

The United Nations World Water Assessment Programme

Insights

Institutional Capacity Development in Transboundary Water Management

Ruth Vollmer, Reza Ardakanian, Matt Hare, Jan Leentvaar, Charlotte van der Schaaf and Lars Wirkus

UN-Water Decade Programme on Capacity Development (UNW-DPC)



United Nations Educational, Scientific and Cultural Organization



The United Nations World Water Development Report 3 Water in a Changing World

Coordinated by the World Water Assessment Programme, the *United Nations World Water Development Report 3: Water in a Changing World* is a joint effort of the 26 United Nations agencies and entities that make up UN-Water, working in partnership with governments, international organizations, non-governmental organizations and other stakeholders.

The United Nations' flagship report on water, the WWDR offers a comprehensive review of the state of the world's freshwater resources and provides decision-makers with the tools to implement sustainable use of our water. The WWDR3 represents a mechanism for monitoring changes in the resource and its management and tracking progress towards achieving international development targets. Published every three years since 2003, it offers best practices as well as in-depth theoretical analyses to help stimulate ideas and actions for better stewardship in the water sector.

Water in a Changing World has benefitted from the involvement of a Technical Advisory Committee composed of members from academia, research institutions, non-governmental organizations, and public and professional organizations. To strengthen the scientific basis and potential for implementation of its recommendations, interdisciplinary expert groups were also created for a number of topics, including 'Indicators, Monitoring and Databases', 'Business, Trade, Finance and Involvement of the Private Sector', 'Policy Relevance', 'Scenarios', 'Climate Change and Water', 'Legal Issues' and 'Storage'. An accompanying case studies volume, *Facing the Challenges*, examines the state of water resources and national mechanisms for coping with change in 23 countries and numerous small island developing states.



This series of side publications also accompany the WWDR3, providing more focused, in-depth information and scientific background knowledge, and a closer look at some less conventional water sectors. These publications include:

Scientific Side Papers

This series provides scientific information on subjects covered in the WWDR and serves as bridge between the WWDR3's contents and scientific, peer-reviewed publications.

Sector and Topic-Specific 'Insight' Reports

The reports and documents in this series will provide more in-depth information on water-related sectors, issues and topics in a stand-alone manner. Examples of the subjects of this series include Integrated Water Resources Management, transboundary issues and technology, among others.

Dialogue Series

Sectors and topics to which water is cross-cutting or important will be covered in this series of side publications. Some examples of subjects discussed in this collection of reports include climate change, security, biodiversity, poverty alleviation and land use.

Published by the United Nations Educational,
Scientific and Cultural Organization,
7 place de Fontenoy, 75352 Paris
07 SP, France

© UNESCO 2009

ISBN 978-92-3-104107-5

Cover graphics by Peter Grundy,
www.grundini.com

Cover design and typesetting by Pica Publishing,
publish@picapublish.com

Printed by Savas Printing, <http://savasm.com.tr>

Printed in Turkey

The designations employed and the presentation of material throughout this publication do not imply the expression of any opinion whatsoever on the part of UNESCO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The authors are responsible for the choice and the presentation of the facts contained in this book and for the opinions expressed therein, which are not necessarily those of UNESCO and do not commit the Organization.

Institutional Capacity Development in Transboundary Water Management

Ruth Vollmer, Reza Ardakanian, Matt Hare, Jan Leentvaar, Charlotte van der Schaaf and Lars Wirkus

UN-Water Decade Programme on Capacity Development (UNW-DPC)

Table of Contents

Foreword and acknowledgements	1
Acronyms and abbreviations	2
1. Introduction	3
2. The overall setting	4
2.1 External drivers of cooperation	4
2.2 Internal drivers of cooperation	5
3. Transboundary water cooperation	7
3.1 Purpose and form of transboundary water cooperation	7
3.2 Manifestations of transboundary water cooperation	9
3.3 Funding mechanisms	10
4. Requirements for institutional capacity development	11
4.1 Policy and legal framework requirements	11
4.2 Cooperation requirements	13
4.3 Funding requirements	13
4.4 Stakeholder participation	14
4.5 Awareness raising	15
5. Conclusions	16
References	18

Foreword and acknowledgements

The broad mission of the the *UN-Water Decade Programme on Capacity Development* (UNW-DPC) is to enhance the credibility, coherence and integrated effectiveness of the capacity development activities of UN-Water. By doing so, it intends to strengthen the efforts of the members and partners of UN-Water in their quest to support Member States to achieve the Millennium Development Goals (MDGs) related to water. UNW-DPC supports individual, organizational and institutional capacity development activities as well as contributing to the development of the strategic future of water-related capacity development.

The impetus for the development of this publication was twofold: to provide further substantive background information to support issues raised in the *United Nations World Water Development Report 3: Water in a Changing World* (WWAP, 2009) concerning the requirements for institutional capacity development, and to provide a wider audience for the results of the International Workshop on Institutional Capacity Development in Transboundary Basins held on 10–12 November 2008 in Bonn, Germany and hosted by the UN-Water Decade Programme on Capacity Development. The workshop set out to collect and discuss success stories and examples of best practices that have led to the development of institutional capacity supporting effective transboundary water management. The ultimate aim was to provide future recommendations for required institutional arrangements and an assessment of needs for capacity development in this field.

I would therefore like to thank the participants of this workshop, who include representatives of transboundary basins from around the world (Niger, Senegal, Nile, Okavango, North Western Sahara Aquifer System, Harirud, Mekong, the Rhine, Danube, Guarani Aquifer and the Great Lakes). Some of the many outcomes of their group discussions are expressed herein, supporting or supported by up-to-date information from current literature on the subject. In addition, I would like to extend my gratitude to the workshop's co-organizer UNESCO-IHP, as well as to the German Federal Government, through the Federal Ministry for Economical Cooperation and Development (BMZ) and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), for their kind contributions. Many thanks go also to WWAP for reviewing and enabling the publication of this body of work.



Reza Ardakanian, PhD,
Director, UNW-DPC

Disclaimer

As the results of the workshop were based on the outputs of group discussions, any views related to these results that are expressed in this publication cannot and have not been assigned to any single participant; instead, when referred to, participants' views are described in the following text as coming from what, for brevity's sake, is termed the 'UNW-DPC workshop'. It cannot be assumed that individual participants will always agree with what has been written and any mistakes in interpretation of workshop results are the authors' own.

Acronyms and abbreviations

CD	Capacity Development
ESD	Education for Sustainable Development
EU	European Union
FAO	Food and Agricultural Organization
ICPDR	International Commission on the Protection of the Danube River
IJC	International Joint Commission
ILA	International Law Association
NARBO	Network of Asian River Basin Organizations
NBI	Nile Basin Initiative
NGO	Non-governmental organization
NWSAS	North-West Sahara Aquifer System
RBO	River basin organization
REC	Regional Economic Commission
SADC	Southern African Development Community
SLIM	Social Learning for the Integrated Management and sustainable use of water at catchment scale
UN	United Nations
UN-DESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
UNW-DPC	UN-Water Decade Programme on Capacity Development
WMO	World Meteorological Organization
WWAP	World Water Assessment Programme
WWDR	United Nations World Water Development Report

1. Introduction

Sound and sustainable approaches to manage and allocate freshwater resources are of tremendous significance for human health, survival, nutrition and development. The recognition thereof has been exemplified through numerous international conferences and initiatives since the 1970s.¹

The interconnectedness of border-crossing freshwater systems inevitably results in the interdependence of all its users and stakeholders, who share a river, lake or aquifer notwithstanding their potential diversity in many other respects. Water-related activities in one state are likely to impact the water situation in another one and water-related problems such as pollution can often only be solved through transboundary cooperation. Therefore, the need to cooperate on water issues beyond the borders of states has been broadly accepted for many years.² Since 1814, more than 300 bilateral and multilateral agreements on the cooperative use and development of transboundary waters have been concluded (Gerlak, 2007, p. 2),³ with approximately 200 such agreements on the non-navigational uses of transboundary waters made within the last 50 years (WWAP, 2003, p. 316).

Cooperation, however, is not necessarily based on formal agreements. It can manifest itself in a variety of 'cooperative institutional arrangements', which means that states – formally or informally – 'agree to a common set of rules that govern their interactions' (Gerlak, 2007, p. 2). A recent study by the University of Arizona has attempted to map cooperative institutional arrangements on water, which – according to this data set – exist in 41% of all transboundary river basins in the world (ibid). This in turn means that '158 of the world's 263 international river basins, plus transboundary aquifer systems, lack any type of cooperative management framework' (UN-Water, 2008, p. 6).

Awareness of, and cooperation on, water issues has increased tremendously within the last few decades. Yet the challenges keep expanding ever more rapidly due to exponentially growing demand for freshwater resources in all water-using sectors, still further exacerbated by decreasing availability of safe water resources due to pollution and climatic changes. Furthermore, climate change will increase the variability of the hydrological cycle and thus lead to less reliable water supply patterns. Predictions show a strong continuation of all these trends in the future, which has the potential of drastically increasing the severe negative impacts that water scarcity and poor sanitation already have on the health and livelihoods of many millions of people, particularly in developing countries. Moreover, water scarcity constitutes a major development constraint.

1 See FAO, 2006, for an overview.

2 For an outline, see UN-Water, 2008, p. 1.

3 Most of this cooperation has been established with regard to surface waters, such as transboundary rivers or lakes, and only very little of it covers aquifers (UN-Water, 2008, p. 2).

Already in the first World Water Development Report (WWDR), progress made 'in areas of water governance and management' was emphasized as development of particular note (WWAP, 2003, p. 371). Since then, this focus on governance and the need for governance reform has taken hold in debates on freshwater issues globally. Criteria for effective water governance have been developed (WWAP, 2006, p. 49), which represent the most desirable, but at the same time most idealized, situation.⁴ Without any doubt, making these a reality will become even more vital in the future. Building and strengthening institutionalized water cooperation between states must be seen as one aspect of this. Given the enormous tasks such cooperative institutions face, it is indispensable to ensure that they possess the capacities to act accordingly.

