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Educational, Scientific and  
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Nations World Water Assessment  
Programme



Network of Asian River Basin Organizations

# IWRM GUIDELINES

## at River Basin Level

**PART I**  
**PRINCIPLES**





United Nations  
Educational, Scientific and  
Cultural Organization

Organisation  
des Nations Unies  
pour l'éducation,  
la science et la culture

Organización  
de las Naciones Unidas  
para la Educación,  
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科学及文化组织

## FOREWORD

by Mr Koichiro Matsuura,  
Director-General of UNESCO

Water is fundamental for sustainable development. It affects *inter alia* sanitation, health, poverty alleviation, disaster reduction, and ecosystem conservation, and cuts across all eight Millennium Development Goals, in particular MDG 7 and its target to reduce, by half, the proportion of the 2.6 billion people without access to safe drinking water and basic sanitation by 2015. In addition, the ever growing vulnerability that is induced by global and local changes such as population changes, climate changes and variability, socio-economic issues and environmental degradation, can result in increasing both the frequency and severity of extreme events, including droughts and floods.

Integrated Water Resources Management (IWRM) can play a key role in addressing these needs and challenges. However, progress towards implementing IWRM has so far varied widely depending on the area, capacity, political will, and understanding of IWRM concepts and their implementation.

Implementing IWRM at the river basin level is an essential element to managing water resources more sustainably, leading to long-term social, economic and environmental benefits. Because water is managed locally, a river basin approach provides a practical framework, defined by geographical and hydrological characteristics, which facilitates implementation of IWRM by involving downstream and upstream basin wide issues as well as incorporating environmental and socio-economic aspects.

To this end, UNESCO's International Hydrological Programme (IHP), following the issuance of its 2007–2008 review report titled 'IWRM Implementation in Basins, Sub-basins and Aquifers: State of the Art Review' realized the need for an instruction manual that synthesizes practical methodologies for IWRM at the river basin level. These Guidelines are a follow up to the review, and are also a contribution towards the World Water Assessment Programme (WWAP), which is currently launching the third United Nations World Water Development Report (WWDR-3). They are meant to be a living document – users are therefore invited to use these materials interactively with the project team, and contribute to its improvement with suggestions on methodology as well as by introducing new case studies.

I sincerely hope that these Guidelines will assist water practitioners in finding better and more efficient solutions to day-to-day problems, as well as play a catalytic role in promoting holistic integrated actions amongst all water practitioners, ultimately leading to more sustainable societies.

I would like to acknowledge, with thanks, the support of Steering Committee members and partner organizations in the production of these Guidelines. My special thanks go to the Government of Japan for its dedicated support throughout the implementation of the project.

Koichiro Matsuura

## MESSAGE TO THE USERS

What is integrated water resources management (IWRM)? It is a step-by-step process of managing water resources in a harmonious and environmentally sustainable way by gradually uniting stakeholders and involving them in planning and decision-making processes, while accounting for evolving social demands due to such changes as population growth, rising demand for environmental conservation, changes in perspectives of the cultural and economic value of water, and climate change. It is an open-ended process that evolves in a spiral manner over time as one moves towards more coordinated water resources management.

Why is IWRM needed? Water is a limited resource that is essential for economic growth and environmental and social well-being. Because it affects everyone, managing this precious resource requires balancing the interests of the many different user groups and individuals. Without that balance many conflicts can occur. Promoting coordinated water resources management in a basin that is open to all stakeholders will not only resolve such conflicts but will also bring enormous benefits to society, the basin, and to individual stakeholders.

The principles and concepts of IWRM have been widely recognized, but the implementation of IWRM is not satisfactorily progressing in many basins. This is, perhaps, because the practitioners responsible for water resources management at the basin level encounter difficulties in understanding where and how to begin, or the advantages of applying IWRM with respect to their actual situation may not be apparent enough. On the other hand, policy makers' dedicated approaches for setting up enabling environments and political frameworks that strongly support sound and sustainable water resources management are necessary prerequisites for IWRM to function effectively. Therefore, it is desired that practitioners and decision makers absorb the ideas and needs of IWRM, and understand the effectiveness of applying these within a basin-wide approach. UNESCO realised that there was a need for a mechanism to translate the IWRM principles into practical applications. These Guidelines for IWRM at River Basin Level are intended to be used for that purpose, as a tool to fill that 'gap'.

To get started with IWRM, you need to identify the full spectrum of stakeholders involved in river basin management issues. It is important to have a good understanding of how other stakeholders relate to water, and how they are related to you through water. As a practitioner involved in IWRM in your basin, you will probably face difficulties and challenges. Conflicts of interest and opinions among stakeholders may make coordination extremely difficult. In order to overcome such situations, you need a set of 'keys' to advance IWRM in your basin. Knowing which kinds of 'keys' have been used in other basins will allow you to create a 'key' suitable for your situation.

