Integrated Water Resources Management in the 21st Century

Revisiting the Paradigm

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Foreword

Two years ago, the Water Observatory of the Botín Foundation launched a book entitled '*Water, agriculture and the environment in Spain: can we square the circle?*'. Based on the Spanish experience, this volume showed how emerging paradigms have changed the water management picture, and how water management is subject to an increasing number of variables that transcend the watershed scale. Take for instance the concepts of soil storage (*green* water) or virtual water flows, which trigger essential changes to the way water balances have been traditionally computed; or the role of food trade on water use patterns, which presents strong implications for the conventional notion of food security. More than ever, these have made water policy a global issue.

The present book takes the idea one step further. While keeping an eye on the Spanish experience, we attempt to draw from the experience of international institutions and specific case studies to single out some of the aspects that will constrain the way we manage our water resources in the future. Readers will find that some of the chapters present a more traditional outlook, while others are more innovative. All of them however show that water management is subject to the same rapid change that permeates most aspects of our daily lives, and that adapting is perhaps the main task at hand.

This book compiles the papers presented by sixteen international experts at the 6th Botín Water Workshop, held in Madrid, Spain, in November 2012. It is divided in three sections. Section one provides an introduction to the prevailing concepts of integrated water resources management (IWRM). Thus, chapters one to three showcase the history of the IWRM concept and its guiding principles. They also acknowledge some of the emerging issues that water managers will need to take into account in coming years, as well as critical views as to what IWRM can achieve and what lies beyond its means. Chapters four and five present views from members of the Organization for Economic Co-operation and Development and the World Trade Organization, two international organizations which are likely to play increasingly important roles in the manner in which water embedded in food and manufactured products flows around the globe.

Section two builds on the Water Observatory's ongoing research on Spain and Latin America. Chapters six to ten draw overarching conclusions from issues such as the role of virtual water trade, the state of freshwater ecosystems, the relevance of groundwater resources and urban water supply or the role of water institutions. These set the scene for section three. Chapters eleven to sixteen present a series of selected

case studies dealing with the reality of integrated water resources management in countries so diverse as Peru, Spain, Chile or China. All of them showcase the beauty of the concept when applied to real-life situations, as well as its practical limitations. Overall, most authors highlight the importance of IWRM as a *useful utopia*, whose value lies more with the steps that need to be taken than with reaching an ever-elusive end goal.

We hope that this book will provide a valuable contribution to the current debate on the world's water resources.

The Editors

About the Water Observatory of the Botín Foundation

Over the last two decades the Marcelino Botín Foundation has maintained the Observatory of Trend Analysis, a private research body whose purpose is to investigate the drivers that catalyze change in today's society.

The Water Observatory, one of its branches, is Spain's first interdisciplinary think tank on water. It was created in 1998 and specializes in analyzing water-related issues of national and global importance (http://www.fundacionbotin.org/water-observatory_trend-observatory.htm). The Observatory is known for its scientific rigor, which combines natural science with economic and social science perspectives to offer new ideas that may contribute to underpin decision-making in the field of water resources.

Since its early days, the Observatory has provided a forum for the exchange of ideas among water experts, facilitating the transfer of new knowledge to water decision makers and to society as a whole. In more recent times, the Water Observatory has focused on developing and disseminating water footprint, virtual water trade and water and food security concepts, particularly in the context of Spain and Latin America.

As per the proposal of Board Member Emilio Botín O'Shea, the Botín Foundation launched a multidisciplinary analysis of Spain's groundwater resources in 1998. Over the ensuing four years, Professor M.R. Llamas led this project, which culminated with a presentation at the 2003 Kyoto World Water Forum. Its outcomes remain an influential benchmark for groundwater policy in Spain.

Between 2004 and 2008 work focused on the organization of international workshops on water resources. The main findings of these meetings were compiled in two books, entitled *Water Crisis: Myth or Reality?* and *Water Ethics*, both which can be freely downloaded from the website. Since 2008 the Water Observatory has also published twelve monographs (PAV and SHAN papers), a special issue of the *Water Policy* journal and three books, entitled *Water Footprint and Virtual Water Trade in Spain* and *Water, Agriculture and the Environment is Spain: can we square the circle?* and *Rethinking Water and Food Security,* respectively. Most of these works have been presented at major international meetings, including the Stockholm Water Week or the World Water Forum.