Against this background, what this publication attempts to do is to provide practical guidance for institutional capacity development in transboundary waters. Its approach is based on the assumption that capacity development needs to be demand-driven, in the sense that practitioners decide what mechanisms they can make use of in their specific contexts in order to ensure ownership and thereby effectiveness and sustainability. To this end, after giving a brief overview of the context of transboundary water cooperation (Section 2) and the different incentives and manifestations thereof, including their funding and legal and policy frameworks (Section 3), requirements for institutional capacity development activities will be outlined, in terms of the necessary legal and policy framework, cooperation and funding (Section 4).⁵

Whereas the important role of context cannot be overemphasized in capacity development activities in general, it will not be possible to elaborate on this in more detail within the present publication. Thus, no specific recommendations can be given with regards to the most suitable approaches for specific cases. Instead, it is the sincere hope of the authors to support and facilitate the process of mutual learning and sharing of experiences by providing ideas and orientation to those people and organizations looking for them.

Definitions

'Transboundary waters', for the purpose of this publication, are defined as freshwater resources shared by two or more states and comprising rivers, lakes and aquifers. The term 'basin', in the present use, always includes the hydrogeological basin, i.e. groundwater resources, either with or without connection to surface water.

4 Those are: participation, transparency, equity, effectiveness, rule of law, accountability, coherency, responsiveness, integration, ethical considerations.

5 Parts of this publication are based on the outcomes of an international expert workshop on Institutional Capacity Development in Transboundary Basins conducted by UNW-DPC and UNESCO-IHP in Bonn, Germany, in November 2008.

'Capacity Development (CD)', for the purpose of this publication, is defined as 'the process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time' (UNDP, 2008, p. 4). This definition is necessarily very broad, as capacity always corresponds to the specific functions and objectives of different societies and can be a feature of various kinds of institutions.

The concept of 'institution' is challenging to grasp, as the term is used with a variety of different meanings (e.g. sometimes not in reference to the term 'organization' and sometimes almost synonymously to it). Institutions embody the constraints and incentives that shape opportunities in every sector of society. There are formal and informal institutions. The formal side consists of the organizations and written rules and policies that govern our transactions. These include things as diverse as the structure of government and the private sector, the tax system, property rights, national constitutions, legislations and municipal bylaws. But institutions go beyond the formal structure. Even the way we react to the formal structure may be determined by our cultural heritage, our values and other social characteristics. Together, these formal and informal institutions ultimately determine what we can, and cannot, collectively accomplish. In turn, what we demand from our institutions and how we respond to them determines how they develop and change.

As can be seen in the above definition, capacity development is commonly looked upon at three different levels (individual, organizational and societal). The broad definition of institutions as introduced above comprises the organizational and societal level and it also touches on the individual one. Generally, this publication is based on the recognition that all three levels of capacity development are interdependent and that pursuing one on its own leads to inefficiency (Fukuda-Parr et al., 2002, p. 8). However, its purpose is also to make a point regarding the common association of capacity development with human resource development (at the individual level). Capacity development, here, is considered as a much broader concept that 'refers not merely to the acquisition of skills' (individual), but also to 'the capability to use them' (institutional) (ibid., p. 10), which requires access to the necessary resources, the right framework conditions, etc.

Furthermore, even in the context of international cooperation, one should not forget the national and the local levels. Ultimately, all decisions agreed upon in an international context need to be implemented 'at home'; they stand and fall with the capacities and the willingness to put them into practice at all levels involved. Therefore, national and local needs and priorities are important factors to be taken into account in international cooperation. Institutional cooperative mechanisms on transboundary waters thus face the challenge of simultaneously creating integration as well as coordination in a

vertical (between stakeholders, end users, governments, donors, etc.) and a horizontal dimension (e.g. between governments, ministries, etc.). The focus of this publication on activities going on at the international level should be seen as merely one side of the coin.

2. The overall setting

Institutionalized cooperation in transboundary settings is generally assumed to result in benefits for the states involved, as it provides them with information and reduces uncertainty as well as transaction costs (Gerlak, 2007, p. 3). Nonetheless, it can be observed that cooperation on water management between states is a lengthy and complicated process, which requires substantial resources, capacities and support in order for it to materialize and be sustained. Certain framework conditions can either facilitate cooperation or make it less likely or even impossible to occur. As Swatuk and Wirkus (2009, p. 18) write; 'Transboundary cooperation has moved forward most successfully where immediate need is combined with an abundance of appropriate human, financial and technical capacity'.

This section provides an overview of what drives and what complicates transboundary water cooperation. The relevant factors can be distinguished as falling into two different categories: factors that are external to the basin, f(or example international legal norms) and factors that are internal to the basin, such as the hydrogeography of the basin or political features of states' relations.

2.1 External drivers of cooperation

During the 1990s, a legal framework for transboundary watercourses was developed at the international level. The starting point for many of the related activities were the non-binding Helsinki Rules on the Uses of Waters of International Rivers, which had been set up by the International Law Association (ILA) in 1966. In 2004, they were updated to become the Berlin Rules on Water Resources. Both documents were developed in order to codify customary international water law at their respective points in time. The Helsinki Rules were used as a model by the International Law Commission, a legal advisory body to the UN, when drafting the articles on the non-navigational uses of international watercourses, which were then revised to become the Convention on the Law of the Non-navigational Uses of International Watercourses, adopted in 1997 by the UN General Assembly. However, this sole international convention on transboundary water governance has not yet received the number of ratifications required for it to enter into force. The situation looks different on a regional level. The Convention on the Protection and Use of Transboundary Watercourses and International Lakes, adopted by the United Nations Economic Commission for Europe (UNECE) in 1992 (in force) is also a reformulation of the Helsinki

Box 1 The legal framework for transboundary water cooperation¹

1992: Convention on the Protection and Use of Transboundary Watercourses and International Lakes: urges to use transboundary waters in an ecologically sound and rational manner and asks to respect the aims of resource conservation and environmental protection (Art. 2, 2.b); adopts both the precautionary and the polluter-pays-principle (Art. 2, 5.a & b), declares sustainability as a goal (Art. 2, 5.c) and dedicates a full article to the issue of dispute settlement (Art. 22). It has been adopted by the United Nations Economic Commission for Europe (UNECE) and signed by its members as well as by states having consultative status with this institution, i.e. most Central Asian states.

1997: United Nations Convention on the Law of the Non-navigational Uses of International Watercourses: emphasizes the equitable and reasonable utilization² of the resource and the 'duty' of states 'to co-operate in the protection and development' of shared waters (Art. 5). It first endorses the obligation not to cause significant harm (Art. 7), and stipulates that in a situation of competing water uses, special regard needs to be given to the requirements of vital human needs (Art. 10.2). The protection of ecosystems is treated in Articles 20–23, and mechanisms of dispute settlement are described in detail in Article 33. The Convention represents today's basic framework for any international agreement between states that share any kind of water body.

2004: Berlin Rules on Water Resources, articulated by the International Law Association (non-binding). These Rules revise former legal agreements and do not only treat international watercourses but water resources in general. Chapter III applies to internationally shared waters only. After an introduction to the general principles regarding the management of all waters (such as integrated management, sustainability and minimization of ecological harm), they state that: 'Basin States shall in their respective territories manage the waters of an international drainage basin in an equitable and reasonable manner having due regard for the obligation not to cause significant harm to other basin States.' The protection of all aquatic environments is treated in Chapter V, specifying earlier statements; Chapter XIV deals with the settlement of international water disputes, thereby drawing on the previous UN Convention.

1 See <http://www.bicc.de/index.php/transboundary-rivers-and-crisis-prevention> for more information (accessed 12 February 2009).

2 Obviously, these are not clearly defined terms and their exact meaning depends on what agreements states negotiate on the basis of the Convention. However, the Convention lists a number of factors, which need to be considered in order to implement these principles (see Millington et al., 2006d, for a discussion).

Rules. Furthermore, the EU Water Framework Directive is based on such earlier approaches, and places particular emphasis on public participation. The first water-related regional agreement that has fully adopted the UN Convention on the Law of the Non-navigational Uses of International Watercourses is the SADC Water Protocol, set up by the member states of the Southern African Development Community (SADC). Its revised version entered into force in 2003.

In a recent development in transboundary water cooperation, on 11 December, 2008, the UN General Assembly adopted a resolution on the Law of Transboundary Aquifers. The resolution encourages states 'to make appropriate bilateral or regional arrangements for the proper management of their transboundary aquifers' and invites them to consider the draft articles that are annexed to the resolution as a basis for the elaboration of a convention, which might become the legal international framework for cooperation on shared groundwater resources.⁶

Despite the fact that binding commitments on transboundary water cooperation have only been achieved regionally, international efforts have delivered a framework that can be used as a guideline for agreements on water cooperation between states.

It has been observed that the influence of 'converging forces' on local and context-specific water governance, i.e. external influences penetrating national

agendas (such as legal codification, the influence of epistemic communities, environmentalism and globalization), can result in poor implementation due to a lack of resources (financial or other), 'plural systems' (multiple layers) of governance, and even to a neglect of other equally important policy areas (Gupta, 2007, pp. 2). Against this background, the openness of the international legal framework can be seen as an opportunity. Whereas international conventions can provide strong support for national governance reform, too strong an influence of global approaches can even become an impediment to local action. 'In contrast with the naturally vague and occasionally contradictory global declarations and principles, the institutions developed by co-riparian nations have been able to focus on specific, regional conditions and concerns' (WWAP, 2003, p. 315).

2.2 Internal drivers of cooperation

Regional conditions and characteristics play an important role when it comes to the reasons for transboundary water cooperation. In a recently established database on cooperative institutional arrangements between states around shared waters,⁷ the Regional Water Governance Project of the University of Arizona has attempted to identify contextual factors influencing water cooperation (Gerlak, 2007).⁸

6 By the end of 2008, the status of this new convention was still pending.

7 The database covers cooperation on surface water bodies only; therefore, data on groundwater cooperation cannot be provided.

8 The database also categorizes institutional cooperative arrangements according to the depth or intensity of cooperation into three categories: shallow, intermediate and deep cooperation (see Gerlak, 2007, pp. 4 for details and Section 3 of this publication).