These Guidelines provide you with the necessary information to help you implement IWRM under your own circumstances. They consist of the fundamental concepts of IWRM as well as perspectives of various stakeholders with regard to water issues, keys for success for overcoming problems, and good examples where such keys for success were applied. IWRM cannot be accomplished in isolation. Think of IWRM as a user-friendly and cooperative approach that is an alternative to the previous activities of individual water using sectors acting in their own interests, with very little interaction with one another. The Guidelines invite each sector to fruitful participation and cooperation in IWRM, with a practical road map so as to contribute to achieving both private and public benefits in a sustainable manner.

IWRM is a process that evolves continuously over time – principles change, as do technologies and procedures. You cannot do everything at once. Set goals that are achievable within the given timeframe, and start with what you have. Enhance your IWRM expertise by revisiting your experience in the light of the keys for success presented in these Guidelines. Convey your knowledge and wisdom to other practitioners as well as to younger generations. If you face challenging situations in the frontline of the IWRM implementation, refer to these Guidelines once again, and find your own Key for Success.

Co-Chairs of the Steering Committee  
IWRM Guidelines at River Basin Level  
Eugene Z. Stakhiv  
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## ACKNOWLEDGEMENTS

The Guidelines have been written as a contribution to the World Water Assessment Programme (WWAP), presently launching the third United Nations World Water Development Report (WWDR–3). Many individuals and organizations from around the world have contributed to the Guidelines. We would like to thank in particular the Japanese Ministry of Land, Infrastructure, Transport and Tourism, and the Japan Water Agency for their substantial contributions to the project. The Guidelines are a work in progress, and will be up-dated continuously so as to increase and retain its utility for all users.

UNESCO acknowledges that GWP/INBO is also producing an IWRM handbook focused on basins. UNESCO and GWP/INBO have been actively coordinating their efforts so that the Guidelines and the GWP/INBO handbook complement each other. The Handbook highlights the creation of an ‘enabling’ institutional framework that promotes key IWRM principles through policy guidance, legislation and a well-functioning regulatory framework. These Guidelines, on the other hand, describe an approach to introducing IWRM at the river basin level that begins with implementing currently available measures in the context of existing institutions and resources, and as capacity grows, evolving towards a fully integrated approach towards the provision of multi-sectoral water services.

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The Guidelines can be downloaded from the UNESCO website (<http://www.unesco.org/water/>)

## STRUCTURE OF THE GUIDELINES

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The Guidelines consist of two parts.

**Part 1** deals with the **Overarching Principles of IWRM at River Basin Level**.

**Part 2** deals with **practical examples intended for use by practitioners of IWRM**.

Part 1 provides basic principles of IWRM mainly targeting policy-makers, and explains the benefits of IWRM at river basin level and the need to promote it at the policy level. It also proposes a spiral model of IWRM, which illustrates the evolving and dynamic nature of the IWRM process.

Part 2 consists of three sub-parts:

- Part 2-1 The Guidelines for IWRM Coordination
- Part 2-2 The Guidelines for Flood Management
- Part 2-3 Invitation to IWRM for Irrigation Practitioners

Part 2-1 and Part 2-2 are compiled from the point of view of comprehensive coordination of IWRM at the basin level. Part 2-3 is prepared from the perspective of irrigation practitioners as representatives of water users. This document invites them to actively participate in IWRM. Hence, the document is entitled 'Invitation to IWRM'.

Two main features of the Guidelines are the Sector Perspectives and the 'Key for Success'. Sector Perspectives provide insights on what individual sectors are typically thinking. What is described in this section may not be complete, but the important thing is to know how other sectors perceive water management and how they are related to IWRM.

The core of Part 2 is the keys for success, which can be used in practice to help IWRM succeed at the basin level. Some of the keys for success are extracted from good examples of IWRM implementation in several different river basins worldwide.

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# I. Introduction

## KEY MESSAGES

- Water is important for sustainable development (I.1)
- IWRM at the river basin level is a process that leads to water security and helps mitigate water-related risks (I.1)

## I.1 BACKGROUND

### Water is important for development

Sound management of water resources is fundamental for sustainable development. Good water cycle management is vital for growth, social and economic development, poverty reduction and equity – all of which are essential to the achievement of the Millennium Development Goals.