Towards the end of 2005, Prof. Llamas delivered a speech in the opening session of the academic year of the Royal Academy of Sciences of Spain. This conference dealt with new water management paradigms, including the *colors of water* and the role of virtual water flows. Research on these new ideas crystallized in the formal

constitution of the Water Observatory as a think-tank to promote innovation in water management practices. Thus, the Water Observatory was established as an ongoing collaboration agreement between the Botín Foundation, the Universidad Complutense de Madrid and the Universidad Politécnica de Madrid.

Research staff is recruited through these universities, which also provide the venue for the Secretariat and offices. Ramón Llamas, Emeritus Professor of the Universidad Complutense, is the serving Director, while Alberto Garrido, professor of Agricultural Economics and Natural Resources at the Universidad Politénica of UPM, and Director of the CEIGRAM, is Deputy Director.

The activities of the Water Observatory have led to outstanding policy impacts. Take for instance the effect of the groundwater project on the groundwater management regulations of Spain's 2001 National Water Plan; or the decision by the Ministry of Environment to include the water footprint in Spain's River Basin Management Plans (BOE, no. 229, September 22nd 2008), in line with the European Union (EU) Water Framework Directive (WFD) (2000/60/EC).

Contents

Section 1

Introduction and international perspectives

Chapter 1

Integrated Water Resources Management (IWRM): The international experience

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ABSTRACT: Water is now seen as a central plank of sustainable natural resources management, it 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. Implicit in all this is the need for integration. This is already at the heart of Integrated Water Resources Management (IWRM) and this chapter argues that it is timely to revisit IWRM as an approach that can facilitate and lead the process of 'greening' the world's economies. There are skeptics, but evidence is presented from the 2012 UN survey of 134 countries that 82% have embarked on reforms to improve the enabling environment and integrate approaches to water resources management, 65% have developed IWRM plans, and 34% say they are at an advanced stage of implementation. It is argued that IWRM is no longer just an idea; it is a reality for many. It is truly 'fit for purpose' – a process whose time has come.

1 INTRODUCTION

Integrated water resources management is a concept that few would argue against. Surely, it is a given that if we wish to manage scarce water resources effectively and avoid wastage then we must approach this together in a coordinated manner. Indeed, the idea of taking a 'silo' or fragmented approach to resource planning would seem archaic today. This essentially simple idea has growing international acceptance, yet implementing it in reality has proved to be far from simple and some argue that it is an ideal that is largely unattainable in practice. Biswas (2008) is just one skeptic who wonders why it has not been possible to properly implement a concept that has been around for at least two generations.

But there is another reality. Across the world, economies are expanding, cities are spreading, populations are growing, and many are enjoying better living standards. But what is not growing are the natural resources that underpin all this economic and social development. Water, in particular, is a limiting resource in many countries. We do not yet face a global water crisis, that many are predicting over the next 30–50 years. But there is little doubt that recent global events – increasing food and energy prices, severe droughts and floods, worries about water and food security, and the threat of climate change – have heightened our concerns over water availability.

Water is now seen as a central plank of sustainable natural resources management, it is embedded in all aspects of development – food security, health, and poverty reduction – as it is an essential part of sustaining economic growth in agriculture, industry, and energy generation, and it sustains the natural ecosystems on which everything else depends. The Stockholm Statement (2011) described water as the 'bloodstream of the green economy'. But if the world continues to use water at current rates it is estimated that demand could outstrip supply by as much as 40% by 2030.

Water management and water scarcity have rightly come to preoccupy many different sectors in many different societies as never before. There is now a worldwide movement and new enthusiasm towards sustainable resource use. And implicit in all this is integration. This has always been at the heart of IWRM and so it is now timely to re-visit this concept as an approach to development that can facilitate and lead the process of 'greening' the world's economies. How has thinking about IWRM shifted in recent years? Is there a more universal understanding of what IWRM means? Are the drivers in place to make it more attainable? What are the experiences of those who seek to practice IWRM? Is it now a process that is truly 'fit for purpose' – a process whose time has come?

