausted that a country begins to look at demand management options. Economic water pricing and water services become important and full cost recovery becomes feasible as incomes rise. During the past decade, countries such as China, Morocco, and Mexico have entered this latter phase. Holistic and integrated governance and management of water, land, and ecosystems become desirable goals but only become reality after a further spell of evolution when appropriate institutional arrangements are established.

This progression was considered normal, acceptable, and inviolate until it was challenged by IWRM thinking. This argued that the progression, even in poor countries, should collapse into a single, smooth protocol that integrates

full cost recovery and holistic, participatory natural resource management with water infrastructure creation right from the start of the evolutionary process.

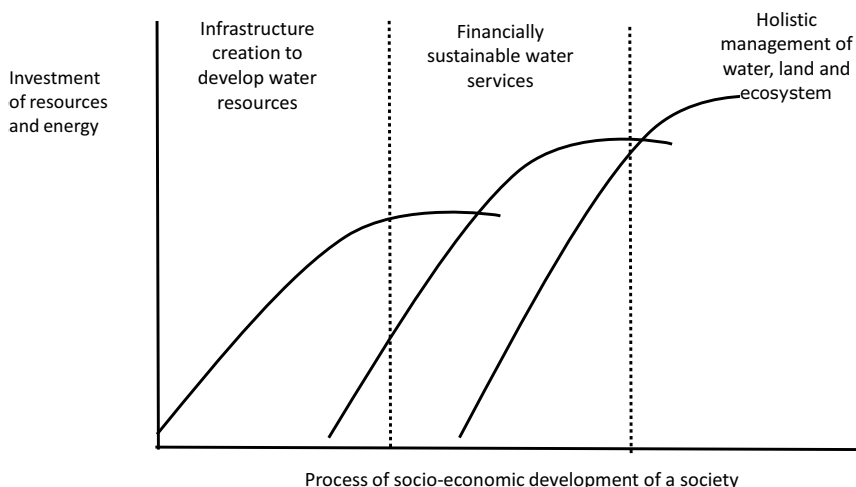


Figure 1. Conventional approach to water sector interventions, pre-IWRM

In summary, the most powerful beneficial impact of IWRM has been to transform the global discourse on how governments and communities can best manage their water resources. It offered a sharply different view, compared with earlier thinking, on what, where, who, why, and how to intervene in the water sector from the micro to meso to macro levels (Table 2). So different was this view that it was often considered theoretical, idealistic, aspirational, and far removed from the prevailing reality in many countries.

Table 2. IWRM’s impact on notions of water management

		Pre-IWRM thinking	IWRM thinking
What	What water interventions are needed?	Water supply or irrigation infrastructure to be designed and built	Holistic management of water, land, and ecosystem in a catchment/basin perspective through supply and demand-side interventions
Where	Where is the action concentrated?	Where the infrastructure is being built	A catchment/basin plan provides the framework for all infrastructure design as well as policy and management interventions
Who	Who will implement the intervention?	Municipality or government department or a territorial organisation	Catchment/basin level institutions will play the over-arching planning and coordination role
Why	For what purpose is the intervention designed?	To improve welfare and livelihoods by making more water available from nature to project beneficiaries	To promote holistic supply and demand-side management of natural resources to enhance productivity, equity, and environmental sustainability

How to implement	How will water interventions be planned and implemented?	Engineers and hydrologists will plan, design, and build water infrastructure	Catchment/basin level institutions create stakeholder platforms to plan and implement water interventions in a gender-participatory process
How to finance	How will management, operations and maintenance (MOM) costs be covered?	Government pays for the capital cost and recovers part of the MOM cost by charging a user fee	User fee covers not only the MOM cost but also interest and depreciation of fixed capital and the cost of internalising various externalities originating from the intervention

3.3 Dealing with the ambiguity

If IWRM is lauded by some for its flexibility to offer ‘something for everyone’, it is criticised by many more for being fuzzy, ambiguous, and bereft of practical substance. Biswas (2008) is the most vocal:

“In spite of the fact that its promoters have spent hundreds of millions of dollars in recent years, the fact remains that the definition of this concept remains amorphous, and the results of its application in a real world to improve water policy, programme and projects at macro- and meso-scales have left much to be desired”.

Concerns about the fuzziness were widely shared, particularly among social and institutional researchers. Mollinga (2006) described IWRM as a “concept looking for a constituency”. Molle (2008) called IWRM a nirvana concept that embodies “an ideal image of what the world should tend to” or “a vision of a ‘horizon’ that individuals and societies should strive to reach”. Jonker (2002) says IWRM suffers from two infirmities: the nature of the science which has informed its development, and its curiously ambiguous character in terms of current intellectual paradigms. He also writes, “There is still a long way to go to achieve a common understanding of IWRM and to develop and refine approaches for its successful implementation”. Even GWP (2000) agreed that “IWRM has neither been unambiguously defined, nor has the question of how it is to be implemented been fully addressed. What has to be integrated and how is it best done? Can the broad principles of IWRM be operationalised in practice – and, if so, how?”

But perhaps there is too much concern about ambiguity, fuzziness, or a more precise definition. What is well understood is that putting IWRM into practice is highly complex and unique to each country’s circumstances and to define it more specifically, as Biswas (2004) and others seem to suggest, may be not only impossible but also not very helpful. Mason and Callow (2013) imply that we should not worry about ambiguity. They argue that a common language is a vital prerequisite to having meaningful discussions

about highly complex issues among different disciplines and interest groups while each acknowledges the different contributions that others bring to the table. They cite ‘water security’ as having intuitive appeal; a term that most people now identify with, and which brings people together to discuss it while holding very different views and ideas as to what it means.

3.4 The ‘IWRM Package’

The criticism of ‘fuzziness’ was, for some, a ‘fig leaf’ covering the difficulties that many observers and practitioners encountered in implementing IWRM – taking that leap from pre-IWRM thinking to IWRM action.

In order to be more specific and make IWRM implementable, the UN system, international financial bodies, and global civil society turned IWRM into a ‘package of practices’ (the ‘IWRM Package’). For policy-makers in many poor countries, this became the ‘conditionality’ attached to large, badly needed loans from multilateral lenders. The IWRM Package became a mix of policy instruments and was centrally about preparing countries for integrated management of water demand by strengthening the role of water policy, law, and administration, the three pillars of water governance. Implementing the Package began to overshadow the original philosophy that emphasised an evolutionary and flexible process.

The IWRM Package generally included the following:

- Announcing a national water policy that declares water as national property (as in Mexico, China, and EU member states) and presenting a cohesive, well-understood normative framework to guide all players in the sector.
- Introducing a national water law that provides the legal framework for implementing the water policy (Mexico’s Law of the Nation’s Water of 1992; South Africa’s Water Law of 1995).
- Accepting the principle of water as an economic good by pricing water resources as well as services to reflect its scarcity value and to ensure it is efficiently used and allocated to high-value uses (Israel, Mexico, China, and South Africa).
- Adopting the river basin as the unit of water and land resources planning and management, creating river basin organisations in place of territorial or administrative departments, and treating ground and surface water as part of the same system.
- Creating water rights, preferably tradable, by instituting a system to register water users and issue water withdrawal permits (Australia, United States, Mexico, and Spain).
- Accepting participatory water resources management with the specific

inclusion of women, so that water becomes ‘everybody’s business’.