### The emerging concept of IWRM

Integrated Water Resources Management (IWRM) emerged around the 1980s in response to increasing pressures on water resources from competition amongst various users for a limited resource, the recognition of ecosystem requirements, pollution and the risk of declining water availability due to climate change. A central

goal of IWRM at the river basin level is to achieve water security<sup>(1)</sup> for all purposes, as well as manage risks while responding to, and mitigating, disasters. The path towards water security requires resolving trade-offs to maintain a proper balance between meeting various sectors' needs, and establishing adaptable governance mechanisms to cope with evolving environmental, economical and social circumstances. IWRM strives for effective and reliable delivery of water services by coordinating and balancing the various water-using sectors – this is an important part of sustainable water management. As water is mainly managed locally, the river basin approach is recognized as a comprehensive process for managing water resources in a more sustainable manner. However, well-developed, well-tested, scientifically robust, socially accept-

1. Further definitions of 'water security':

(1) 'water security' is the reliable availability of an acceptable quantity and quality of water for production, livelihoods and health, coupled with an acceptable level of risk to society of unpredictable water-related impacts.' (Mexico City, 2006. Water for Growth and Development. A Theme Document of the 4th World Water Forum, World Bank).

(2) Water security is the capacity to provide sufficient and sustainable quantity and quality of water for all types of water services and protect society and the environment from water-related disasters. (Tunis, 28 January, 2008, African Ministers' Council on Water (AMCOW) and the African Development Bank (AfDB).

able and economically viable approaches to implement IWRM at the river basin level are still not widely available.

### The relationship between Integrated Water Resource Management (IWRM) and Integrated River Basin Management

The term ‘Integrated River Basin Management’, as used in these Guidelines, is referred to in the context of implementing IWRM for the provision of water services at the river basin level. IWRM is defined by the Global Water Partnership (GWP) as ‘a process which promotes the coordinated development and the management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems’. It is a holistic approach that seeks to integrate the management of the physical environment within that of the broader socio-economic and political framework. The river basin approach seeks to focus on implementing IWRM principles on the basis of better coordination amongst operating and water management entities within a river basin, with a focus on allocating and delivering reliable water-dependent services in an equitable manner.

### Purpose of these Guidelines

The purpose of developing these Guidelines is to facilitate the practical implementation of IWRM at the river basin level, relying on available resources – by making the existing system work more effectively. These Guidelines will also help raise international awareness of IWRM.

## 1.2 STATUS OF IWRM IMPLEMENTATION

### History of IWRM

An early example of an integrated approach took place in the 1930s in the United States of America (USA), with the development of comprehensive watershed plans for natural resource usage (e.g. Tennessee Valley Authority). Since then, the UN and other international organizations have developed different forms of integration under the IWRM concept, which has evolved over the decades. IWRM has remained an important concept for water management since the Agenda 21 process of the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992. Its profile has been raised through more recent global pronouncements such as the World Summit on Sustainable Development (WSSD) in 2002, where the target to ‘develop integrated water resources management (IWRM) and water efficiency plans by 2005, through actions at all levels’ was agreed through the Johannesburg Plan of Implementation (JPOI) with support to developing countries.

### Status of IWRM implementation

Experience in various countries has shown that IWRM is an essential prerequisite for effectively coordinating water development strategies across diverse sectors, political jurisdictions and geographical regions within a river basin. However, progress towards implementing IWRM in developed and developing countries has varied widely. According to a recent UN-Water Status Report <sup>(2)</sup>, lack of progress is characteristically associated

2. Status Report on Integrated Water Resources Management and Water Efficiency Plans (CSD 16), UN-Water 2008.



with the need to improve public awareness amongst the hierarchy of political jurisdictions and overlapping management institutions. In developing countries, progress can be hindered by additional obstacles related to the region, such as technical capacity, political will and understanding of IWRM concepts and implementation. The Status Report also revealed the existence of diverse interpretations among countries of IWRM planning and management processes and their frameworks. These differences may even exist within one country or between different stretches or sub-basins of the same river.

### **Global enhancement of IWRM at the river basin level**

UNESCO's International Hydrological Programme (UNESCO-IHP) declared in its latest programme report that there is a need for an instruction manual that synthesizes practical methodologies for Integrated River Basin Management to help implement IWRM. The application of IWRM principles at the river basin, watershed, lake basin or aquifer scales of management is also increasingly accepted worldwide as the way to overcome

the considerable challenges in implementing IWRM. Although an 'enabling' institutional infrastructure is a desirable prerequisite for implementing IWRM, it is not enough for the practical execution of effective water management – that is, for the efficient and reliable delivery of water-dependent services such as hydropower, municipal and industrial water supply and irrigated agriculture, or even environmental flows and flood damage reduction. It is at the river basin scale that cooperation schemes, wide-ranging efforts such as coordination, collaboration and joint action are currently implemented. In some cases, cooperation has resulted in the establishment of standing institutional structures through which governments can interact regularly. However, institutional arrangements to facilitate a fully implemented IWRM approach at a basin level have not emerged, primarily because the concept is complex and requires a very high level of commitment and follow-through. Tools for IWRM need to be documented in the context of the existing and emerging human capacity in basins, taking into consideration whether river basin organizations are involved in the formal coordination processes.