The database reveals interesting regional and general features, which can be assumed to have an effect on the likelihood of transboundary water cooperation. The regional distributions of such cooperations are presented in proportion to the number of transboundary waters within a certain region. According to this delineation (which says nothing about the total numbers), 100% of transboundary waters are covered by some kind of cooperative, institutional arrangement in North America, 41% in Europe and 40% in the former Soviet states, 20% in the Middle East (all of them shallow) and 26% in Asia (*ibid.*, p. 5).⁹

Using the cases from the database, the role of contextual factors in the establishment of a certain type of cooperative institutional arrangement has been evaluated statistically. Regarding the different contextual factors, physical features of the basin have an important influence. It was found that the amount of available water per person increases the likelihood of intermediate cooperation and decreases deep cooperation. The same is true for high aridity.

Furthermore, activities of riparian states were looked into and found to play an important role. Protected areas in the basin are negatively correlated with deep cooperation (with the exception of Ramsar Wetland Sites, where the correlation is positive). A high degree of development in the basin often coincides with intermediate or deep cooperation, but not with shallow cooperation. Prior cooperative events between riparian states are correlated positively with all types of cooperation (*ibid.*, p. 9).¹⁰

This last observation, especially, is widely shared. Experts at the UNW-DPC workshop emphasized that a historical record of cooperation is very conducive to a government's readiness for transboundary water cooperation. A rather extreme example to underline the importance of the political context is the Danube, where cooperation only became possible after the fall of the Iron Curtain, which had previously divided the riparian states. After that, the EU had an additional influence on countries wishing to join the Union, so that these states became more willing to cooperate on water. A different case in point is represented by the SADC region, where water has been one of the most important drivers for regional cooperation. After all, the water protocol has been the first binding protocol in the context of the South African Development Committee (SADC) (Croll and Wirkus, 2003). The unifying force of transboundary waters is also emphasized by Wolf (2004, p. 8), especially in the presence of 'relatively strong institutions'. Such differences, however, must also be seen against the background of the overall water situation in the region.

9 Data for other regions is not provided.

10 A number of interesting factors have been left out, such as development assistance, economic development, government type and membership in intergovernmental organizations (IGOs) (Gerlak, 2007, pp. 11).

Regarding socio-economic circumstances, it has been argued that, for example, a high degree of integration (great density of political, economic and societal ties among the countries) can help to overcome severe obstacles to water cooperation (Bernauer, 2002, pp. 551). Such obstacles can be related to the respective position of countries with regard to the resource (upstream, downstream) and in relation to each other (in terms of power differential). Given the interdependencies that shared resources create, 'one state's behavior often imposes unintended costs on other states', also referred to as 'negative externalities' (Mitchell and Keilbach, 2001, p. 891). Negative externalities can be symmetrical, with all states being simultaneously 'victims' and 'perpetrators', such as in situations of common pool resources or where the countries involved are at the same time upstream and downstream riparians (sharing a number of rivers or lakes, as for example in the Great Lakes Region in the United States and Canada). Or they can be asymmetrical, with some states being responsible for the externalities, and others suffering the bulk of the consequences.

Based on a rational design framework,¹¹ it has been suggested that in the case of symmetric externalities mutual cooperation on the issue at stake should be preferred by all states over a (non-cooperative) status quo ('issue-specific reciprocity') – for example, joint pollution prevention. Cooperation provides the potential to solve a problem (such as that of organic pollution) more effectively: 'States create international institutions in attempts to resolve problems they cannot solve alone' (*ibid.*, p. 891–92).

In the case of asymmetrical externalities (e.g. upstream–downstream situations) the distribution of incentives and benefits from cooperation is asymmetrical too. Coercion or side payments (exchange) become more likely options for restructuring incentives for externality-generating behavior. Particularly, in such settings 'the distribution of power among states ... influences the likelihood and shape of institutions states create' (*ibid.*, p. 896), as powerful upstream riparians might expect no benefits at all from cooperation. However, even in such constellations, cooperative institutions can be created and maintained, if states are successful in broadening the scope of their cooperation beyond the contended issue and create benefits for all states involved. This option was also brought up at the UNW-DPC workshop: 'enlarging the pie' (identifying the benefits to be shared from win-win management solutions) helps to make cooperation more attractive and to create greater potential for gain for all participating states.

11 That is, based on the assumption that the 'choices states make in designing international institutions reflect rational efforts to create mechanisms compatible with the incentives in the strategic situations they face' (Mitchell and Keilbach, 2001, p. 916). The statements made in this framework have been evaluated and confirmed using a number of individual case studies; however, they have not yet been tested in a statistically significant way.

These examples, as well as Gerlak's database analysis (2007), clearly underline the fact that institutional arrangements are set up to respond to certain demands, which are specific to the given basin. This must always be kept in mind, as it implies that certain cooperative mechanisms that work very well in one setting may not work in another or even prove unnecessary. One must also consider that water can have specific subjective meanings and values, and can thus play a role in the identity-formation processes of social players (Bernauer, 2002, p. 557). Therefore, applying models that are based on purely economic calculations might not always suffice.

Two more factors, which are barely discussed in the literature, figured prominently at the UNW-DPC expert workshop. Particularly in less developed regions, donors strongly promote cooperation between states on shared waters, thereby creating an additional incentive for cooperation but also creating new challenges related to ownership of the cooperative process and sustainability of the institutions so developed. Additionally, although public awareness of water issues in general can provide an additional incentive for governments to put them on the agenda, knowledge and information are an absolutely indispensable precondition for cooperation in the case of groundwater. Groundwater is very often neglected simply because of a lack of data and of recognition of the shared aquifer, its dimensions, discharge rates and socio-economic significance. This was made very clear at the workshop, where two of the rare examples of transboundary cooperations on groundwater were presented: the North-Western Sahara Aquifer System (NWSAS) and the Guaraní Aquifer in Latin America. Both cases underline the benefits of dealing with the adverse consequences of a lack of political and societal awareness about groundwater issues.

3. Transboundary water cooperation

Depending on the context, cooperation can assume a variety of different forms and levels of intensity. Furthermore, the purpose of cooperation is important. Having reviewed some research on framework conditions, we will now give a structured overview of the various purposes cooperation can serve and the forms it can assume.

3.1 Purpose and form of transboundary water cooperation

Transboundary water cooperation can be established to deal with a multitude of issues. States might decide to cooperate because they see a need to: manage water quantities (i.e. make joint decisions on the allocation between user groups for purposes such as power production, recreation, irrigation, drinking water and household supply, and industry); prevent and control pollution (e.g. through an inventory of pollution sources, joint water-quality objectives); jointly monitor and assess the state of water resources; share data and information; conduct

shared research and/or development projects; create warning and alarm systems; deepen mutual assistance; increase public awareness; build a forum for exchange; or steer and coordinate adaptation to climate change in the water sector.

Cooperation can take place on one or more of these issues. In the case of single-purpose cooperation, the purpose has often been the motivating factor for cooperation. This means that on top of the framework conditions outlined above, cooperation often needs a key driver, such as 'a natural disaster, conflict on water sharing, severely poor regulation and management, or severe resource degradation' (Millington et al., 2006a, p. 10). As pointed out above, in situations of asymmetrical externalities, single-purpose cooperation is unlikely to occur unless beneficial to all states involved. In fact, once established, the scope of initially narrow cooperation tends to broaden, as in the case of the International Commission for the Protection of the Rhine, which started with a focus on pollution reduction and today is characterized by a fairly comprehensive mandate. Nonetheless, an early focus on water quality is rather atypical: 'In earlier days, single-purpose water resource planning was the norm, and surface water quantity was the prime concern' (Millington et al., 2006a, p. 3). Today, planning is becoming more multi-purpose, and it is increasingly recognized that the issues of quantity and quality of both surface and groundwater should be treated together and that the ecological and societal context needs to be taken into account as well (ibid.).

The increasing complexity and multi-purpose nature of cooperation on water management is a reflection of institutional changes at a global level (see 'converging forces' above). It has been observed for the United States that river basin organizations 'were originally formed in the early twentieth century for development purposes, but more recently their goal has switched to sustainable development' (Hooper, 2006, p. 24). On a more global level, Delli Priscoli refers to these changes as value shifts between old (traditional) and new institutions, growing internationalization of environmental concerns being one of the 'new' values promoted by newer groups, who feel that 'traditional water institutions are somehow not including a complete enough picture of values at stake' (Delli Priscoli, 2003, pp. 74–5). So, even regarding cooperative mechanisms that are established in regions with a low degree of development of water resources, an exclusive focus on infrastructure is hardly acceptable any more today.

Concerning the different forms that transboundary water cooperation can assume, the Regional Water Governance Project of the University of Arizona distinguishes three intensity levels of cooperation (see Gerlak, 2007, p. 4, for details):

- *Shallow cooperation* is characterized by 'loose institutional cooperation', without official headquarters or formalized bureaucratic mechanisms

of cooperation, such as joint committees, coordination teams, technical teams, task forces, or partnerships.

- *Intermediate cooperation* is characterized by a 'more sophisticated level of bureaucratic organization', regular meetings between the parties, and a permanent headquarters or secretariat with independent staff, yet without financial independence (i.e. donor dependent).
- *Deep cooperation* is characterized by 'a high degree of bureaucratic organization and financial independence'. Such institutional arrangements qualify as formal international organizations, as they 'institutionalize collective decision-making and oversight in governance', 'provide sufficient bureaucratic organization to assure some stability of management' and 'demonstrate some autonomy in organizational operation and in the execution of the collective will of the membership' (ibid., p. 3).

Gerlak's database also reveals a clear distribution of the 180 institutional arrangements it contains within the three intensity levels of cooperation, with 61% displaying shallow cooperation, 35% belonging to the category of intermediate cooperation and only 4% (or a total of seven arrangements) to the deepest level of cooperation (Gerlak, 2007, p. 5).

Thus, depending on the intensity level of cooperation, decision-making is more likely to take place in the institutional framework of a joint body or of the governments of the states involved, thereby implying a greater (deep cooperation) or lesser (shallow cooperation) transfer of decision-making power from the national governments to the joint bodies.