Key words that underpin the IWRM vision of water governance were: process, integration, basin-scale, demand-side management, participatory, gender-just, and ‘getting the price right’.

3.5 The gap between theory and practice

For many developing countries, the IWRM Package became an end in itself. Many witnessed efforts to impose it, as if doing so would somehow help societies to leapfrog their water economies from anarchy to order, from non-governance to good governance.

While the noble intentions behind the IWRM concept have never been in question, IWRM interventions in poor countries produced many criticisms. One concern was the slow pace of internalising the IWRM approach. Schulze (2007) wrote that IWRM has proved problematic to migrate from theory to practice. Blanco (2008), an IWRM observer in Colombia, lamented that IWRM meant ‘paralysis-by-analysis’. The general inability of governments and communities to leap from conventional water management to the IWRM Package made scholars such as van der Zaag (2005) ask whether IWRM is a relevant concept or just an irrelevant buzzword. Najjar and Collier (2011) ask: why is IWRM so difficult? Why has it advanced so slowly and typically only at the conceptual level?

In much of Latin America and the Caribbean, Dourojeanni and Nelson (1987) found that “Formulation of [IWRM] plans and policies appears straightforward but, practice bears little relation to theory”. Frustrated by the lack of progress, the United Nations Environment Programme (UNEP) counted converting IWRM theory into practice as ‘unfinished business’ (IWA/UNEP, 2002). In the High Level Panel on IWRM at the 7th World Water Forum, Mohamed Ait Kadi (GWP TEC Chair) asked, “If the promotion of IWRM was more clearly owned on a country-wide basis somewhere, and the result were spectacular, [these] doubts would be silenced”.

Middle and high income countries have had a much happier experience because IWRM was interpreted and implemented in a way that is only really suited to countries with the most developed water infrastructure and management capacities (Butterworth et al., 2010).

Schulze (2007) complained about “some foci of IWRM in the ‘south’ which are often forgotten by the ‘north’”. Schiff (2010) found there was a puzzling disparity in implementing IWRM in rich and poor worlds. Effective demand

management, encouraging ‘a water-oriented civil society’, transparent policy processes, conflict resolution guidelines for regional and international water issues, equitable access to water resources, decentralising water policy, and privatising water provision – all these work much better in Germany and Canada than in India and southern Africa. “IWRM is an intergenerational social contract between the north and the south” (Coleringa, personal communication, 2015).

Even in the rich world, IWRM implementation is not without problems. This is especially true for realising water as an economic good. Developing countries have always been reluctant to introduce full cost recovery pricing owing to widespread poverty and lack of ability to pay. But even in developed countries [of Mediterranean Europe], full cost recovery is a far cry thanks to “strong lobbying power of interest groups” (Sgobbi and Fraviga, 2006). Davis (2007) noted that even in the rich world “wide-scale adoption of IWRM remains elusive”.

3.6 Cosmetic adoption

In many low-income countries of Asia, Africa, and Latin America, IWRM as a participatory process for promoting coordinated development and water management was undermined by the ‘IWRM Package’ imposed as part of a water sector restructuring loan from multilateral lenders. In some countries, this met with popular resistance.

In the early 2000s the government of Sri Lanka made two bold but abortive attempts to push through IWRM-style reforms in the water sector (Box 3). In contrast, many other South and Southeast Asian countries, notably Indonesia, Nepal, Thailand, and Vietnam, did not face any opposition from media and civil society (Molle, 2005). But, in the absence of a proper process, there was no genuine IWRM buy-in.

Box 3. Introducing the IWRM Package in Sri Lanka

A new set of water policy and water law drafts provided for establishing state ownership of water; an institution of water-use rights through the issue of withdrawal permits; pricing of water in all uses; transferable water permits to encourage trade in water rights; and replacement of existing water organisations by river basin organisations. In sum the IWRM Package. Sri Lanka’s media and civil society bitterly opposed the logic underlying the proposed reforms (Samad, 2005). The government, unprepared for such strident opposition, rapidly withdrew the reforms which it was not convinced about in the first place.

Under the influence of the international aid community, Cambodia moved rapidly into IWRM as the legal framework for managing water which “excludes local narratives, voices and realities” (Mang, 2009). “The imposition of IWRM from the ‘outside’... is ultimately being resisted because of local perceptions of the model as being inappropriate and illegitimate”.

Even under China’s powerful enforcement, local observers such as Yu (2014) noted that with poorly developed policies and lack of multi-level cooperation, IWRM [as implemented] “can reinforce destructive practices which are dangerous, costly, and difficult to detect. Approaches are needed that have flexibility to account for physical, socio-economic and political specificities.”

In Vietnam’s Red River Basin, Molle and Hoanh (2011) concluded that IWRM icons, such as river basins organisations established by donors, “have been quite disconnected from existing institutional frameworks. Such institutional change as is visible result[s] from the interaction between endogenous processes and external pressures, in ways that are hard to predict.” Molle (2005) found little match between the reality of the water economies of the Mekong region and the reforms borne out of “a global water discourse largely driven by international organisations”. His review of IWRM experience in the Mekong led him to emphasise:

“a gap between formal and state-centered initiatives and reality on the ground, which proceeds at a different pace. Lessons learned elsewhere are certainly important but cannot be adopted indiscriminately and must not be allowed to crowd out the emergence of endogenous and condition-specific solutions.”

In brief, IWRM came unstuck in much of Asia except perhaps Central Asia where some donors invested heavily in the process of IWRM promotion at various levels.

3.7 Global ideal and local practice in Africa

The gap between the global ideal and local practice from imposing the IWRM Package was wider in Africa than in Asia. In Malawi, Mkandawire and Mulwafu (2006) found that “[the] neglect of [customary] norms and laws may have negative consequences for the majority of the villagers who rely on them” and that “IWRM continues to operate at a high and often idealistic level, thanks to insufficient capacity building in awareness, planning, and implementation processes at different levels of society”.

In Zimbabwe, among the earliest to adopt IWRM in 1995, Tapela (2002) found that “although the legal and institutional frameworks have been put in place, the implementation of the IWRM approach has tended to be problematic” largely due to “the transaction costs” imposed by water reforms on common folk.

In the Ethiopian Blue Nile Basin, Hagos et al. (2011) complained about poor enforcement capacity of the water bureaucracy, a tendency to deploy command-and-control mechanisms in the guise of IWRM, and an “ongoing clash between IWRM interventions and customary laws and institutions”.

In the Cross River Basin in Nigeria, a TVA-style River Basin Authority was established in 1976, even before IWRM became a global campaign. Akpabio et al. (2007) found that, 30 years later, IWRM had failed, leaving a “large gap between the original objectives and the actual delivery of services”, thanks to “legal, political, administrative, and financial obstacles”. The authors pleaded for “reform to reflect local circumstances and conditions”.

In Boteti River sub-basin in Botswana, Swatuk and Motsholapheko (2008) found that IWRM led to elaborate data collection but implementation was constrained by “numerous human, financial, and technological limitations”. They concluded that “the globalised ideals of IWRM are of limited use when attempting to alter localised management practices in basins with deeply embedded social and cultural practices”.

In Burkina Faso, Debevec and Banhoro (2014) found IWRM reform stuck in the “gap between discourse and reality” and failed to take root for the lack of “financial resources and the required technical skills”.