## 2. Benefits of Integrated Water Resources Management at the River Basin Level

### KEY MESSAGES

- The river basin is an appropriate unit for integrated management (2.1)
- IWRM can effectively deliver a triple bottom line of economic efficiency, social equity and environmental sustainability that are essential for sustainable development (2.1)
- Applying IWRM enables appropriate inclusion of water-related disaster management and alleviation of environmental impacts (2.1)
- The importance of water should be recognized at the highest level of decision-making as well as at the basin level (2.2)
- Each sector benefits by participating in IWRM (2.3)
- IWRM is the foundation for progressing adaptation to climate change (2.1)

### 2.1 THE RIVER BASIN AS AN APPROPRIATE UNIT FOR INTEGRATED MANAGEMENT

A basin-level perspective enables integration of downstream and upstream issues, quantity and quality, surface water and groundwater, and land use and water resources in a practical manner.

Water is recognized as essential for social, economic and environmental development. Management within a basin unit enables the integration of all-important environmental and socio-economic issues into evolving management plans and complementary

regulatory decisions. A basin-level perspective, defined by geographical and hydrological characteristics, facilitates the practical integration of downstream and upstream as well as basin-wide issues, and the incorporation of quantity and quality aspects of the basin's available surface and groundwater resources. Cumulative land-uses in a river basin, such as urban development, agriculture and forest conservation, can have profound impacts on water resources in the basin and vice versa. A basin-level perspective allows water managers to address the linkages between water resources management and the management of land and other related resources

effectively. Sustainable development should reflect national development objectives and plans, as well as those of local governmental units and management agencies. IWRM provides the institutional and intellectual infrastructure that allows the numerous competing goals and objectives to be coordinated and administered in a coherent and uniform manner.

### **Benefits for adaptation to climate change**

A basin level perspective also becomes increasingly important in addressing global and local change issues, particularly as climate change impacts are realized through the response of the hydrological cycle, in terms of quality and quantity with direct impacts on the basin. Such changes may include increases in the number and severity of floods and droughts over current seasonal patterns. Climate change is the supply-side driver, which ultimately determines how much water is available, when and where – and ultimately how much we can use. It can lower environmental flows in rivers, affecting water availability, quality and other water functions such as sanitation, hydropower and navigation. Climate change may not always be perceived as the fundamental water challenge in every region, but it may exacerbate existing management challenges. In order to reasonably mitigate these anticipated climate impacts, it is even more essential to coordinate a variety of existing water management practices in a basin across all relevant sectors, and optimize operation of water infrastructure consistent with sustainable development goals and availability of water. Accordingly, IWRM at the river basin level is the foundation upon which the implementation of adaptation strategies, based on a sequence of climate change projections, and impact assessments can be realized.

### **Integrated management of water resources, disasters and environmental issues**

The management of water-related disasters such as floods and droughts, including proper risk management, should not be considered in isolation, and should comprise an essential part of IWRM. Managing the extremes in the hydrologic cycle comprises the essence of water resources management, as these events can have severe social and economic consequences on development. Improved management of extremes can produce high rates of return in terms of GDP (Gross Domestic Product), maintaining economic growth and social cohesion.

Proper management of water resources offers increased flexibility in facilitating and supporting natural ecological functions and human activities by improving the resilience and robustness of those systems under a variety of stresses, including climate change. The seasonal and annual variability in quality and quantity of water that supports these diverse functions can be estimated through monitoring, analysis and assessment, thereafter incorporated into planning and operations. For example, operating rules for dams controlling storage facilities for flood control, municipal water supply and hydropower can be periodically modified to maximize their utility, while at the same time ensuring environmental flows. Thus, IWRM applied at the river basin level enables appropriate inclusion of water-related disaster and risk management as well as alleviating potential environmental impacts.

## 2.2 INTERACTIONS BETWEEN THE RIVER BASIN APPROACH AND DIFFERENT ADMINISTRATIVE LEVELS

### Multiple objective water management

Food security, gender, health, environment, industry and many other objectives are closely related to sound water resources management. Water managers, especially those in developing nations, constantly face the question of how these challenges of providing for diverse and competing needs, in the face of increasing scarcity and climate variability, can be successfully addressed in a socially acceptable and economically-efficient manner, within the resource constraints of their respective systems. Consultation with stakeholders on their needs and objectives is a necessary and continuous process. Maintaining this ongoing public consultative process is a fundamental aspect of the evolution of the IWRM process as proposed in these Guidelines. The public participation process reinforces the acceptability of IWRM as the foundation approach to water management that can create ownership and resolution of issues among all stakeholders.

### Need for awareness at the highest levels

Currently, not all nations devote the requisite attention to ‘governance’ of water-related issues at national levels and link their national strategies to planning and management of water resources at a basin scale. Therefore, the importance of water resources for development and management at a basin level should be recognized at the highest national, regional and local levels. Where the river basin has one or

more international borders, providing acceptable trade-offs among competing management objectives from a neutral viewpoint becomes an increasingly time-consuming challenge.