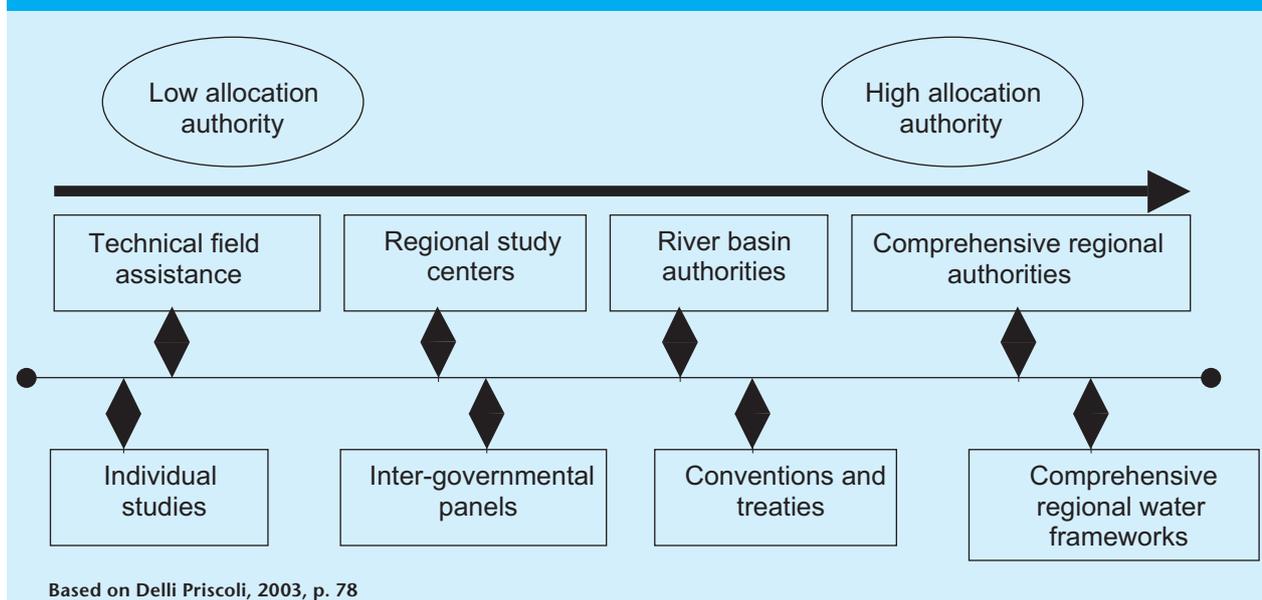
Both of these aspects, purpose and form, are formalized in a representation of different cooperative

institutional arrangements on a continuum from low allocation authority to high allocation authority, or simply low vs. high authority (in decision-making) in general, which was developed by Delli Priscoli (2003, p. 78) and is illustrated in Figure 1.

In Figure 1, high authority coincides with a comprehensive (multi-purpose) approach towards cooperation. At the left end of the continuum, the role of transboundary cooperative mechanisms is limited to planning, 'allocative action [is] based solely on individual national autonomy'. At the right end, higher-level authority and decision-making power (e.g. on operations and revenue generation) is transferred to the transboundary level. 'individual studies, regional study centers, treaties, conventions, and river basin authorities, up to comprehensive regional authority', are among the various cooperative approaches along this continuum.

Figure 1 is not intended to imply there is any automatism leading towards a transfer of authority from the national to the transboundary level: 'The realities of water flows in the light of increasing economic development, interdependence, sustainability, and population growth, seem to push us from the left to the right of this continuum' (Delli Priscoli, 2003, p. 79). However, 'legitimate and important political realities generally resist such regional water management notions'. Therefore, it is not surprising that very few comprehensive regional authorities have ever been created. Most of the regional arrangements tend to have either a comprehensive mandate or high authority, the latter ones usually being focused on a single purpose. At the same time, and in line with this argument, joint bodies that are rather limited in their purpose of cooperation (e.g. to gathering data and information) 'can achieve a great deal of authority and influence over decisions' and actions related to their task (ibid.).

Figure 1 Power and authority of different institutional mechanisms



3.2 Manifestations of transboundary water cooperation

As pointed out above, in some cases, states decide to set up a formal organization or coordination unit for their cooperation based on bi- and multilateral treaties, such as a secretariat or a management committee. This kind of cooperation is embedded in and determined by a specific policy and legal framework, and requires that financial and non-financial resources be sustainable, two important aspects we will examine in more detail below.

If the intensification of cooperation leads to the creation of new structures for water cooperation, certain principles should be kept in mind. Most importantly, and obviously, when a new structure replaces an older one, it is necessary to make sure that it is at least as efficient as the older structure. Generally speaking, (formal) institutions should not be replaced when they are working fairly well; they should rather be strengthened (Millington et al., 2006a, p. 6). Furthermore, it needs to be considered that new bodies always add to the administrative structures already in place and create new requirements for coordination and communication.

Three different approaches to the creation of new joint bodies – taking into consideration issues of cooperation intensity – are distinguished in a recent World Bank paper on Integrated River Basin Management (Millington et al., 2006a). Despite its focus on river basins and on (predominantly) the national context, many of its statements are applicable to international water bodies in general. According to this view, river basin organizations (RBOs) can be grouped into three categories:¹²

- A River Basin *Commission* is adequate when ‘significant development options are still to be considered in the river basin’, ‘conflicting uses [are] significant’, ‘information and policies still need further development’, and ‘water resource planning and management practices are not well detailed’. A commission is formally constituted and comprised of a management board or group of commissioners who ‘set objectives, goals, policy and strategic direction’, are supported by technical staff, and possibly complemented by a presiding Ministerial Council. A Commission does not interfere with general water management functions but sets ‘the bulk of water shares that each state/province is entitled to divert and ... monitor(s) water use’. It is characterized by equal partnerships among member governments and may include other stakeholders as well (Millington et al., 2006a, p. 8).
- A River Basin *Authority* can either be a ‘large multi-disciplinary organization with specific development tasks’ (e.g. hydropower development) or ‘an organization that absorbs virtually all the water resources functions of other

agencies in the basin’. While in some countries authorities are being transformed into commissions or coordinating committees/councils (see below), this model is adequate, for example, in some African basins because of their relatively low degree of water resources development, such as the Niger. However, it is not suitable for ‘historically, geographically, and politically very complex’ basins such as the Nile (ibid., p. 9).

- A River Basin *Coordinating Committee* or *Council* is based on the assumption that ‘existing agencies ... are operating effectively’, ‘most of the important data networks are in place’, ‘most of the high priority water projects have been constructed’ and ‘competition for resource use ... has been resolved’. This comprises ministers or senior representatives of main water-related agencies, meeting regularly; it has no executive power and is legally based on letters of agreement from the participating agencies.¹³ This category, however, is more common in the national context and serves to complement joint bodies on a higher level.

What these categories look like in practice will be illustrated with a few examples from the UNW-DPC workshop. At a high level of joint decision-making and cooperation intensity, a joint body, based on bi- or multilateral treaties, might not only have the responsibility to approve (infrastructure) projects, but also to conduct studies on emerging projects, give advice to the riparian states (based on the studies) and mediate in conflicts (such as the International Joint Commission [IJC] in the Great Lakes Region). When joint organizations have the mandate to authorize or reject water development projects such as dams, each country has to submit a proposal to the Commission, where experts then evaluate the proposal and its consequences and make a decision on the basis of scientific data, modelling, etc. (companies have to submit to national authorities, who can forward the proposal). This model is typical in francophone areas in Africa such as the Senegal River Basin.

At a lower level of cooperation intensity, river basin commissions such as the International Commission on the Protection of the Danube River (ICPDR) function more as consultative mechanisms that provide a forum for states and stakeholders to exchange and share information, experience and common understanding. The purpose is to prevent projects implemented by one riparian state from harming others, while the final decision on project implementation is always made at the national level (however, the ICPDR also checks national legislation on navigation and nature protection). The effectiveness of such mechanisms is based on peer pressure, rather than legislation. The ICPDR can be seen as a guiding framework, which facilitates the creation of national structures and legislations. Similarly, in the Harirud Basin (shared by the Islamic Republic of Iran and

¹² For a more detailed categorization, see Hooper, 2006.

¹³ See Millington et al., 2006a, p. 6, for more detailed descriptions.

Turkmenistan), technical issues and their dimensions are discussed in a joint committee, which gives recommendations to the ministerial level, where the final decisions are made (while large development projects require not only prior notice but also consensual approval in order to be implemented, as put down in a treaty). The basis for decision-making in such a context can be agreed minutes (i.e. non-legal agreements).

Whereas regional (in the sense of supra-national) decision-making is based on treaties, which are signed and ratified by states and therefore considered to be relatively strong, their enforcement mechanisms are often weak or non-existent. Regarding the legal and policy frame for cooperation at a fundamental level, two different approaches can be differentiated. Either a convention is passed obliging countries to undertake the necessary steps towards its implementation (the Nile, Danube), or states decide by themselves to incrementally harmonize national legislation on certain issues (such as flood control) in order to be better able to implement joint decisions (the Rhine).

One more feature that distinguishes cooperative mechanisms is the geographical scope or the size of the organizational unit. Whereas integrated approaches to water resources management (while also calling for subsidiarity) recommend choosing the river basin, watershed or aquifer as the basic unit (hydrological boundaries), some authors have cautioned that it might be 'hydrologically more appropriate to allocate and manage water at a sub-basin, watershed or even administrative unit level than at basin level', because 'some issues require basin level perspectives, some do not' (Moench et al., 2003, p. 9).

3.3 Funding mechanisms

One more aspect deserves further attention, as it is the *sine qua non* of cooperation in transboundary waters – funding.

As emphasized at the UNW-DPC workshop, every single activity in water cooperation requires funding. And although investments in cooperation on transboundary waters in many cases certainly outweigh the costs of non-investment in the long term, financial mechanisms of cooperation are not only vital but also very often scarce. Reliable long-term funding is indispensable for activities such as creating and maintaining a joint body or coordination unit, training people for management or data collection, coordination of policies and research, as well as public awareness raising and monitoring.