In Tanzania, where IWRM-linked loans led to statutory legal systems driving out plural customary laws to regulate the use of water resources, Maganga (2003) argued that the “neglect of customary laws ... will have negative consequences for individuals and groups who were better served by customary systems”. Swatuk (2005) concluded in southern Africa “rural dwellers are suspicious of the motives behind [IWRM-style] reform”, and that “efforts to fully recover costs in urban areas have been met with widespread civil resistance”. To achieve sustainable, equitable, and efficient water use in the region, “it is important to reflect on the political nature of these activities and to reconsider (and be prepared to revise or discard) the basic assumptions and ideologies driving the reform process”.

As experience mounted in southern Africa, the region began to increasingly view “IWRM as a highly normative discourse that prescribes a long list of activities without context, such as basin management, environmental flows, strengthened permit systems coupled to fees, and subsidiarity and participation” (van Koppen and Schreiner, 2014).

3.8 IWRM politics in southern Africa

Mehta et al. (2014) show that the real impacts on Mozambique, South Africa, and Zimbabwe are determined by the politics of implementing IWRM and the interface between global and national interests in shaping water policies.

Swatuk (2008) commented on southern Africa that:

“IWRM has produced an invidious power politics. IWRM focusing on demand management and eco-centric approaches pushed by donors and influential international actors such as the IUCN and World Wide Fund for Nature have limited local support from southern African decision-makers but not from the masses suffering in abiding poverty and inequality, and vulnerability to water insecurity.”

In South Africa, politics were most evident in the apartheid era, when aggressive pursuit of ‘water as an economic good’ directed water to high value uses. This severely undermined equitable access to water and created a highly unequal water economy. Commercial farmers, 1.2 percent of the rural population, appropriated 95 percent of the water while the small farmers in homelands, 98.8 percent of the population, were dependent on 5 percent of total water for their agrarian livelihoods:

“For whites, the new discourse of water as an economic good had no tangible impact on their well-being. White ecologists increased their control over water in nature reserves that did not fit the criteria of economic efficiency. Water in the homelands fell under stricter government control. Thus, the real trade-off was for black South Africans. An increasing proportion of black South Africans ... had become economically too ‘inefficient’ to deserve any more water than the negligible portion of water resources they used. Water for ‘the’ environment, defined by whites, became more important” (van Koppen and Schreiner, 2014).

Van der Zaag (2005) claimed, “IWRM should explicitly deal with the fact that water tends to build asymmetrical relationships between people, communities and nations”.

3.9 Putting the ‘cart before the horse’

For most poor countries, the donor-driven IWRM Package put the ‘cart before the horse’. The main local concern was improving water infrastructure and services, and managing these better. But the IWRM Package forced many towards demand management even before the services to manage demand were created.

In 1991, Tanzania identified water development as a key national policy goal with priority for creating new infrastructure and water storage. People needed more and better managed infrastructure but there was little outside support. This was low in the priorities of international financial agencies. Thus Tanzania ended up with the IWRM Package. The reforms could not deliver better domestic water supply systems, improved irrigation water control, and better hydraulic infrastructure. Rather they gave people water withdrawal permits, water pricing, and defunct catchment organisations. According to Swatuk (2008), what Tanzania went through is true of much of southern Africa:

“For the masses, IWRM has [been] and is widely seen to have impeded the development of water infrastructure in the region and undermined an approach to resource use which offers a pathway toward broad-based social benefits through the capture of the region’s water resources”.

According to Muller (2010), this Package was not the original intent. Integrated water resource development and management was recommended at the Rio Summit in 1992. But the word ‘development’ disappeared and the Dublin Principles, ‘a preconference lobbying product’, were aggressively promoted instead. The resulting IWRM doctrine constrained infrastructure investments in developing countries, often ignoring the context within which water resources are managed. As a result, the positive outcomes have been limited. To become ‘fit for the purpose’, Muller suggested that IWRM must be taken back to basics.

Briscoe, the 2014 Stockholm Water Prize laureate, was an open critic of global IWRM ideology and the harm that donor-driven IWRM could do in poor countries. According to Catley-Carson (2014), Briscoe characterised as ‘moral hazard’, the efforts of the global community to propagate, often with concessional funding, a vision that today’s rich countries neither experienced, nor would have supported, in terms of their own domestic policies when they were in the situation that today’s developing countries are in.

3.10 Alternatives to the ‘IWRM Package’

It is now widely acknowledged that most of the problems of implementing IWRM were not so much to do with the ideas embodied in the IWRM approach; rather they were to do with the IWRM Package and the way in which this was implemented. This relieved funding agencies of the burden of discovering the real problems and priorities of poor countries and helping them to design their own tailor-made IWRM process (Giordano and Shah, 2014).

The Package also tended to shut out alternative thinking for pragmatic solutions. Merrey (2008) advocated an approach based on studies in Ruaha basin in Tanzania and Olifants in South Africa. He suggested that “basin managers identify priority problem areas and focus specifically on finding solutions to these problems ... rather than starting with a broad set of principles and trying to implement these”. Lankford et al. (2007) argued that “instead of relying on broad generic principles”, it might work better to build on “local solutions generated by local resource users to guide adaptive problem solving”.

Merrey et al. (2005) found the IWRM approach largely ignored livelihoods and poverty concerns. This was surprising since, in low-income countries, improving water resources governance is closely linked to society’s concerns about poverty eradication and improving livelihoods. They suggested IWRM should promote human welfare, especially poverty reduction, and encourage better livelihoods and balanced economic growth through effective democratic development and management of water.

Giordano and Shah (2014) supported Merrey by saying “We need to put the problems first and then work to find pragmatic solutions, whether they use IWRM principles or not”. This is easy to say but not so easy to do, even in countries like South Africa which pioneered several IWRM practices. In 1994 the National Water Act embraced IWRM but it did not help to provide equitable access to water for South Africa’s poor. In 2013, South Africa sought to remedy this with a new strategy with explicit emphasis on developmental water management (DWM) (van Koppen and Schreiner, 2014). DWM differs from IWRM in at least three ways. First, it accepts that water management is not an end in itself but a means to equitable, redistributive, broad-based social and economic development. Second, it restores the primacy of water infrastructure and service delivery and brings these to centre stage of the water policy debate. Third, it puts emphasis back on operationalising equity, the third leg of IWRM which has been paid little more than lip service to date.

4 REAL DRIVERS OF WATER SECURITY



What are the factors that really drive increases in national water security?

The nature of the state is one driver. Countries with hard, authoritarian governments are often able to push far-reaching sector policy reforms more easily than democracies. Countries in the New World – Australia, Brazil, Canada, New Zealand, and the US – have used water law and property rights to introduce effective water governance in ways that other countries would find hard to do.

But by far the most powerful driver is the overall stage of a nation's economic development. It seems simplistic but it is true that rich countries are water secure, no matter how limited their water resources endowment; and poor countries are water insecure, no matter how abundant their water resources endowment.

Figure 2 demonstrates a strong positive relationship between water security and PPP-adjusted GDP (purchasing power parity-adjusted gross domestic product) per person for 147 countries. Some two-thirds of the inter-country variations in the level of water security are explained by differences in per capita GDP. The remaining variations show no indication of successful implementation of IWRM-style reforms. Bhutan, Tajikistan, and Tanzania are among the poorest countries and are not known for implementing IWRM yet have high scores for water security. In contrast, Argentina, Botswana, El Salvador, and South Africa are richer and have seriously pursued IWRM-style water reforms but have low water security indices.