### Responsibilities and roles of different administrative levels and functions

Ideally, the implementation of water resources management and basin level planning should be linked to national strategies and policies that explicitly link the various levels of governmental and private sector decision-making. Basin level water resources management should coincide with a national ‘vision’ and principles for sustainable development, but also reflect basin-specific issues in its management plans and implementation, involving basin-wide stakeholders in an appropriate manner.

A key aspect of IWRM requires that the national government(s) create an enabling environment, including a legal framework, to facilitate a multi-sectoral coordinated basin-level approach. Thus, there will need to be linkages and coordination amongst the national, regional, local and basin levels. The responsibilities of the different levels of administration and relevant stakeholders and their relationships and roles within the river basin management need to be clearly defined. A well-drawn relationship diagram provides a foundation to maximize each party’s potential role, generate a synergistic effect, enable a flexible approach and improve efficiency in every aspect of water resource management. The principle of ‘subsidiarity’, however, requires that the implementation of projects and operation of water functions need to be the responsibility of the appropriate institution or organization in the basin, which

is empowered to manage the tasks and has the authority to influence policy, keeping in mind that the basin is the appropriate frame of reference for water resources management. In fact, few nations have established an 'ideal' vertical IWRM hierarchy where national policies and management strategies are fully developed and coordinated for all aspects of water management at all levels of government. The principles of IWRM can be implemented at virtually any entry point in the vertical water management hierarchy, consistent with the principles of 'subsidiarity'. These Guidelines fundamentally advocate that the ideal of a perfect IWRM system does not exist – it is difficult to implement – yet needs to be initiated with whatever resources are available and whatever institutional framework exists. Sound water management improves imperfect policies and makes them work better to deliver vital services.

## **2.3 ALL SECTORS BENEFIT FROM IWRM AT THE RIVER BASIN LEVEL**

### **Why participate in an IWRM process?**

Awareness of IWRM is partly the result of the realization that, until the 1990s – and still today in some countries – infrequent interaction between individual sectoral activities, such as agricultural irrigation, flood control, hydropower, etc., resulted in sectors having little effective coordination. Another failing of such a fragmented approach was the insufficient focus on national sustainable development as well as IWRM. The first step on the path to integration requires that each sector has access to all the compiled basin data, updated information, as well as the ability of avoiding unexpected risks caused by uncoordinated internal and/or external sector activities. Moreover, the processes inherent in achieving basin sustainability need to be undertaken through a series of urgent actions, coupled with flexible measures and mutual coordination, along with stakeholder participation.

## 3. IWRM is an Evolutionary Process at the River Basin Level

### KEY MESSAGES

- IWRM is an iterative, evolutionary and adaptive process, conceptualized as a ‘spiral’, which permits immediate action, builds understanding, develops local capacity and creates ownership (3.1)
- Reassessment of basin hydrology improves understanding of a changing water cycle (3.2)
- Drivers of change at the basin level should be recognized and prioritized for adaptation (3.3)
- Reassessment for adaptation to changes can be an opportunity to consider and address special drivers such as climate, land-use changes and the agricultural footprint in the evolving IWRM process (3.4 to 3.6)

### 3.1 THE SPIRAL MODEL FOR CONCEPTUALIZING THE EVOLUTIONARY IWRM PROCESS

#### The conceptual spiral model of IWRM planning

The evolutionary, adaptive implementation of the IWRM process presented in these Guidelines is illustrated by a ‘spiral model’. In this model, water resources development in a basin, along with management principles and objectives, evolves over time, as new demands and needs emerge, and innovative solutions are added at each stage. A

river basin continuously adapts to those demands as part of an orderly IWRM process. This is facilitated by agreements among basin stakeholders on the necessary trade-offs at each turn of the evolutionary water management spiral. The ‘spiral model’ (See Fig. 3.1) is a convenient graphical conceptualization of the iterative, evolutionary adaptive management process, adjusting to new needs, circumstances and societal goals. The spiral evolutionary model reflects progressive positive changes in historical water resources development and management and offers the following advantages:

- It allows IWRM actions to be started at any point of the evolutionary process.
- It builds capacity over time.
- It promotes cooperation and integration.
- It promotes the pursuit of better solutions that adapt to changing circumstances and values.
- It facilitates consensus building and stakeholder ownership at each 'turn of the spiral'.
- It illustrates IWRM as an incremental, step-by-step process, and therefore provides a practical framework for looking ahead and planning for successive 'turns of the spiral'.