2 OUR JOURNEY

The origins of IWRM are now part of water resources history. Snellen & Schrevel (2004) provide an excellent account of this. They cite establishing the Tennessee Valley Authority (TVA) in 1933 as an early example of how to bring together the different facets of water use, such as navigation, flood control, and power production, for economic development. But the modern ideas of IWRM – the need for integration in and across the water sector – have their roots in the 1977 international water conference, which led to the Mar del Plata Action Plan. In 1992 IWRM was incorporated in what has now become known as the 'Dublin Principles' which was a precursor to including IWRM in Agenda 21 of the United Nations Conference on Environment and Development (UNCED). This is about improving water resources management by connecting the many different water services and providing good governance, appropriate infrastructure, and sustainable financing. In 1996 the Global Water Partnership (GWP) was founded to foster IWRM and provide a global forum for dialogue among corporations, governmental agencies, water users, and environmental groups to promote stability through sustainable water resources development, management, and use. In 2002 the World Summit on Sustainable Development (UN, 2005) in Johannesburg again called for the development of 'IWRM and all countries agreed to develop IWRM and water efficiency plans'.

The advent of IWRM marked a fundamental shift away from the traditional top-down, supply-led solutions to water problems that were dominated by technology (McDonnell, 2008). When water was plentiful and abstractors few, the rules of water sharing in most societies were few and basic. But as water use increased, shortages occurred and awareness grew of the impact this had on the environment, more complex institutions were needed to negotiate and coordinate water allocations

Box 1: Integrated water resources management: Definition and approaches

The Global Water Partnership (2000) defined IWRM as:

> 'IWRM is a process which promotes the coordinated development and management of water, land, and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital eco-systems'

This definition is the most authoritative definition on IWRM. These are often referred to as the IWRM 'principles' (GWP, 2000).

IWRM is defined as a process; it does not offer a 'blueprint' approach to water management. Water resources are different from place to place and so too are development priorities and social and economic issues. Country or water basin planning may differ but IWRM provides a common approach and experience shows that there are features common to all. These include a strong enabling environment; sound investments in infrastructure, clear robust and comprehensive institutional roles; and effective use of available management and technical instruments. These are the practical elements of implementing IWRM (Muller & Lenton, 2009).

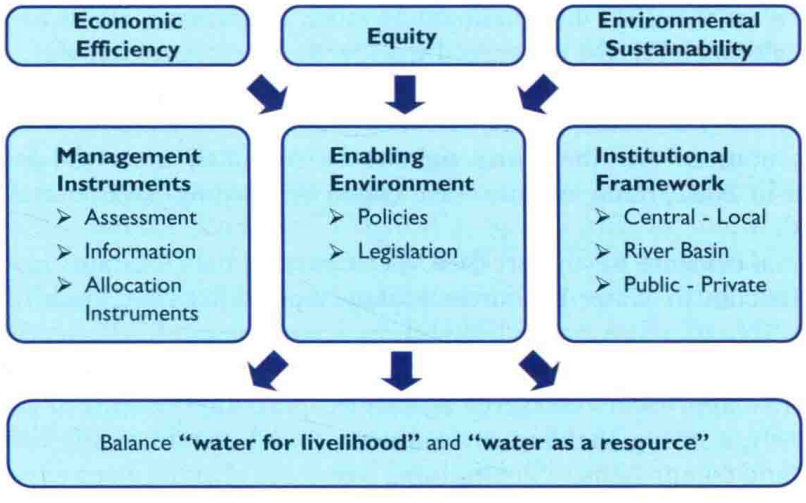

Figure 1 Common IWRM features.

Since its inception in 1996 GWP has driven a worldwide movement towards IWRM. It has helped countries around the world to (1) recognize basic principles that underpin good water management; (2) develop a stronger enabling environment of policies and laws; (3) build more appropriate institutional frameworks; and to (4) share, adopt and adapt management instruments and tools (Ait Kadi & Arriens, 2012).

among different users. Administrations responsible for developing and managing water resource infrastructure had to pay more attention to managing and protecting the resource (Muller & Lenton, 2009).

At first 'integration' meant bringing together water resources with engineering and economic driven solutions. But there was increasing awareness that the way land is managed impacts water resources and vice versa and that water quantity could not be managed in isolation from water quality. As water demands increased it became clear that bridges were needed between human and natural systems and between the water sector and the economy. 'Vertical' bridging was also needed across different levels of decision-making from local, provincial, and national to river basins and transnational scale. So the idea of integration grew to include more decentralized approaches to water management in a more holistic context together with an appreciation of local ideas and demand management (McDonnell, 2008). But integration did not mean that everything needed to be together and managed under 'one roof' or that sectoral decision-making should be abandoned. On the contrary, this was considered to be both undesirable and unworkable. What was clear though was that integration meant increasing complexity and this has undoubtedly contributed to the concerns about fully achieving it.