Water security is a stronger function of economic development of a country than many other variables such as absolute water availability (Figure 2).

In other words, the argument is not that GDP grows as water security grows but rather the opposite – water security grows as GDP grows. This broad assertion is amply supported by the empirical Water Poverty Index¹ developed by Sullivan et al. (2003) and by the GWP-OECD report (2015).

¹ The Water Poverty Index (WPI) was a composite of five indices of equal weight: [a] water resource endowment; [b] access to water for drinking, sanitation, and productive purposes; [c] management capacity; [d] water use; and [e] water environment. While the overall WPI was hard to interpret, the Water Access Index was defined almost as the inverse of how 'water security' is defined now. For example, Grey and Sadoff (2007), cited in Box 2, define water security as the "availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production" which is best approximated by the Water Access Index. Regression analyses showed that there is no significant relationship between per capita GDP and water resources per person or between the Water Access Index and water resource endowment per person. However, there is a strong positive relationship between Water Access and GDP per person.

This positive relationship is not hard to explain. The quality of water governance in a country depends on the quality and size of human and other resources available, including public water institutions, their rule-enforcement capacity, and the ability of the poorest sections of society to pay for a minimum acceptable level of public water service. All this determines the potential to build a viable, modern water industry. All these drivers are weak in poor countries and strong in wealthy ones.

The World Water Council's (WWC) Water Environment Index² appears to support this view (Figure 3). As living standards improve, the growing demand for 'environmental amenity' generates pressures that encourage societies to find ways of growing the economy that reduce the demands on scarce natural resources, such as water, and thus increase security. Gleick (2002) calls this the 'soft water path'. This thinking is reinforced by the Kuznets 'U'-shaped curve³ showing that when societies begin from low levels of economic development, the quality of their environment first declines as intensive economic growth uses natural resources as 'factors of production' and then increases as the economy continues to grow (Bhattarai and Hammig, 2001).

² The Water Environment Index "tries to capture a number of environmental indicators which reflect water provision and management and which are included in the Environmental Sustainability Index (ESI) (Esty, 2008). These indicators not only cover water quality and 'stress', but also the degree to which water and the environment generally, and related information, are given importance in a country's strategic and regulatory framework." The Index is a composite of indices of water quality, water stress (pollution), environmental regulation and management, informational capacity, and biodiversity based on threatened species.

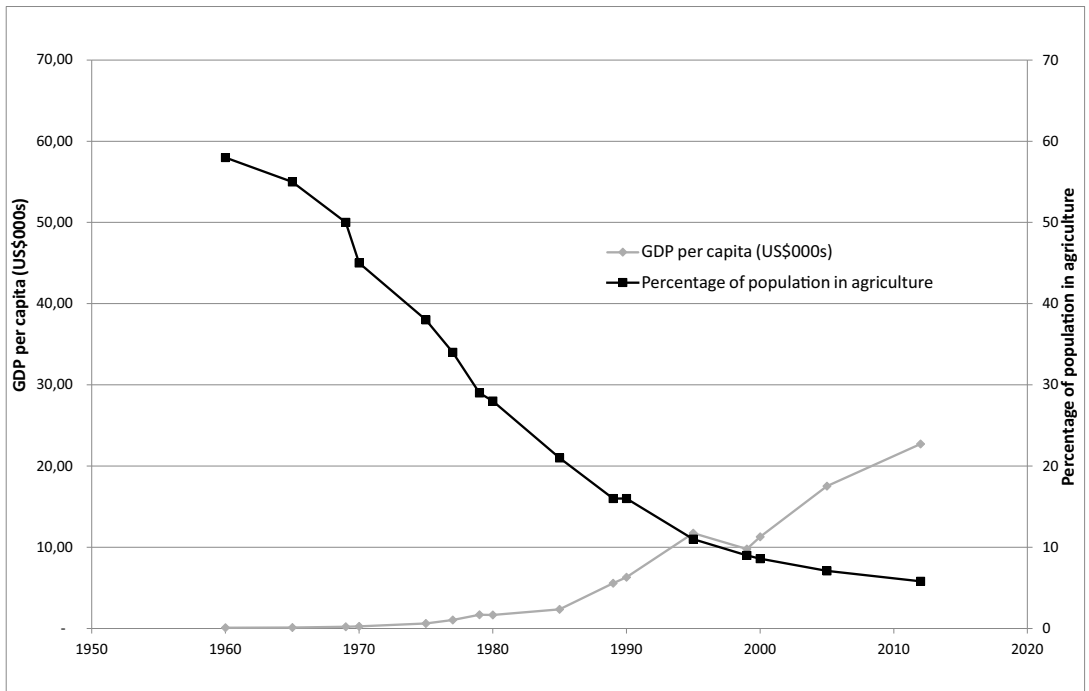
³ Nobel laureate Simon Kuznets had proposed decades ago a U-shaped relationship between economic growth and income inequalities suggesting that income inequalities first increase when a poor country embarks on a growth path but decline after a threshold is reached. Later a similar U-shape relationship was postulated to describe the relationship between economic growth and environmental quality.

In countries such as China, India, and Pakistan, it is not hard to see why the Water Environment Index would increase rapidly with economic development. Water resources, especially groundwater, are under great stress because far too many people must rely on farming for their livelihoods. A few decades of rapid economic growth can shift this population overload to off-farm jobs, relieve pressure on land and water, and improve the quality of the water environment.

One example is South Korea. During the past 50 years, the farming population fell from 60 percent of the total population to 3 percent as people moved into off-farm livelihoods (Figure 4).

The logical conclusion is that in order to be effective, water resource management strategies must be context-specific. A key defining issue is where a country is in the evolutionary process of economic development. The ‘one-size-fits-all’ framework implied in the IWRM Package overlooks this important fact and the result is a gap between theory and practice.

Figure 4. South Korea: GDP growth and decline in population in agriculture 1960–2012. Source: Lee (2014)



5 TRANSFORMING WATER ECONOMIES



ater economies differ in a variety of ways; but one dimension of critical importance is the extent to which a country has formalised water service provision.

Rich countries usually have highly formal water economies and most people are secondary users. They connect with the water governance regime through a plethora of large-scale organised service providers – primary water diverters that are easily amenable to regulation. The state ‘steers’ the water economy by means of water law, policy, and administration – the three pillars of IWRM.

In contrast, most low-income countries have informal water economies where the final water users, particularly in rural communities, are themselves primary water diverters, drawing water directly from shallow wells and streams to meet their personal water requirements. The reach of the state apparatus is very limited and ‘governing’ informal water economies is rather a contradiction in terms, for by definition, an informal economy is usually outside the direct legal, regulatory, and administrative ambit of the state.

Informal institutions “are the structure that humans impose on their dealings with each other” (North, 1990). Informal irrigation service markets of South Asia, urban tanker water markets throughout the developing world, traditional hill irrigation institutions in the Himalayas, and informal water user associations are all examples of institutional arrangements that dominate the informal water economy and operate outside the ambit of the ‘three pillars’.

As countries grow economically, their water economy organisations transform in several ways (Table 3). In poor countries (Stage I), most households self-supply their water needs; agriculture is the major draw on water resources. The capacity and financial resources available within state water bureaucracies is low; and the water economy is predominantly informal. India is an example in which over 80 percent of rural households rely on informal water supplies rather than any formal service provider. In

poorer states, such as Bihar and Uttar Pradesh, the informal sector exceeds 95 percent. In richer states, the percentage falls rapidly as the role of the formal water service providers increases. In cities, dependence on formal service providers grows as household income increases. But most poor slum dwellers still rely on informal supplies.