IWRM at the river basin level seeks improvements in existing and conventional approaches to water resources management leading towards the ultimate goal of sustainable development. There are certain evolutionary development processes that are characteristic of every river basin – moving from a focus on economic development to community safety and environmental protection, and to reliable delivery of services and integrated resource management. Every major flood, drought or failure of an infrastructure system designed to provide a certain level of safety and reliability of services, serves as an opportunity to introduce new policies, programmes, projects and technologies that are more compatible with IWRM for sustainable development. This may be in the form of introducing a new watershed management unit; an equitable water allocation agreement that includes provisions for environmental flows; or a drought contingency management process.

In fact there are two inter-twined spirals – almost equivalent to a 'double helix': one representing the historical evolution of water resources development in a basin, and the other reflecting the specific point in the spiral in which new planning processes are insti-

tuted to represent updated IWRM principles. The planning process, also linked to the 'spiral', requires several stages over time to achieve one full circle of the IWRM planning and implementation system. This spiral planning process begins with 'Recognizing/Identifying' pressing issues or needs, then 'Conceptualizing' the problem itself and formulating possible solutions, 'Coordination and Planning' among stakeholders in order to reach an agreement, and 'Implementing/Monitoring/Evaluating' the plan and its outcomes. The iterative process then begins again with 'Recognizing/Identifying' at the next stage of evolution, incorporating ever-changing ideas, values and technologies, thereby responding to new needs.

Every basin has a similar evolutionary spiral, some, like those of the Nile, Tigris and Euphrates, stretch back over thousands of years. Water resources development and management is among civilization's oldest publicly-managed enterprises, and in many instances served as the 'governance' model around

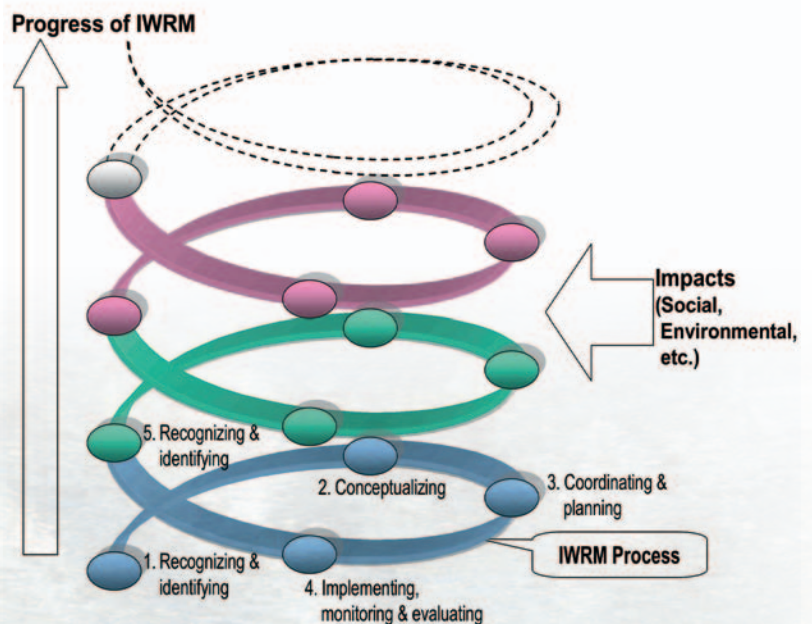


Fig. 3.1 IWRM Spiral and Process

which other public service activities were conducted. Delivery of reliable water supply to irrigated agriculture was a priority service of ancient civilizations. It is only over the past thirty years that the principles of water management have been adapted to respond to increased societal awareness about the environment, and cultural (e.g. the role of women in water management) and socio-economic changes, in other words, the fundament of sustainable development. IWRM is the management framework by which those goals associated with sustainable development can be attained.

### Stages of IWRM spiral planning

The first stage of the ‘spiral’ begins with ‘Recognizing/Identifying’ a need to adopt IWRM. At this stage it is important to grasp the overall picture of the basin and start with already compiled information. The second stage would commence as a result of reviewing the current IWRM system or realizing demand for completely new IWRM. Advanced stages tend to require more complex or broader coordination in accordance with the growing concerns of stakeholders, socio-economic needs and priorities.

### Moving up the spiral

Shifts upwards on the spiral represent periods when a need for renewal or revision of IWRM has been ‘identified’. Water managers should therefore remain alert to the evolving IWRM need to respond to changes in a basin. Changes in a basin may include economic growth, changing social values and demand, and unexpected crises, all of which would act as catalysts highlighting the necessity of developing or revising water resources management. Such changes should be considered as a driving force for better water resources management and a valuable opportunity to

enhance IWRM. Consensus building is time-consuming but is facilitated by making an early start on the requisite actions. Information on similar cases in diverse areas may help foresee necessary changes and demands on IWRM.