With water resources development (irrigation schemes, reservoirs, hydropower, etc.), the situation is a different one, as the required expenditures are needed for a limited timeframe only, after which investments should pay off, so that revenues can in some cases even be reinvested in maintaining

joint bodies for water cooperation. However, development projects can also create additional costs, e.g. in the form of compensation for water pollution, resettlement or the loss of livelihoods as a consequence of land use change, and there are limits to development within each basin (and even more so for groundwater aquifers). Furthermore, investments in infrastructure for improved water supply and sanitation are urgently needed in many regions; these, however, are unlikely to produce significant revenues.

Potential sources for funding, mentioned by the experts at the UNW-DPC workshop, include national governments, the end users of water, the private sector (infrastructure development and partnerships), external donors, and regional economic commissions (RECs). Each of these has its own strengths and weaknesses. Thus, donor support can guarantee substantial amounts and is perceived as a reliable source of funding (for the duration of the project/programme). Yet institutions depending on donors can lack the commitment and ownership of member states; and the acquisition of funds is a lengthy process, the outcome of which is uncertain. Furthermore, funding can have certain conditionalities attached to it, and there is the risk of money being diverted from its intended use. Regarding the aspect of ownership, there are differences between loans (needing to be paid back), grants (possibly including conditions) and trust funds (different level of control by the donor).

National sources presuppose government commitment, and are expected to increase the cost efficiency and predictability of the funding, while at the same time they put a strain on national budgets. They are often insufficient and can be rather volatile, e.g. when political majorities change. Also, national governments sometimes fail to fulfil their financial commitments. National contributions can be spent by governments according to their capabilities in either cash or in-kind (non-cash) contributions.

User contributions have the potential to create sustainability and elicit local level commitment; however, they require a large administrative overhead and usually do not amount to large sums. Private sector funding can be significant, and it is often linked to infrastructure development, e.g. for water supply, or sewage systems. However, it is also strongly linked to specific (corporate) interests. Finally, regional economic commissions can play a very positive role, also in terms of regional cooperation and integration, where they exist. At the same time, they place constraints on national sovereignty in such a way that financial support might give them a say in decisions on water issues. The hydrogeography of basins or aquifers does not necessarily coincide with the borders of existing RECs, but as the example of the Danube (as discussed above) shows, this is not necessarily a disadvantage.

4. Requirements for institutional capacity development

Institutions in transboundary water cooperation have generally shown a remarkable vitality, and it has been observed that ‘once international institutions are in place, they are tremendously resilient over time, even between otherwise hostile riparian nations, and even when conflict is waged over other issues’ (WWAP, 2003, p. 318).

Already for the First World Water Development Report, a brief evaluation of existing agreements on transboundary water cooperation was conducted. Generally, many were found to suffer from a lack of clear and tangible provisions (e.g. with no clear delineations of water allocation), as well as from insufficient capacities to adapt to change (regarding hydrological conditions as well as water demand). Water quality standards, monitoring, enforcement and conflict resolution mechanisms were found to play a minor role, if any. Only a minority of the agreements comprised all riparian states; and public participation, which is indispensable for the resilience of these institutions, proved to be very often overlooked (WWAP, 2003, p. 316).

One major challenge for institutional capacity development is the creation of an enabling environment, which supports the ‘concerted action’ of the variety of different, but mostly interdependent, stakeholders within a basin. Based on case studies conducted in the European context (SLIM project, 2004a), constraints to concerted action were identified as including institutional arrangements established in an overly top-down manner and without recognition of the context; and ‘rigid allocations’ of ‘organizational responsibilities’ reinforcing ‘existing boundaries’ and undermining collaborative activities. Unilateral decision-making and overly bureaucratic procedures reduce cooperation potentials by discouraging participation and creative solutions. Failure of the more formal institutions to deal with current challenges and changing situations and to fulfill their core functions might lead relevant stakeholders to turn away from them and act unilaterally. The same is true for the fragmentation of institutional responsibilities. This is not only inefficient, because of the overlaps as well as different interests, responsibilities and experiences of the organizations involved; it also does not lend itself to advancing the implementation of agreements and conventions (ibid.).

Very generally and based on preliminary research, certain design features for sustainable water cooperation have been suggested. These are:

- feasibility: ‘the match between objectives and available resources and know-how’;
- flexibility: ‘adaptive capacity of cooperative arrangements in view of changing interests of riparians and changing scientific knowledge and environmental problems’;

- effective organizational structures: ‘well-run professional international river commissions’;
- inter-administrative relations: ‘close ties between international river commissions and national-level authorities’; and
- openness: ‘involvement of non-governmental stakeholders and sub-national political units’ (see Bernauer, 2002, p. 561, for details).

Requirements and capacity development activities at the institutional level, which are conducive to achieving these features, were extensively discussed at the UNW-DPC workshop. The results comprise part of the following sections, which outline capacity development requirements and activities for the different institutional mechanisms.

The sustainability of cooperative water institutions largely depends on the institutional capacities within the member states. Although this is not the focus of the present publication, it cannot be overemphasized that all capacity development activities at the transboundary level require simultaneous efforts in the national context in order to have any effect.

4.1 Policy and legal framework requirements

Depending on purpose and context, states decide on the appropriate institutional framework for their cooperation, establish it through a decree or government decision, and empower it through legislation, regulations, or arrangements. Although numerous factors influence the effectiveness and sustainability of cooperative mechanisms, the policy and legislative framework is considered the most important one of all (Millington et al., 2006b, p. 2–4).¹⁴

Usually, a strong driver, such as severely degraded water quality or the risk thereof (a problem that requires joint action), provides impetus before agreements are negotiated. Since the 1997 UN Convention provides a general framework only, which needs to be filled with content and adapted to the specific situation, negotiating agreements on solutions requires technical expertise. Developing countries especially may need support on this. Such support could be provided by UN agencies which have played an important role, for example, in the establishment of the Mekong River Commission (ibid., pp. 5–6).

The establishment of a new basin organization ‘will almost certainly clash with existing administrative arrangements or not link easily with them’ (Millington et al., 2006b, p. 7). Relevant tasks and responsibilities regarding water are usually fragmented and located at different central government ministries within each country and possibly at a number of ministries on the state or provincial level, too. The legal framework needs to clearly point out

¹⁴ According to this source, policy is seen as a ‘high-level response’ to an issue of perceived importance, while the legislative framework is the ‘legal empowerment of the policy’.

how coordination of new and existing structures will take place, and to determine for each administrative level how new forms of governance are going to be implemented (*ibid.*). It must clearly define the organizations involved in national and transboundary water governance, including their duration, tasks (permanent, consultative, etc.) and differential responsibilities (who deals with what). For this purpose, states have to decide to either create new legislation or amend existing laws. In any case, joint bodies require not just a clear mandate and rules; the rules also need to be amendable according to predetermined procedures, to allow flexibility and adaptation to changes.

National legislation has to be brought into coherence with international conventions that have been signed and ratified by the states. However, tensions can arise not only between the national and the international levels, but also between the local, municipal, provincial, regional, national, and international levels – all of which might be characterized by different understandings of roles and values, which can create mutually exclusive or overlapping institutions. In order to overcome fragmentation and enhance (inter-ministerial) coordination, a national water council or coordinating committee can be established (see the description above). The advantage of this would be that a balanced representation of the different interests of ministries and other stakeholders is more likely to be achieved. Furthermore, it might be advisable for countries that are located in a number of shared basins, each of which might require formalized cooperation agreements, to have this kind of national-level coordination (Millington et al., 2006b, p. 11).

The legal framework does not only have to be clear-cut and coherent; legal provisions also need to be enforceable. However, very often, means of enforcement are missing. The more general the principles agreed upon at an international level, the more difficult it is to implement them in a national context. This implies that the goals of formal agreements should be made measurable.

Implementation can be promoted if national legislations on certain issues are harmonized. However, this is a lengthy process, which should not be superimposed, but emerge as a result of its perceived advantages on the national level (most likely with some of the countries taking the lead on it and others following, as in the Rhine Basin, discussed above). Nonetheless, international frameworks have an effect on the legislation of countries, sometimes even on non-members (*cf.* the effects of the EU Water Framework Directive on non-EU member states that are members to the ICPDR).

Furthermore, in order to facilitate implementation, practical aspects need to be taken into account during the policy-making process. Administration and important stakeholders who will be in charge of the implementation should be involved to ensure

that they are not principally opposed to the legislation and that it is feasible. Too great an influence of external actors on the policy-making process has in the past led to stalemates and non-implementation of promising policy approaches in the water sector (WWAP, 2006, p. 59). Therefore, in some contexts, for example in the Senegal Basin, a different approach on enforcement and implementation has been pursued. There, national and local coordination committees have been established, which are interlinked with the Permanent Water Commission and its advisory body.

Details on volumetric water sharing are often not included in agreements because they are very hard to agree upon. An approach towards this conflictive issue has been described by Wolf (2004, pp. 16–17). He recommends to move ‘from rights to needs’, i.e. to base allocation decisions on needs such as irrigable land, population size or other requirements. If an allocation agreement is the goal, the potential variability of river flows and their consequences need to be taken into account. And if ensuring ecological sustainability is part of an existing agreement (as, for example, in the Mekong River Commission Agreement), ‘flow regime requirements for the environment must be established ... before water sharing for consumptive use among basin partners can realistically occur’, for such a provision to be meaningful; and acceptable minimum flows need to be part of the agreements (Millington et al., 2006b, p. 7). Achieving this might require technical assistance.

One major gap in current legal agreements on transboundary water cooperation is their insufficient recognition of groundwater. It has been suggested that groundwater be integrated into existing treaties on surface water. However, aquifer boundaries tend to differ from those of surface water bodies. That means that cooperation on groundwater would in some cases comprise a different set of countries and stakeholders altogether. Groundwater has recently begun to be recognized in legal and policy processes has only recently begun, so there is not yet much experience on this. Most likely, new mechanisms of dealing with this issue will have to be developed, as it has been observed that even where existing (surface water) conventions or organizations include groundwater, the latter is often treated, as it were, like a stepchild. As always, context-specific solutions are required, and where surface and groundwater resources are hydrogeographically connected, institutional capacity development might allow existing institutions to adequately integrate groundwater into their mandate and activities. Such capacities specifically concern improvements of the data situation and awareness of different time cycles of groundwater renewal. Activities also need to be sensitive to potential differences regarding access rights to groundwater (compared to surface water). In some countries the right to groundwater abstraction is linked to land ownership, which can be determined by traditional tenure systems.