In rich countries (Stage IV), most water needs are served by organised service providers (municipalities or water companies); agriculture cedes water to industry; the water economy is highly formalised; and water institutions bring to bear substantial financial, scientific, and managerial resources to govern water resources.

Switzerland is an example of a highly formalised water economy (Stage IV). In 2005, 70 percent of the population was urban; the country was facing continuous reduction in industrial workers and farmers. As far back as the eighteenth century, 15–20 percent of the Swiss population was connected to the public water supply, which is a higher proportion than in India today. Currently 98 percent of the Swiss population is linked to public water supply networks and 95 percent is connected with wastewater treatment facilities. In the early 2000s, the per capita water bill was US\$468, which is more than the total income per capita of Bangladesh. All the water users are served by a network of municipal, corporate, cooperative water service providers. There are long-standing stringent laws and regulations about water abstraction from any water body, which is administered only through formal concessions. However, these concessions are held by a small number of formal service-providing public agencies; as a result, their enforcement entails few transaction costs (Luis-Manso, 2005). In this highly formalised water economy it is not surprising that IWRM instruments work perfectly well.

Table 3. Stages of evolution of a country's water economy

Transformation of informal water economies with overall economic growth				
	Stage I: Completely informal	Stage II: Largely informal	Stage III: Formalizing	Stage IV: Highly formal water industry
% of users in the formal sector	<5%	5-35%	35-75%	75-95%
Examples	Sub-Saharan Africa	India, Pakistan, Bangladesh	Mexico, Thailand, Turkey, Eastern China	USA, Canada, Western Europe, Australia
Dominant mode of water service provision	Self-supply and informal mutual-help community institutions	Partial public provisioning but self-supply dominates	Private-public provisioning; attempts to improve service and manage the resource	Rise of modern water industry; high intermediation; self-supply disappears
- - - - - Human, technical, financial resources used/km ³ of water diversion - - - - - % of total water use self-supplied _____ Rural population as % of total Cost of domestic water as % of per caput income Cost of water service provision				
Concerns of the governments	Infrastructure creation in welfare mode	Infrastructure and water services, especially in urban areas	Infrastructure and service in towns and villages; cost recovery; resource protection	Integrated mgt. of water infrastructure, service and resource; resource protection
Institutional arrangements	Self-help; mutual help and feudal institutions dominate	Informal markets; mutual help and community management institutions	Organized service providers; self-supply declines; informal institutions decline in significance	Self-supply disappears; all users get served by modern water industry.

In between these extremes lie a range of conditions which, for simplicity, are listed as Stages II and III (Table 3).

In sub-Saharan Africa and South Asia, it is difficult to find a country with a modern, organised, water industry like those in European or the US. South Africa (Stage II) is the exception that tests the rule that overall economic prosperity drives the formalisation of the water economy. White South African towns and the large commercial farms in the countryside are served by what approximates to a modern water sector. However, the former homelands, where 90 percent of South Africans live, are still served by an informal water economy. Much the same occurs in Brazil and Chile. In Asia (Stages II and III), dependency on public systems and formal water providers increases as wealth increases – from a poor province or district to a rich one, from villages to cities, and from poor villages to well-off villages (Shah, 2006).

In Morocco (Stage III), an IWRM success case, a World Bank evaluation noted that:

“Despite the considerable progress on the legal front ... a far more important challenge is the creation of an institutional framework and a change in behaviour among ministries and population ... 10 years after the approval of [World Bank funding for] WRMP, it is beginning to look as if it will take a generation to see the results” (World Bank, 2013).

After 20 years of implementing the IWRM Package there is not one stage I country where it can be shown to have been implemented and materially improved water security. In general, evidence shows that the IWRM Package only really works when countries reach Stage IV.

Evidence also shows that the IWRM Package is relatively straightforward to implement where a small number of large bulk water users, individual or corporate, account for most water diversion. However, it is almost impossible to implement in countries whose water economy is dominated by large numbers of dispersed small users. This is the case in most poor countries where millions of smallholder irrigators self-provide their irrigation and domestic water needs, largely from groundwater but also from ponds, tanks, and streams. Putting a price on water is possible in these circumstances but collecting the fees from millions of unmetered smallholders in rural areas is an almost impossible administrative task with unacceptably high transaction costs. This is particularly relevant to countries where informal groundwater abstraction is emerging as the main water source for both irrigation and domestic use (Box 4).

Box 4. Groundwater governance: IWRM’s ‘Achilles heel’

In large parts of Asia, especially South Asia and China, informal groundwater wells have emerged as the main water source for both irrigation and the domestic water economy.

Applying the IWRM Package to groundwater abstraction comes from water governance experiences in Australia’s Murray-Darling basin from which many lessons have been learned. The most basic lessons include:

1. If you can’t measure it, you can’t manage it!
2. If you don’t allocate it, you can’t manage it!
3. If users don’t respect your abstraction management regime, you can’t manage it!

These lessons have an immediate appeal to policy-makers in developing countries. Yet, operationalising these is a challenge, particularly where groundwater use is extensive.

In South Asia and China, the groundwater economy has boomed as the mainstay of agriculture as well as domestic water supply. Tubewell irrigators have over-exploited aquifers by relentless pumping of groundwater as a free resource.

In India

A 2003 survey in over 4,500 villages showed that more than 80 percent depended on water from own wells, tanks, and streams without any direct administrative influence from a formal agency. A survey of some 79,000 farming households in the late 1990s showed that over 90 percent of water infrastructure assets were owned and operated by households.

India's national water policy documents of 1987 and 2001 made a strong pitch for allocating groundwater by creating some kind of water rights; but the idea remained only on paper. In 2006, the deputy chairman of India's planning commission took the path of least resistance when he made a desperate plea to impose a volumetric levy on groundwater abstraction to create an incentive for conservation. But this did not take off either. The key operational challenge was identifying each user, measuring volumes abstracted and then collecting a volumetric cess, all of which proved to be a Herculean task for a water administration with little implementation capacity.

In China

In China, issuing water withdrawal permits to over 7.5 million tubewell owners is proving a logistical nightmare; monitoring withdrawals by farmers is a long way off. A 2005 survey of 448 villages and 126 townships from 60 counties in Inner Mongolia, Hebei, Henan, Liaoning, Shaanxi and Shanxi found that, "less than 10 percent of well owners obtained a well drilling permit before drilling, despite the nearly universal regulation requiring a permit. Only 5 percent of village respondents believed that well drilling decisions required consideration of well spacing. Even more tellingly, water extraction charges were not collected in any village, and there were no quantity limits put on well owners."

Sources: GWP (2013b); GWP (2014e); GWP (2015b); Wang et al. (2007); Macdonald and Young (2000).

The IWRM Package overlooks the evolutionary process that the IWRM approach has always emphasised. It tries to transform, all at once, a predominantly informal water economy into a predominantly formal one. This would normally be the result of a long process of economic growth and transformation. Evidence across the world suggests that there is no shortcut for a poor society to morph its informal water economy into a formal one. Such a transformation is tied to the relatively slow processes of economic growth and social change. When countries try to force the pace, interventions are likely to come unstuck. Interventions are more likely to work if they aim to improve the working of a water economy and build on the informal structures.