### Where does a basin stand on the spiral?

An important aspect of the spiral planning model is understanding where the basin is situated on the spiral. What phase are the actors in? Are they in the phase of ‘recognizing’ changes or ‘conceptualizing’? How many stages have already been accomplished in the IWRM spiral? It is recommended that water managers analyse the situation of their basin to establish approximately its current position in the spiral before undertaking any action. Part 2 of these Guidelines is designed to cover most stages, phases and steps by providing examples from a number of basins. Any basin management can therefore restart its own IWRM by orienting itself to the nearest position in the ‘spiral’, which then has direct links to useful advice for the next step. If there seem not to be similar conditions or appropriate solutions, it is recommended that users refer back to earlier sections of the Guidelines.

## 3.2 REASSESSMENT OF BASIN HYDROLOGY

Adapting management plans designed to respond to changes at river basin level requires a sound understanding of the present hydrological cycle, and the range of human activities affected by and affecting the hydrological cycle, and the cultures dependent on the resources of the basin. The internal hydrology of a basin can be reassessed for water quantity, quality, and reliability, social change, water demand and the state of the ecosystems, and the relation between the



responses to external drivers. Reassessment also involves reviewing current capacity to mitigate or adapt to changes including climate change. Review of the potential capacity of a basin can include a review of historical data and information as well as traditional knowledge. All local stakeholders should be involved in the process. This reassessment provides an opportunity to address other issues that should be involved in the entire process of IWRM.

### 3.3 ADAPTING MANAGEMENT PLANS TO CHANGES

#### Drivers of change

Water resource systems are directly and indirectly affected by the interaction of numerous human related drivers of economic, social, and demographic functions such as:

- Governance (institution, legal framework, decentralization).
- Demography (population growth, gender, migration, urbanization).
- Land use (agriculture, urbanization, deforestation, pavement).
- Economy (industrialization, globalization, food and fuel crises).
- Social conditions (education, culture, poverty).
- Technology (water use technologies, information technology, energy transformation technology).
- Climate change and variability.

Water managers should understand how different drivers of change affect the hydrology and the related water demands and functions to the inhabitants in the basin. Prioritizing adaptation responses to those changes is a key component of the IWRM process at the river basin level.

### 3.4 CLIMATE CHANGE AS AN UNCERTAIN DRIVER

Evidence of changes in the hydrological cycle is becoming increasingly apparent, and with progressing climate change the hydrological cycle is expected to intensify over the coming decades, according to computer model predictions. However, while there is more confidence in predicting changes in mean temperature and precipitation, the hydrologic extremes – that is, floods and droughts, are highly uncertain. Thus, it is important to consider appropriate adaptation measures to ensure sustainable water security for social, economic and environmental needs. However, new measures to mitigate and adapt to the impacts of climate change cannot be identified without first assessing the vulnerability of existing water management and water functions. Climate change is expected to impact the quantity and quality of water resources, but will also have an impact on water use. Thus, water management and efficiency of use must be improved in response to new risks created by the impacts of climate change. Setting up a viable IWRM framework is both necessary for current water management and as a platform for adapting to climate change.

There is a need to improve understanding on how climate change affects the hydrological cycle and the availability of water resources. Utilization of recent modeling and information technologies are essential in this respect. Improvement of observation and measurement networks will be essential in many river basins. In decision-making, integrated appraisals of adaptation and mitigation options across multiple water-dependent sectors are central. Cooperation should be promoted in the development of effective early-warning systems for water-related disaster prevention and mitigation

to reduce the negative impacts of climate change on economic development, food security and poverty eradication efforts. It is equally essential to raise awareness of public concerns about water use and availability, with clear relevance of climate change and other external forces, reminding them of the necessity and limitations of water resource for human existence in accessible ways such as through media, education and participatory processes.

### **3.5 ADDRESSING URBANIZATION AND LAND-USE CHANGE**

Inappropriate land management practices developed over the years are now adversely affecting the land, water and ecological resources of many basins. Some river basins have been dramatically modified due to human disturbances such as agriculture, grazing, deforestation and urbanization. These disturbances affect the amount and quality of water in river basins around the world. The development plan for a river basin must also account for expected changes in the future in terms of basin activities and their respective water requirements, and devise ways to militate against the adverse impacts of such changes.

### **Quantifying water response to land-use changes**

It will become vital to account for accelerated urbanization and changes in land use as the population increases (due to changes in demographics and social and economic activities within the basin) and their impact on the river basin management. They will result in changes in runoff patterns, water use patterns and water quality. Excessive urbanization and population growth will also constrain options for water management, such as limiting land available for water controlling facilities. Such changes can increase flood risks, reduce freshwater ecosystems, reduce river flow, deplete springs, and aggravate water quality or ground subsidence due to over-abstraction. Disaster management requires coordination of housing and urban policy with the water sector.