4.2 Cooperation requirements

Many cooperative mechanisms, especially those not involving a joint body, do not have a legal framework. Of course, such informal institutional cooperation has capacity requirements as well. At the UNW-DPC workshop, the importance of regular meetings between cooperating parties with a clear goal was emphasized. Cooperation at the political level is likely to have a stronger impact if participants actually have the authorization to make decisions and concessions. In the case of informal inter-ministerial coordination, it is vital to involve all relevant ministries (including finance, planning, foreign affairs, etc.). The consideration of expert input should be ensured in all these processes. Cooperation becomes more attractive if it contributes to national capacity development – for instance, when people benefit from participating in expert meetings or technical exchange, referred to as ‘Learning from joining’ at the workshop.

It was also mentioned at the workshop that the gap between research and policy-making needs to be overcome, however challenging this may seem. This requires more applied research, with an eye to practical scientific results, as well as reaching out to universities. Dialogue forums between water engineers and policy-makers can be conducted. Existing knowledge needs to be better managed, organized, shared and transferred. Interestingly though, for many practitioners, over and above creating more scientific results, implementation of what is already known seems to be the bigger and more pressing challenge (Adeyemo, 2003, p. 171).

One cooperative activity that can be conducted at any intensity level of cooperation is the joint collection of data on the state of the resources. Data and information are a vital element of cooperation and a precondition for informed decision-making, and they have a crucial function in terms of building trust between states. The challenges faced by basin communities in this regard vary considerably. Especially in developing regions such as the Nile Basin, basic infrastructure for data collection needs to be put in place first. Where monitoring of water resources already takes place, the standards for data collection and processing need to be harmonized, if not standardized, between the states to make the data comparable. For the purpose of joint monitoring, UNESCO and the World Meteorological Organization (WMO) have provided a glossary of terminology, the ‘International Glossary of Hydrology’. The United Nations Statistics Division and the Division for Sustainable Development of UN-DESA have developed the System of Environmental-Economic Accounting for Water (UN-Water, 2008, p. 9) to support such activities. If quotas or shares are agreed between states, (joint) monitoring activities should be extended to include the monitoring of compliance. New technologies including remote sensing (thermal infra-red imagery) are already being used to this end in some basins (Millington et al., 2006d, p. 16).

A coordination unit or joint body, in cases where it exists, has to display continuity and flexibility. This can be enhanced by the establishment of a permanent secretariat. As most of these organizations tend to consist of few and highly specialized staff members, thus suffering from a serious gap if only one staff member leaves, their institutional memory needs to be increased by improving knowledge management. The importance of, and detailed steps and requirements towards, good organizational management of a basin organization are outlined in Millington et al. (2006c). To be able to assess the performance of basin organizations, goals need to be measurable and indicators should be developed. Such indicators can then serve as the basis for performance reporting and auditing, the results of which should be managed in a transparent and open manner. Reporting is not only a tool to assess progress made within the organization. ‘State of the Basin’ reports can be published with the aim of raising awareness and providing a basis for decision-making and action (as done by the Mekong River Commission). Adding to this, such reports give an indication of the effectiveness of cooperation in terms of environmental sustainability.¹⁵ A comprehensive list of performance indicators for basin organizations has been developed by Hooper (2006).

Activities suggested at the workshop that aim enhancing the performance of such a body include internship programmes and staff exchanges between organizations and formal institutions in different basins on an individual basis for human resource development (‘twinning’), as well as increasing the level of staff coverage. As the skills required for water cooperation are unique and interdisciplinary, changes in university curricula have been proposed, which could be implemented with the support of UNESCO and UNW-DPC. Education centres specialized in education for water management could be set up, as well as open educational resources to allow access to teaching material. In-house and on-the-job-training as well as team approaches towards human resources development should also play a role. In terms of learning from each other, it was recommended to create forums for the sharing of knowledge, expertise and experience.

4.3 Funding requirements

Concerning funding, depending on the context of cooperation, numerous institutional capacities are required, as outlined by the experts at the UNW-DPC workshop. In order to acquire and use funds from external donors, financial management skills, dialogue and negotiation skills, transparency and accountability, visible results of spending, and clear agreements on targets between donors and countries are needed. On the donor side, it would be an important step to coordinate donor activities in order to decrease overlap and gaps. Furthermore, they need to know more about project implementation, and harmonize their rules and requirements in

¹⁵ See Millington et al., 2006h for more information on this.

order to facilitate proposal writing. A useful step in this direction would be multi-donor dialogues.

Regarding national contributions, financial management skills are required along with clear rules of procedure, awareness raising, and empowered financial committees to ensure oversight. Governments must agree on how to divide necessary financial contributions into equitable shares. This can be facilitated by sharing benefits and not just costs. Funded activities need to be made visible to maintain support.

Concrete activities to achieve such goals include training financial management skills (especially for high-level decision-makers), as well as training in writing project proposals and in skills for negotiating with donors (also in order to address conditions). New schools or curricula on water, economy and financing could be established. To ensure transparency and accountability, steering committees can be put in place to provide oversight.¹⁶

Regarding private sector investments, capacities are needed to set and manage trust funds. Furthermore, most investment for infrastructure development is likely to come from private sector parties. States therefore need to agree on notification procedures regarding such projects. Many funding agencies (such as the World Bank, the Asian Development Bank and the Organization of American States) already have policies in place, which require beneficiary states to notify all other states in the basin of planned projects (Millington et al., 2006e, p. 5). However, there have been no such policies put in place by private sector companies. Clear agreements need to determine which projects require approval, what the criteria for evaluation and approval are, how this process is carried out (who decides which information needs to be delivered by the submitting party, etc.), and what happens in cases of disagreement.¹⁷ When setting up agreements on the notification process, water flow variability needs to be considered as one criterion. The basic and indispensable precondition for this is knowledge about the natural resource base.

Charges from water users can generally be levied for the 'direct provision of water-related services', for the right to use water and to 'cover the costs of the impacts of economic and social development on the basin's resources' (Millington et al., 2006f, p. 4). The charges should correspond to the real costs of the services; it is also necessary to demonstrate that unnecessary costs are avoided through efficiency of service delivery. The ability to pay must also be considered. Where it is insufficient, subsidies are needed in order to maintain essential services. Millington et al. (2006f, pp. 4–5) also show ways of assessing the actual costs of water management. Pricing water

for the purpose of water conservation, especially in developing countries, is not an appropriate means. In a case where this is deemed necessary, mandatory reductions in water allocation need to be developed together with stakeholders, and end users should be responsible for the management and thereby also for the efficiency of, for example, irrigation systems. Usually, charges are set by governments. However, governments could alternatively create an independent tribunal to hear submissions from water service providers and other stakeholders on their suggestions (ibid., pp. 7, 11). Transparency and the possibility of public inquiry into the mechanisms of pricing are crucial.

A major challenge for many cooperative mechanisms is ensuring financial sustainability, especially if funding comes from external sources in the beginning of the cooperation. The Danube Basin is an example where a transition towards financial autonomy was successful. UN and EU support proved vital for it, initially, and were beneficial in numerous respects (training of chairpersons, public awareness, NGO network). When, after a while, more and more responsibility was given to national governments, most activities were able to be maintained.

4. 4 Stakeholder participation

Stakeholders have been defined as 'individuals or groups who have a legal responsibility or mandate relative to a decision, and who will be directly or indirectly affected by a decision' (WWAP, 2003, p. 373). Therefore stakeholders constitute a large and immensely heterogeneous group or groups. Their involvement has been emphasized as being exceedingly important, and not only by the experts at the UNW-DPC workshop. The experts stated that stakeholder participation offers a broader view, guarantees ownership by water users and the acceptance of decisions. It has become obvious that water policy can no longer be limited to technical interventions, but increasingly needs to be implemented through people. Thus, everything should be done to enable participation, while at the same time this cannot be imposed. The institutional framework should integrate all stakeholders at all levels, from the president to technical people to the local level. The Senegal Water Commission has formalized mechanisms to involve experts in decision-making, and in the Nile Basin the Nile Basin Discourse, a network of civil society organizations, is working on a programme to positively influence the development of the Nile Basin Initiative (NBI).

Stakeholder participation poses an enormous challenge to policy- and decision-making bodies, especially when there are numerous different stakeholders with divergent interests; and it is an extremely costly and time-consuming process. Moreover, the results of it require additional capacities and resources too, as equitable representation of all stakeholders in decisions on transboundary water governance is very likely to result in a much broader focus and more issues to be considered

¹⁶ See also the remarks in the WWDR3 (WWAP, 2009, p254) on the new global Water Integrity Network (WIN) and other corruption-preventing activities on different levels.

¹⁷ See Millington et al., 2006e, p. 3, for more details.

(multi-purpose cooperation). Participatory decision-making becomes increasingly difficult, the bigger the organizational unit is, which means that within a river basin it is enormously challenging (if indeed possible). All the costs connected to it, however, need to be weighed against the hidden costs of not involving stakeholders in the process; and all efforts must be made to avoid what was termed, at the UNW-DPC workshop, the 'illusion of inclusion'. A means of achieving, at one and the same time, both stakeholder involvement and a common goal is the development of a shared vision for a basin. The US Army Corps of Engineers have developed a software tool on shared vision planning, which has been used in the Great Lakes Region. It integrates traditional water resource planning, participation and collaborative computer modelling.¹⁸

Stakeholder participation requires changes to 'long established administrative and political processes' (Millington et al., 2006g, p. 4), which can be difficult to achieve. Depending on the intensity of cooperation, this concerns either joint or national/provincial bodies. However, given the existence of joint bodies, the national level must not be neglected. At each level, different degrees of stakeholder integration and participation, ranging from public hearings to co-decision-making, can be practised.