6 FROM THIS REVIEW

6.1 Two important lessons

Two important lessons emerge from this review. The first is that implementation must be gradual and nuanced. Forcing the pace on developing countries has so far proved counterproductive. The second is that countries at different stages of socio-economic evolution have different needs and capabilities and it is essential to reflect this in the approach taken.

The IWRM concept is so simple and compelling that it is hard to challenge. Yet this review has found many inadequacies in putting IWRM into practice. Much of this stems from failing to recognise that IWRM is a means to an end and not an end in itself. Various funding agencies have 'sold' the concept as a 'fixed package' (referred to here as the 'IWRM Package'). But there was disappointment when changes were far slower than expected. Most crucial was that those promoting IWRM often overlooked the importance of adapting the Package to local circumstances.

However, the disappointing results in some countries does not mean that the IWRM approach should be abandoned. This would be like 'throwing the baby out with the bathwater'. It does mean that the IWRM approach must be adapted to local circumstances rather than trying a one-size-fits-all approach.

Putting IWRM into practice in different countries is about finding a balance between learning from how rich countries manage their water economies and adapting this to local conditions. If there is too much focus on the former, reforms may come unstuck because organising water economies in poor countries is very different. But if poor countries only revel in their exceptional circumstances, they may forfeit the opportunity to learn from the mistakes and successes of others and waste time and energy in 're-inventing the wheel'.

Box 5. From John Briscoe, 2014 Stockholm Water Prize laureate

Every water solution is a local solution. Moreover, every solution is provisional and contains the seed of a future problem; it works for a time and there is a constant challenge and response cycle. There is a spiral-like reflexive relationship between water and economic growth; improved water management promotes growth and economic

growth creates opportunities for new kinds of water management interventions which are hard to implement when income levels are low.

In poor countries, give primacy to creating appropriate water infrastructure and building capacity for its sustainable management as the first step to improving management of the water economy. South Africa would not have built a strong agricultural and mineral economy but for its investment in inter-basin water transfers which has now made IWRM-type interventions possible. Counterintuitively, while transparency, equity, good governance, and participation have high intrinsic value, they have doubtful instrumental value, in the sense that these are neither necessary nor sufficient for improving the working of a water economy or for removing poverty. China adopted a top-down approach for lifting millions of people out of poverty by relentlessly pushing economic growth. ‘Develop now and clean-up later’ is not the best development approach, but the reality is that this has produced today’s rich countries. Many people find Briscoe’s views extreme, but these were behind the World Bank’s 2004 water strategy which asserted that “the main management challenge is not a vision of integrated water resources management” but of forging a “pragmatic but principled approach” to water governance reform.

6.2 Implementing the Water Goal

The aims of IWRM are synonymous with those of the Water Goal (SDG 6), particularly Target SDG 6.5, and so the lessons drawn from this review are most apt for implementing SDG 6. The most important lesson is that implementation must be gradual and nuanced. Forcing the pace on developing countries to achieve SDG 6.5 Targets may prove counterproductive. Those involved in implementation must also recognise that applying a ‘one-size-fits-all’ package is most inappropriate. Countries at different stages of socio-economic evolution have different capabilities and different needs. Table 4 sets out a broad framework comprising four stages of national water economy evolution and suggests appropriate interventions in six key areas: capacity building, institutional reform, policy and legal regime, investment priorities, management of ecosystem impacts, and water pricing and cost recovery.

In fragile economies (Stage I), where formal water infrastructure and institutions are mostly non-existent and people rely on local and informal water supplies, IWRM must give priority to creating infrastructure, building local capacity, and developing an information base to provide the foundation for basin-level planning.

In emerging economies (Stage II), where basic infrastructure and institutions exist in the public and private sectors, the focus must shift to financial and economic viability, integrating traditional local water institutions into formal ones, and creating a basic legal and regulatory framework for water diversion and quality management.

Middle income countries (Stage III) are more prepared and accepting of all the components that make up the IWRM process if they are gradually introduced through a proper participatory process. This approach can reduce the dangers of opportunistic, cosmetic adoption of new practices and increase the prospects of strong water governance reforms.

The IWRM also has much to offer the rich countries (Stage IV) in improving efficiency, water quality, biodiversity, sustainability, and much more. The European Community’s Water Framework Directive (WFD) was inspired by and is synonymous with IWRM and there is still much to do in terms of implementing it.

Table 4. Indicative priorities for an IWRM strategy for achieving SDGs

Indicative priorities for an IWRM strategy Contextualised to water economies at different stages of evolution				
Evolutionary stage	Stage I Completely informal	Stage II Larely informal	Stage III Formalising	Stage IV Highly formal water industry
% of users in formal water economy	5–15	15–35	35–75	75–95
Examples	Congo, Bhutan	Bangladesh, Tanzania	Mexico, Thailand, Turkey, China	US, Canada, France, Australia
Capacity building	Invest in basic techno-managerial capacities for creating affordable infrastructure and service	Build capacities for efficient management of water infrastructure and water service provision	Build local capacities for catchment/river basin level water resources management	High level techno-managerial capacity for water and energy efficient water economy
Institutional reforms	Make existing institutions equitable and gender-just without emasculating them	Create representative and participatory institutions at project or watershed levels	Integrate customary and formal user organisations and territorial agencies into basin organisation	Modern water industry with professionally-managed service providers
Policy and legal regime	Effective policies for water for livelihoods & food security; create a regulatory framework for bulk water users	Establish basic water policy and water law consistent with local institutions and customary law	Introduce policy and legal regime for a transition to basin level water governance	Policy and regulatory framework for a modern water industry and transboundary water governance
Investment priority	Establish and improve water infrastructure for consumptive and productive use by the poor and women	Invest in infrastructure modernisation for improved service delivery and water use efficiency	Invest in infrastructure for basin level water allocation and management including interbasin transfers and Managed Aquifer Recharge	Technologies and infrastructure for improving water and energy efficiency in water economy
Managing ecosystem impacts	Create broad-based awareness of aquatic ecosystem; regulate water diversion and pollution by corporate consumers	Proactive management of water quality and ecosystem impacts at project level; invest in low-cost recycling	Focus on water quality and health management, urban waste water recycling, control of ground water depletion	Zero or minimal discharge water economy; reduce carbon footprint
Water as a social and economic good	Minimise perverse subsidies; make subsidies smart, rationing to minimise waste	Volumetric water pricing for bulk users; partial cost recovery for retail consumers; targeted subsidies for the poor	Full financial cost recovery of water services; metered water supply; 90% population covered by service providers	Full economic cost recovery of water services including the costs of managing ecosystem impacts.

6.3 Guidelines for implementation

This paper offers a framework for guiding SDG 6.5 (and IWRM) implementation and the interventions that may help to improve the all-round working of water economies related to the various stages of economic and social evolution. But some countries will need more detailed guidelines to help them develop their unique pathway through the various stages of socio-economic development and the interventions needed to build capacity, reform institutions, develop policy and legal regimes, prioritise investments, manage ecosystem impacts, and administer water pricing and cost recovery.