3 THE STATUS OF IWRM IN THE WORLD

Concerns about the reality of implementing IWRM have been raised many times. Most recently in the 2011 International Dresden conference, IWRM experts concluded that, although IWRM has gained worldwide acceptance over the past 20 years and is now included in national policies, strategies, and laws, actual implementation is lagging behind (Borchardt, 2011). So what is the current state of IWRM planning and implementation? Are the critics right to be sceptical? Since the Johannesburg commitment in 2002, many nations have begun developing 'IWRM and water efficiency plans'.

Substantial evidence to support IWRM comes from the UN status report on Integrated Approaches to Water Resources Management (UN, 2012) published in time for the Rio+20 Conference. Some 134 nations across the world (Figure 2) responded to the survey carried out to determine progress towards sustainable water resources using integrated approaches measured against the practical elements of implementing IWRM, namely, a strong enabling environment; sound investments in infrastructure, clear robust and comprehensive institutional roles; and effective use of available management and technical instruments (Muller & Lenton, 2009). Here we review some of the highlights of this survey.

3.1 Enabling environment: Policy, Laws & Plans

Over the past 20 years, since the 1992 UNCED conference, most countries in the survey have observed increases in water-related risks and competition for water use across all sectors (UN, 2012). In high HDI countries (HDI is the Human Development Index which is a composite index that measures health, knowledge, and income according to which countries are categorised in four bands: low, medium, high, and

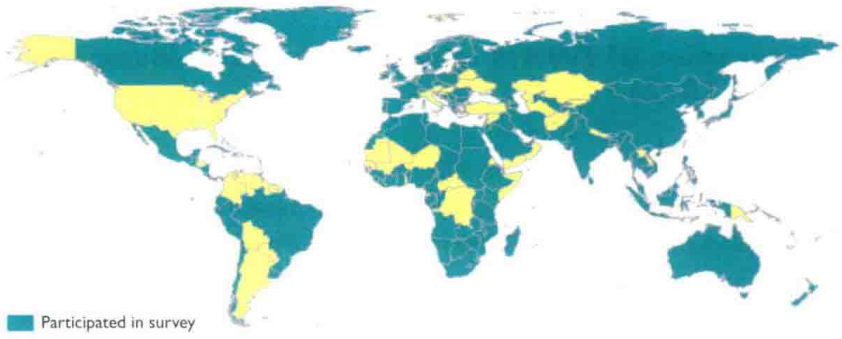

Figure 2 Countries participating in the UN IWRM survey (UN, 2012).

very high) water for the environment is seen as the main priority while in low HDI countries the focus is on domestic water supplies, particularly for growing cities, followed by water for agriculture.

Encouragingly, 82% of countries have embarked on reforms to improve the enabling environment and integrated approaches to water resources management. Some 65% have developed IWRM plans and 34% say they are at an advanced stage of implementation. But 25% report obstacles to implementation such as weak and conflicting legal frameworks and inadequate or non-existent strategic planning. In Albania, the legal system has little in common with the European Union yet they would like to move towards the EU's Water Framework Directive (WFD). In Peru and Samoa national laws conflict with traditional practices and customs. Azerbaijan is concerned with challenging transboundary water issues while countries such as Portugal, Denmark, and Germany, have difficulties in balancing internal agricultural, industrial, and environmental water interests.

Integration is working well in high HDI countries and is driven by water scarcity and environmental concerns (Australia, Spain) and by international agreements such as the EU Water Framework Directive. Even countries with complex federal and state structures have managed to agree and implement sweeping reforms (Brazil, Australia). Many high HDI countries have the added advantage of a legacy of 'easy hydrology' – low rainfall variability, rain distributed throughout the year and perennial rivers sustained by groundwater base flows (Grey & Sadoff, 2007).

Progress is much slower in low and medium HDI countries, which includes most of sub-Saharan Africa and south Asia. Most have large rural populations that rely on subsistence agriculture and are exposed not just to the vagaries of uncertain and unpredictable seasons but also to the 'difficult hydrology' of absolute physical water scarcity and severe flood risk, usually at different times but often in the same place (Grey & Sadoff, 2007). More difficult hydrology usually means more costly infrastructure to control and manage water.

One indicator used in the survey of how well water is integrated, is the inclusion of water in planning documents, such as Poverty Reduction Strategies, National Strategy for Sustainable Development, and National Environmental Action Plan. Almost 80% of countries included water in these plans.