Organizations involved in policy design and planning need to invest in institutional capacities of facilitating participatory and inclusionary processes (SLIM project, 2004b). They also need to be trained in the use and applicability of the different possible methods of facilitating participatory processes.¹⁹ This is all the more important as increasing water scarcity will require reallocations and will demand management – and therefore careful balancing – of stakeholder interests.

Stakeholders in turn need organizational capacities, relevant knowledge (i.e. on transboundary legal issues) and access to relevant information and communicational skills. This requires transparency and information dissemination by relevant organizations, as well as education and training, which enable stakeholders to turn awareness into action and achieve tangible results.

The creation of an effective interface between the technical and the political community requires a common or at least mutually comprehensible language; and the diversity of stakeholders (in terms of language, organizational culture, etc.) should not be underestimated. Stakeholder involvement, furthermore, always raises the issue of representativity, i.e. the question of whom representatives really speak for. Establishing balanced representation of all groups is a major challenge as well.

4.5 Awareness raising

The neglect of groundwater has been deplored throughout the present paper. Groundwater resources miss out from many cooperative mechanisms, and are less likely to be covered by any legal agreement. And financial flows mainly target cooperation and development projects regarding surface water. The reasons for this major shortcoming are linked to a lack of awareness, owing to the fact that groundwater and groundwater pollution are less perceivable and because ecosystems are the main beneficiary of groundwater protection. Looking again at the definition of institutions chosen and introduced, above, which includes social norms and values, it becomes clear that all institutional transformation starts with awareness. Without awareness of the interconnectedness of ecological and human systems and the responsibility of human beings for the state of the world's resources and for each other, no attempt at transboundary water cooperation can be sustainable in the long run. Many cooperative mechanisms are in fact the result of raised awareness among the public and among policy-makers. The integration of an awareness-raising component is therefore especially vital in contexts of cooperation with strong donor involvement. There, it is the only means to ensure sustainability and a transition from external funding to financial self-reliance.

Awareness-raising activities can take place at different levels. Information on the development of target-group-specific communication strategies for awareness raising can be found in Millington et al. (2006d, p. 9). In any case, a previous assessment should be conducted in order to be able to support existing initiatives and provide the training that is really required. Because public awareness is also a means to prioritize (ground)water on national agendas, awareness-raising activities can be extended to comprise education and training that enables stakeholders to turn awareness into action and achieve tangible results. Regarding civil society activities, the opportunities of networking and practice sharing via the Internet (mailing lists, forums, blogs, etc.) should be made use of.

Examples of awareness-raising activities at the communal level are basin-wide awareness programmes – on the state of the resources or waste disposal – for example, which can be long-term programmes or take place in the frame of 'water weeks'. They can be complemented by specific media stories, art or short story competitions and many other activities.²⁰ Schools are particularly important. Curricula could be extended to include water quality monitoring with simple means, the results of which could be exchanged via Internet networks of schools within a basin (Millington et al., 2006d, p. 4). The ongoing UN Decade on Education for Sustainable Development provides an excellent framework for such activities.

18 It can be accessed at <http://www.svp.iwr.usace.army.mil/>

19 For a description of the different methods see Hare et al, 2007.

20 See Millington et al., 2006d, p. 4, for examples.

Another goal of awareness raising should be decreased nutrient levels through changing consumer behaviour. To support communal activities, ratings and awards could be created, and celebrities involved to bridge the gap between government agencies and people in the communities. Water users such as farmers, irrigators and industrialists need to be made aware of ways to protect water resources. Respective programmes could be channelled through water user associations. High-level stakeholders and decision-makers on the national, provincial and community levels need more technical information, and clear statements on priority areas for action (e.g. where resources are under stress or will be in the near future). Many of the mechanisms have been outlined above including regular meetings, where such information can be presented (ibid., pp. 5–8).

5. Conclusions

Transboundary cooperation on water as one aspect of good water governance will become increasingly important in the future. A global legal framework for cooperation on water exists (see Box 1); yet it lacks binding force in many parts of the world. A variety of factors, ranging from hydrogeographical features of the basin to the socio-political realities and donor commitment, determine the likelihood and eventual shape of transboundary water cooperation. Cooperative institutional arrangements can be categorized according to their purpose (single vs. multi-purpose cooperations) and their cooperation intensity, including a greater or lesser transfer of authority to a joint body. It must be recognized that cooperative institutional arrangements in this context cover an extremely broad spectrum, a fact that is not always clear because of the different uses of the term 'institution'. And despite growing attention to and support for this topic, the institutional capacities of transboundary cooperative mechanisms are often weak compared to the challenges they face.

The recent international workshop on Institutional Capacity Development in Transboundary Basins was the impetus for considering, in this paper, the requirements for capacity development to support cooperative mechanisms.

To review, the mechanisms considered here included the legal and policy framework for cooperation, cooperative mechanisms and funding mechanisms. Important requirements identified for capacity development included the following:

- *Support for the development of suitable legal frameworks:* Capacity is needed, among other things, to improve training in how to negotiate and write adaptable agreements and to improve horizontal and vertical interagency coordination, legal coherence and the integration of technical knowledge and data on the state of the resource into agreements, and to improve the focus on groundwater.
- *Support for the development of suitable cooperative mechanisms:* Capacity is needed, among other things, to support regular exchange meetings between technical and policy experts, as well as expert input into the political process that can lead to more cross-sectoral and trans-boundary understanding, and ultimately to stronger cooperation. Capacity for cross-sectoral integration and coordination, as well as institutional memory, can also be improved by developing capacities for the creation and maintenance of permanent secretariats containing the appropriate technical and facilitating experts. Information and knowledge relevant for promoting cooperation also has to be produced and disseminated, through the development of relevant higher education curricula and forums for knowledge sharing. The latter can be used to support stakeholders to negotiate and plan according to the identification of shared benefits, rather than according to a focus on individual positions and potential losses.
- *Support for the development of suitable funding mechanisms:* Capacity is needed, among other things, to support the coordination and harmonization of donor activities, as well as the development of financial management skills leading to transparency and accountability with respect to visible results being able to be matched against clear goals. More support has to be provided in terms of providing financial tools for calculating cost-benefit-sharing with respect to the different benefits stakeholders gain from alternative cooperation strategies. The development of water-charging procedures, which represent assessed actual costs and the ability to pay while being transparent and sustainable, also needs to be supported.

Furthermore, the capacity of water managers and policy-makers within transboundary basins needs to be developed: in terms of their knowledge of the most suitable techniques to support of cross-sectoral stakeholder participation in planning and public participation, and their ability to implement what can be very resource-intensive participatory activities. As part of this, awareness raising, from the public to the political levels, needs to be improved if transboundary cooperative mechanisms are to be prioritized and sufficiently funded.

Individual requirements and priorities for institutional capacity development can be identified by using the tools for institutional capacity assessments developed by the UNDP (2007). This assessment can be adapted to fit the needs of sectors of various sizes and be applied at different levels. Recently, it has been suggested that regional river basin organization networks (such as the Network of Asian River Basin Organizations NARBO) can play a role in assessing capacity development needs, possibly on a peer review basis, and at the same time provide a forum for exchange on experiences made in institutional capacity development (Makin et al., 2004).

Also, more generally, one should try to learn from what has been done up till now (i.e. which measures have been conducted and what effect they have had). UNW-DPC is currently in the process of developing a repository of initiatives on institutional capacity development in transboundary waters, which can be used by interested transboundary water management stakeholders for future reference as and when they plan further development of their institutions for cooperation.