REFERENCES

- Akpabio, E.M., Watson, N.M., Ite, U.E., and Ukpogon, I.E. (2007) Integrated water resources management in the cross river basin, Nigeria. *International Journal of Water Resources Development*, 23(4): 691–708.
- Bhattarai, M. and Hammig, M. (2001) Institutions and the environmental Kuznets curve for deforestation: a cross country analysis for Latin America, Africa and Asia. *World Development*, 29(6): 995–1010.
- Biswas, A.K. (2004) Integrated water resources management: a reassessment. *Water International* 29(2): 248–256.
- Biswas, A.K. (2008) Integrated water resources management: is it working? *International Journal of Water Resources Development*, 24(1), 5–22.
- Blanco, J. (2008) Integrated water resource management in Colombia: paralysis by analysis? *International Journal of Water Resources Development*, 24(1): 91–101.
- Butterworth, J., Warner, J., Moriarty, P., and Batchelor, C. (2010) Local approaches to integrated water resources management. *Water Alternatives*, 3(1): 68–81.
- Catley-Carlson, M. (2014) 2014 Stockholm Water Prize for John Briscoe laudatory speech. Nestle Water Challenge blog. <https://www.water-challenge.com/posts/2014-Stockholm-Water-Prize-for-John-Briscoe-laudatory-speech-by-Margaret-Catley-Carlson>
- Davis, M.D. (2007) Integrated water resource management and water sharing. *Journal of Water Resources Planning and Management*, 133(5): 427–445.
- Debevec, L. and Banhoru, Y. (2014) The water reform in Burkina Faso between discourse and reality: the case of water user associations in Bougouriba water basin in SW [South West region] Burkina Faso. Paper presented at the 50th Anniversary Conference of the Japanese Society of Cultural Anthropology (JASCA) on The Future with/of Anthropologies, Chiba, Japan, 15 May 2014 [abstract only].
- Dourojeanni, A. and Nelson, M. (1987) Integrated water resource management in Latin America and the Caribbean: opportunities and constraints. *Water Science and Technology*, 19(9): 201–210.
- Durham, B., Rinck-Pfeiffer, S. and Guendert, D. (2002) Integrated water resource management through reuse and aquifer recharge. *Desalination*, 152(1–3): 333–338.
- Esty, D.C., M.A. Levy, C.H. Kim, A. de Sherbinin, T. Srebotnjak, and V. Mara. (2008) Environmental Performance Index. New Haven: Yale Center for Environmental Law and Policy Food and Agriculture Organization (2000) *New Dimensions in Water Security*, AGLMISC/25/2000. FAO, Rome, Italy.
- Gandolfi, C., Soncini Sessa, R., Agostani, D., Castelletti, A., de Rigo, D., Facchi, A., Ortuani, B., Pianosi, F., Rienzner, M., Sachero, V., Tepsich, L. and Weber, E. (2007) IWRM in the Adda basin, northern Italy. *Geophysical Research Abstracts*, 9: 08901.

- Garcia, L.E. (2008) Integrated water resources management: a ‘small’ step for conceptualists, a giant step for practitioners. *International Journal of Water Resources Development*, 24(1): 23–36.
- Giordano, M. and Shah, T. (2014) From IWRM back to integrated water resources management. *International Journal of Water Resources Development*, 30(3): 364–376.
- Gleick, P. (2002) Soft water paths. *Nature*, 418, 25 July 2002. Also available at: www.nature.com/nature
- Global Water Partnership (GWP) (2000) *Integrated Water Resources Management*. Technical Committee Background Paper No. 4. GWP, Stockholm, Sweden.
- GWP (2013a) *The Economic Value of Moving Toward a More Secure World*. Technical Committee Background Paper No. 18. GWP, Stockholm, Sweden.
- GWP (2013b) *Water and Food Security: Experiences in India and China*. Technical Focus Paper No. 3. GWP, Stockholm, Sweden.
- GWP (2014a) *Water Security: Putting the Concept into Practice*. Technical Committee Background Paper No. 20. GWP, Stockholm, Sweden.
- GWP (2014b) *GWP Strategy Towards 2020: A Water Secure World*. GWP, Stockholm, Sweden.
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- GWP (2014e) *Groundwater Governance and Irrigated Agriculture*. Technical Committee Background Paper No. 19. GWP, Stockholm, Sweden.
- GWP (2015a) *Integrated Water Resources Management in Central and Eastern Europe: IWRM vs. EU Water Framework Directive*. Technical Focus Paper No. 8. GWP, Stockholm, Sweden.
- GWP (2015b) *China’s Water Resources Management Challenge: The ‘Three Red Lines’*. Technical Focus Paper No. 6. GWP, Stockholm, Sweden.
- Grey, D. and Sadoff, C. (2007) Sink or Swim? Water security for growth and development. *Water Policy*, 9(6): 545–571.
- Hagos, F., Hailelassie, A., Awulachew, S. B., Mapedza, E., and Taffesse, T. (2011) Land and water institutions in the Blue Nile Basin: setups and gaps for improved land and water management. *Review of Policy Research*, 28(2): 149–170.
- IWA/UNEP (2002) *Industry as a Partner for Sustainable Development: Water Management*. IWA/UNEP, Beacon Press, London.
- Joensson, B.L. (2004) Stakeholder participation as a tool for sustainable development in the Em River Basin. *International Journal of Water Resources Development*, 20(3): 345–352.
- Jonker, L. (2002) Integrated water resources management: theory, practice, cases. *Physics and Chemistry of the Earth*, 27: 719–720.

- Koudstaal, R., Rijsberman, F., and Savenije, H. (1992) Water and sustainable development. In: *International Conference on Water and the Environment Development Issues for the 21st Century*, Dublin, Ireland, 26–31 January 1992, Keynote papers. World Meteorological Organization, ICWE Secretariat, Geneva, Switzerland.
- Lankford, B. A., Merrey, D., Cour, J., and Hepworth, N. (2007) *From Integrated to Expedient: An Adaptive Framework for River Basin Management in Developing Countries*. IWMI Research Report 110. International Water Management Institute (IWMI), Colombo, Sri Lanka.
- Lautze, J. and Manthrilake, H. (2012) Water security: old concepts, new package, what value? *Natural Resources Forum*, 36: 76–87.
- Lawrence, P., Meigh, J., and Sullivan, C. (2002) *Water Poverty Index*. Keele Economics Research Papers 2002/19. Keele University, Keele, UK. Also available at: http://www-docs.tu-cottbus.de/hydrologie/public/scripte/lawrence_etal2002.pdf
- Lee, B.H. (2014) From poverty to prosperity through reforms in agricultural development in South Korea. Presentation at Seminar on Reforms in Management of Public Irrigation System. Bangalore, 30–31 October 2014.
- Luís-Manso, P. (2005) Economic risks in the drinking water sector. Paper presented at International Conference on Water Economics, Statistics and Finance. Rethymno, Greece, July 2005.
- Mason, M. and Callow, R. (2013) Which way now? Supporting decisions for climate compatible development in the water sector. In *Proceedings from GWP Workshop: Assessing Water Security with Appropriate Indicators*. Stockholm, November 20–21, 2012.
- Macdonald, D.H. and Young, M. (2000) *A Case Study of the Murray-Darling Basin*. Natural Resource Management Economics 01/001. Policy and Economic Research Unit, CSIRO Land and Water, Adelaide, Australia.
- Maganga, F.P. (2003) Incorporating customary laws in implementation of IWRM: some insights from Rufiji River Basin. *Physics and Chemistry of the Earth*, 28: 995–1000.
- Mang, G. (2009) Moving blindly towards integrated water resources management? Challenges and constraints facing Cambodia's new water law. *Asia Pacific Journal of Environmental Law*, 12(1).
- Mehta, L., Alba, R., Bolding, A., Denby, K., Derman, A., Hove, T., Manzungu, E., Movik, S., Prabhakaran, P., and van Koppen, B. (2014) The politics of IWRM in southern Africa. *International Journal of Water Resources Development*, 30(3): 528–542.
- Merrey, D.J. (2008) Is normative integrated water resources management implementable? Charting a practical course with lessons from southern Africa. *Physics and Chemistry of the Earth: B: Hydrology, Oceans and Atmosphere*, 33(8–13): 899–905.
- Merrey, D., Drechsel, P., Penning de Vries, F., and Sally, H. (2005) Integrating 'livelihoods' into integrated water resources management: taking the integration paradigm to its logical next step for developing countries. *Regional Environmental Change*, 5: 197–204.