References

- Adeyemo, E. A. 2003.** Effective water governance through the paradigm of IWRM. Paper presented at the 29th WEDC International Conference. <http://wedc.lboro.ac.uk/conferences/pdfs/29/Adeyemo.pdf> (Accessed 15 December 2008.)
- Bernauer, T. 2002.** Transboundary freshwater management: when and why does it succeed or fail? UNESCO (ed.), *Selected Papers of the International Conference 'From Conflict to Co-operation in International Water Resources Management: Challenges and Opportunities'*. Delft, Netherlands, UNESCO-IHE, pp. 545–64.
- Croll, P. J. and Wirkus, L. 2003.** *Wasser im südlichen Afrika: Konflikt- oder Entwicklungspotenzial?* [Water in Southern Africa: potential for conflict or development?] C. Hauswedell, C. Weller, U. Ratsch, R. Mutz and B. Schoch (eds), *Friedensgutachten*, Münster/Hamburg, Germany/ London, LIT Verlag. (In German.)
- Delli Priscoli, J. 2003.** *Participation, Consensus Building and Conflict Management Training Course*. Paris, UNESCO-IHP (IHP-VI, Technical Documents in Hydrology, UNESCO-IHP PCCP Series No. 22).
- FAO. 2006.** Water monitoring: mapping existing global systems and initiatives. Background Document prepared by FAO on behalf of the UN-Water Task Force on Monitoring, Stockholm, FAO.
- Fukuda-Parr, S., Lopes, C. and Malik, K. 2002.** Overview. S. Fukuda-Parr, C. Lopes and K. Malik (eds), *Capacity for Development: New Solutions to Old Problems*. London and Sterling, Virginia, Earthscan Publications Ltd and UNDP, pp. 1–21.
- Gerlak, A. K. 2007.** Regional water governance and institutional arrangements around transboundary waters. Paper presented at the annual meeting of the International Studies Association 48th Annual Convention. http://www.allacademic.com/meta/p179029_index.html (Accessed 1 December 2008.)
- Gupta, J. 2007.** 'Glocal' water governance: controversies and choices. Delft, the Netherlands, UNESCO-IHE (Discussion Draft Paper).
- Hare, M. P., Barreteau, O., Beck, M. B. et al. (2006)** Methods for stakeholder participation in water management. In C. Giupponi, A.J. Jakeman, D. Karssenberg and M. Hare (eds), *Sustainable Management of Water Resources: an Integrated Approach*. Chichester, UK, Edward Elgar.
- Hooper, B. P. 2006.** *Key Performance Indicators of River Basin Organizations*. US Army Corps of Engineering/IWR (2006-VSP-01). <http://www.iwr.usace.army.mil/inside/products/pub/iwrreports/2006-VSP-01.pdf> (Accessed 15 December 2008.)
- Makin, I. W., Parks, Y. P. and Arriens, W. L. 2004.** Supporting the development of effective and efficient river basin organizations in Asia: a discussion of the application of organizational benchmarking approaches. Batu-Malang, Indonesia, Asian Development Bank/International Water Management Institute/Japan Water Agency (NARBO Benchmarking Discussion Note ver 3 1 .02).
- Millington, P., Olson, D. and McMillan, S. 2006a.** *An Introduction to Integrated River Basin Management*. Washington, DC, World Bank. (Integrated River Basin Management: From Concepts to Good Practice, Briefing Note 1).
- . **2006b.** *Charging for Water Resources*. Washington, DC, World Bank. (Integrated River Basin Management. From Concepts to Good Practice, Briefing Note 2).
- . **2006c.** *Organizational Planning for a River Basin Organization*. Washington, DC, World Bank. (Integrated River Basin Management. From Concepts to Good Practice, Briefing Note 7).
- . **2006d.** *Raising the Awareness of the Basin Community*. Washington, DC, World Bank. (Integrated River Basin Management. From Concepts to Good Practice, Briefing Note 8).
- . **2006e.** *River Basin Planning and Management*. Washington, DC, World Bank. (Integrated River Basin Management. From Concepts to Good Practice, Briefing Note 9).
- . **2006f.** *Stakeholder Partnerships, Participation and Funding*. Washington, DC, World Bank. (Integrated River Basin Management. From Concepts to Good Practice, Briefing Note 11).
- . **2006g.** *System Modelling in River Basin Management*. Washington, DC, World Bank. (Integrated River Basin Management. From Concepts to Good Practice, Briefing Note 12).
- . **2006h.** *Transboundary Water Sharing*. Washington, DC, World Bank. (Integrated River Basin Management. From Concepts to Good Practice, Briefing Note 13).
- . **2006i.** *Setting and Managing Basin Sustainability Performance Indicators*. Washington, DC, World Bank. (Integrated River Basin Management. From Concepts to Good Practice, Briefing Note 14).
- Mitchell, R. B. and Keilbach, P. M. 2001.** Situation structure and institutional design: reciprocity, coercion and exchange. *International Organization*, Vol. 55, No. 4, pp. 891–917.
- Moench, M., Dixit, A., Janakarajan, S., Rathore, M. S. and Mudrakartha, S. 2003.** The Fluid Mosaic: water governance in the context of variability, uncertainty and change (a synthesis paper). Kathmandu, IDS/ISSET/MIDS/NWCF/VIKSAT.
- SLIM project. 2004a.** *Developing Conducive and Enabling Institutions for Concerted Action*. (SLIM Policy Briefing No.3).
- . **2004b.** *Facilitation in Policy Processes: Developing New Professional Skills*. (SLIM Policy Briefing No.4).
- Swatuk, L.A. and Wirkus, L. 2009.** Transboundary Water Governance in Southern Africa: An Introduction. In L.A. Swatuk and L. Wirkus (eds), *Transboundary Water Governance in Southern Africa – Examining Underexplored Dimensions*, BICC/DCAF series on Sustainable Peace and Global Security Governance No. 2, Nomos Verlag, Baden-Baden.
- UN-Water. 2008.** *Transboundary Waters: Sharing Benefits, Sharing Responsibilities*. Zaragoza, Spain, UN-IDfA.
- UNDP (ed.). 2007.** *Capacity Assessment Methodology: User's Guide*. Capacity Development Group. Bureau for Development Policy. http://europeandcis.undp.org/uploads/public/File/Capacity_Development_Regional_Training/UNDP_Capacity_Assessment_Users_Guide_MAY_2007.pdf
- UNDP Capacity Development Group. 2008.** *Capacity Development Practice Note*. New York, UNDP.

- Wolf, A. T. 2004.** Regional water cooperation as confidence building: water management as a strategy for peace. Berlin, Oktoberdruck. (Environment, Development and Sustainable Peace Initiative [EDSP] Working Paper 1).
- WWAP. 2003.** *United Nations World Water Development Report 1: Water for People, Water for Life.* Paris, London, UNESCO/Berghahn Books.
- . **2006.** *United Nations World Water Development Report 2. Water: A Shared Responsibility.* Paris, London, UNESCO/Berghahn Books.
- . **2009.** *United Nations World Water Development Report 3: Water in a Changing World.* Paris, London, UNESCO/Earthscan.

World Water Assessment Programme side publications, March 2009

During the consultation process for the third edition of the World Water Development Report, a general consensus emerged as to the need to make the forthcoming report more concise, while highlighting major future challenges associated with water availability in terms of quantity and quality.

This series of side publications has been developed to ensure that all issues and debates that might not benefit from sufficient coverage within the report would find space for publication.

The 17 side publications released on the occasion of the World Water Forum in Istanbul in March, 2009, in conjunction with *World Water Development Report 3: Water in a Changing World*, represent the first of what will become an ongoing series of scientific papers, insight reports and dialogue papers that will continue to provide more in-depth or focused information on water-related topics and issues.

Insights

IWRM Implementation in Basins, Sub-Basins and Aquifers: State of the Art Review

by *Keith Kennedy, Slobodan Simonovic, Alberto Tejada-Guibert, Miguel de França Doria and José Luis Martin for UNESCO-IHP*

Institutional Capacity Development in Transboundary Water Management

by *Ruth Vollmer, Reza Ardakanian, Matt Hare, Jan Leentvaar, Charlotte van der Schaaf and Lars Wirkus for UNW-DPC*

Global Trends in Water-Related Disasters: An Insight for Policymakers

by *Yoganath Adikari and Junichi Yoshitani at the Public Works Research Institute, Tsukuba, Japan, for the International Center for Water Hazard and Risk Management (ICHARM), under the auspices of UNESCO.*

Inland Waterborne Transport: Connecting Countries

by *Sobhanlal Bonnerjee, Anne Cann, Harald Koethe, David Lammie, Geerincq Lieven, Jasna Muskatirovic, Benjamin Ndala, Gernot Pauli and Ian White for PIANC/ICIWaRM*

Building a 2nd Generation of New World Water Scenarios

by *Joseph Alcamo and Gilberto Gallopin*

Seeing Traditional Technologies in a New Light: Using Traditional Approaches for Water Management in Drylands

by *Harriet Bigas, Zafar Adeel and Brigitte Schuster (eds), for the United Nations University International Network on Water, Environment and Health (UNU-INWEH)*

Dialogue Series

Water Adaptation in National Adaptation Programmes for Action Freshwater in Climate Adaptation Planning and Climate Adaptation in Freshwater Planning

by *Gunilla Björklund, Håkan Tropp, Joakim Harlin, Alastair Morrison and Andrew Hudson for UNDP*

Integrated Water Resources Management in Action

by *Jan Hassing, Niels Ipsen, Torkil-Jønch Clausen, Henrik Larsen and Palle Lindgaard-Jørgensen for DHI Water Policy and the UNEP-DHI Centre for Water and Environment*

Confronting the Challenges of Climate Variability and Change through an Integrated Strategy for the Sustainable Management of the La Plata River Basin

by *Enrique Bello, Jorge Rucks and Cletus Springer for the Department of Sustainable Development, Organization of American States*

Water and Climate Change: Citizen Mobilization, a Source of Solutions

by *Marie-Joëlle Fluet, International Secretariat for Water; Luc Vescovi, Ouranos, and Amadou Idrissa Bokoye, Environment Canada*

Updating the International Water Events Database

by *Lucia De Stefano, Lynette de Silva, Paris Edwards and Aaron T. Wolf, Program for Water Conflict Management and Transformation, Oregon State University, for UNESCO PCCP*

Water Security and Ecosystems: The Critical Connection

by *Thomas Chiramba and Tim Kasten for UNEP*

Scientific Papers

Climate Changes, Water Security and Possible Remedies for the Middle East

by *Jon Martin Trondalen for UNESCO PCCP*

A Multi-Model Experiment to Assess and Cope with Climate Change Impacts on the Châteauguay Watershed in Southern Quebec

by *Luc Vescovi, Ouranos; Ralf Ludwig, Department of Geography, University of Munich; Jean-François Cyr, Richard Turcotte and Louis-Guillaume Fortin, Centre d'Expertise Hydrique du Québec; Diane Chaumont, Ouranos; Marco Braun and Wolfram Mauser, Department of Geography, University of Munich*

Water and Climate Change in Quebec

by *Luc Vescovi, Ouranos; Pierre Baril, Ministry of Transport, Québec; Claude Desjarlais; André Musy; and René Roy, Hydro-Québec. All authors are members of the Ouranos Consortium*

Investing in Information, Knowledge and Monitoring

by *Jim Winpenny for the WWAP Secretariat*

Water Footprint Analysis (Hydrologic and Economic) of the Guadania River Basin

by *Maite Martínez Aldaya, Twente Water Centre, University of Twente and Manuel Ramon Llamas, Department of Geodynamics, Complutense University of Madrid, Spain*



The UN-Water Decade Programme on Capacity Development is a joint programme of UN Agencies and Programmes cooperating within the framework of UN-Water.

ADDING VALUE IN WATER-RELATED CAPACITY DEVELOPMENT

The UN-Water Decade Programme on Capacity Development celebrated its opening in August 2007 at the UN Campus in Bonn, Germany. UNW-DPC is hosted by the United Nations University and supported by the Federal Government of Germany. The broad mission of UNW-DPC is to enhance the coherence and integrated effectiveness of the capacity development activities of the more than two-dozen UN organisations and programmes already cooperating within the interagency mechanism known as UN-Water and thereby to support them in their efforts to achieve the Millennium Development Goals (MDGs) related to water.^o



UN-Water Decade Programme on Capacity Development (UNW-DPC)

United Nations University, UN Campus

Hermann-Ehlers-Str. 10

D-53113 Bonn, Germany

Tel. +49 228 815 0652

Fax +49 228 815 0655

info@unwater.unu.edu

www.unwater.unu.edu



United Nations
Educational, Scientific and
Cultural Organization

www.unesco.org/publishing