- Mkandawire, T.W. and Mulwafu, W.O. (2006) An analysis of IWRM capacity needs in Malawi. *Physics and Chemistry of the Earth, Parts A/B/C*, 31(15-16): 738–744.
- Molle, F. (2005) *Irrigation and Water Policies in the Mekong Region: Current Discourses and Practices*. Research Report 95. International Water Management Institute, Colombo, Sri Lanka.
- Molle, F. (2008) Nirvana concepts, narratives and policy models: insights from the water sector. *Water Alternatives*, 1(1): 131–156.
- Molle, F. and Hoanh, Chu Thai (2011) Implementing integrated river basin management in the Red River Basin, Vietnam: a solution looking for a problem? *Water Policy*, 13(4): 518–534.
- Mollinga, P. (2006) IWRM in South Asia: a concept looking for a constituency, pp. 21–37. In: *Integrated Water Resources Management: Global Theory, Emerging Practice and Local Needs* (P.P. Molling, A. Dixit and K. Athukorala, eds). Sage Publications, New Delhi.
- Moore, S. (2013) *Issue Brief: Water Resources Policies and Politics in China*. Brookings, February 2013. <http://www.brookings.edu/research/papers/2013/02/water-politics-china-moore>
- Muller, M. (2010) Fit for purpose: Taking integrated water resource management back to basics. *Irrigation and Drainage Systems*, 24(3-4): 161–175.
- Najjar, K.F. and Collier, C.R. (2011) Integrated water resources management: bringing it all together. *Water Resources Impact*, 13(3): 3–8.
- North, D.C. (1990) *Institutions, Institutional Change and Economic Performance*. The Political Economy of Institutions and Decisions. Cambridge University Press, Cambridge, UK.
- Samad, M. (2005) Water institutional reforms in Sri Lanka. *Water Policy*, 7(1): 125–140.
- Schiff, J.S. (2010) *Integrated Water Resources Management: A Theoretical Exploration of the Implementation Gap between the Developed and Developing Worlds*. Old Dominion University, Norfolk, VA.
- Schulze, R.E. (2007) Some foci of integrated water resources management in the ‘South’ which are oft-forgotten by the ‘North’: a perspective from southern Africa. *Water Resources Management*, 21(1): 269–294.
- Sgobbi, A. and Fraviga, G. (2006) *Governance and Water Management: Progress and Tools in Mediterranean Countries*. Working Papers: 2006.151. Fondazione Eni Enrico Mattei, Milan, Italy.
- Shah, T. (2006) Note for the planning commission, Government of India groundwater regulation: international experience.
- Shively, D. and Mueller, G. (2010) Montana’s Clark Fork River Basin Task Force: a vehicle for integrated water resources management? *Environmental Management*, 46(5): 671–684.
- Sullivan, C.A., Meigh, J.R., Giacomello, A.M., Fediw, T., Lawrence, P., Samad, M., Mlote, S., Hutton, C., Allan, J.A., Schulze, R.E., Dlamini, D.J.M., Cosgrove, W., Priscoli, J.D., Gleick, P., Smout, I., Cobbing, J., Calow, R., Hunt, C., Hussain, A., Acreman, M.C., King, J., Malomo, S., Tate, E.L., O’Regan, D., Milner, S., and Steyl, I. (2003) The water poverty index:

- development and application at the community scale. *Natural Resources Forum*, 27(3): 189–199.
- Swatuk, L.A. (2005) Political challenges to implementing IWRM in Southern Africa. *Physics and Chemistry of the Earth*, 30(11–16): 872–880.
- Swatuk, L.A. (2008) A political economy of water in Southern Africa. *Water Alternatives*, 1(1): 24–47.
- Swatuk, L.A. and Motsholapheko, M. (2008) Communicating integrated water resources management: from global discourse to local practice – chronicling an experience from the Boteti river sub-basin, Botswana. *Physics and Chemistry of the Earth: B: Hydrology, Oceans and Atmosphere*, 33(8-13): 881–888.
- Tapela, B.N. (2002) The challenge of integration in the implementation of Zimbabwe’s new water policy: case study of the catchment level institutions surrounding the Pungwe- Mutare Water Supply Project. *Physics and Chemistry of the Earth, Parts A/B/C*, 27(11-22): 993–1004.
- United Nations (1970) *Integrated River Basin Development: Report of a Panel of Experts* (revised edition). United Nations, New York. Also available at: <http://www.ircwash.org/sites/default/files/214.0-70IN.pdf>
- United Nations Conference on Environment and Development (1992); Agenda 21, Chapter 18.6. and 18.35
- United Nations Environment Programme (UNEP) (2012) *The UN-Water Status Report on the Application of Integrated Approaches to Water Resources Management*. United Nations Environment Programme, Nairobi.
- UN-Water (2013) *Water Security and the Global Water Agenda A UN-Water Analytical Brief*. UN-Water, Geneva, Switzerland. Also available at: <http://www.unwater.org/publications/publications-detail/en/c/197890/>
- van der Merwe, B.F. (2000) Integrated water resource management in Windhoek, Namibia. *Water Supply*, 18(1-2): 376–381.
- van der Zaag, P. (2005) Integrated water resources management: relevant concept or irrelevant buzzword? A capacity building and research agenda for Southern Africa. *Physics and Chemistry of the Earth, Parts A/B/C*, 30(11-16): 867–871.
- van Koppen, B. and Schreiner, B. (2014) Moving beyond integrated water resource management: developmental water management in South Africa. *International Journal of Water Resources Development*, 30(3): 543–558.
- Wang, J., Huang, J., Blanke, A., Huang, Q., and Rozelle, S. (2007) The development, challenges and management of groundwater in rural China, pp. 37–62. In: *The Agricultural Groundwater Revolution: Opportunities and Threats to Development* (M. Giordano and K.G. Villholth, eds). CAB International, Wallingford, UK.
- White, G.F. (1998) Reflections on the 50-year international search for integrated water management. *Water Policy*, 1(1): 21–27.

- World Bank (2013) *Water and Development: An Evaluation of the World Bank Support 1997–2007*. World Bank, Washington, DC.
- World Economic Forum (WEF) (2015) *Global Risks 2015*, 10th edition. www.weforum.org/risks
- Yu, H.H. (2014) Community-based water governance under integrated water resources management reform in contemporary rural China. *Environmental Management and Sustainable Development*, 3(2): 1–17.

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