### **3.6 RECOGNIZING THE EVOLVING ROLE OF AGRICULTURE**

Agriculture is often the dominant water user in many basins. It has assumed an increasingly multi-disciplinary dimension, associated as it is with increasing demands for improved water quality and quantity, rising productivity and demand for food and biofuels driven by population growth, urbanization, and the energy crisis. Agriculture poses a continuing and growing threat of increased environmental pollution. Footprint concepts such as that of 'Virtual Water' by Anthony Allan can help describe how agricultural water management

## 4. The Implementation Process

### KEY MESSAGES

- Embark on IWRM whether the institutional processes are well-developed or not (4.1)
- Recognize water is managed by many agencies, organizations and individuals (4.2)
- Access to actors outside the water box is essential to move political will, sectoral support and public pressure for IWRM implementation (4.2)
- Upgrading new technologies is vital for effective performance (4.2)
- Water resources development coordinated among various sectors and users is facilitated by preparation of a master plan that reflects the individual sector plans and offers the most effective and efficient utilization of the resource (4.2)
- Although not essential to begin the IWRM process, river basin organizations do provide a good institutional mechanism for moving forward (4.3)
- The application of IWRM by basin organizations varies according to each river basin's specific conditions and requirements (4.3)

### 4.1. EMBARKING ON IWRM IN A BASIN

A country's need for water resource management varies according to its characteristics – its geography, climate, size, population, political and cultural systems, level of development, and the nature of its water resource problems. Within a country or a river basin, different areas have diverse water problems and challenges. Each country and river basin must chart its own vision and plans based on its unique situation. A fully integrated approach to managing water in a basin may

not be immediately possible. However, this does not prevent embarking on IWRM at the basin level whether the process is well developed or not.

Various water-related sectors or users should be considered in a well coordinated manner, highlighting the interactions among them, their activities and associated infrastructure. Constructing infrastructure that can meet the demands of multiple sectors while ensuring water for irrigation and ecosystem functioning as well as preventing

negative impacts of floods can be given as examples of an integrated approach. Basin activities, such as development or land use, that may impact water resources and the hydrological characteristics in the basin must also be considered, while taking into account the social and cultural implications of the river for the population residing in the basin. Part of an IWRM approach is to characterize the present situation and use this and other information to anticipate future changes.

## 4.2. IMPORTANT CONDITIONS

The conditions listed below are important, but are not a set of necessary prerequisites for implementing IWRM. IWRM aims to create sustainable water security within the present constraints and through improving conditions incrementally in each basin. Water managers should seek and recognize which conditions are essential to effective management, which cannot be readily instituted, and which can be developed wholly or partially over time to progressively move up the spiral.

- Political will and commitment.
- Basin management plan and clear vision.
- Participation and coordination mechanisms, fostering information sharing and exchange.
- Capacity development.
- Well-defined flexible and enforceable legal frameworks and regulation.
- Water allocation plans.
- Adequate investment, financial stability and sustainable cost recovery.
- Good knowledge of natural resources present in the basin.
- Comprehensive monitoring and evaluation.

### a. Political will and commitment

Political will at all levels can help to unite all stakeholders and move the process forward. It is needed especially if the resulting plan or arrangement would create or require changes in legal and institutional structures, or if controversies and conflicts among stakeholders exist. Generally a high level of political commitment exists to varying degrees outside of the water sector, but water managers should understand that decision makers at these levels drive comprehensive water management over time. Political will is a potential engine of public awareness. However, there is a feedback process, as strong political will is also often motivated by public pressure to address high-profile issues. Water managers should focus on promoting correct understanding of the importance of water and the necessity for IWRM when dealing with the public, press, governments and politicians.

### b. Basin management plan and clear vision

IWRM at the river basin level is generally a long-term process working towards a basin development plan as illustrated in the 'spiral model'. A clear vision should specify the area as well as the level of safety to ensure concrete project execution. The services, expected benefits and effects of each project should be clearly presented as a consequence of satisfied participants' agreements and the appropriate balance of related sectors. Periodic reviews of progress are important to consider changes in national objectives and other plans managed by sectors not directly related to water issues.

### c. Participation and coordination mechanisms, fostering information-sharing and exchange

Identify and involve stakeholders:  
Sustainable basin management, from plan-

ning to implementation and operations, requires well-coordinated mechanisms and frameworks for participation of different stakeholders, sectors and levels of administration. Stakeholder involvement can be defined appropriately for local conditions and improved gradually, for example by setting up a committee, public hearings and workshops in the spiral process of applying IWRM at the river basin level. Stakeholder's participation and its improvement requires assistance from various people representing different sectors. Those who are most likely to be affected should be involved when moving up the spiral to the next step. The identification of key stakeholders can be facilitated through interviews and meetings.

#### **Self-sustaining system:**

Sustained relationships among stakeholders assure successful IWRM. Initial sharing of general basin-wide data and information, and further sharing of more specific information regarding proposed projects, programmes and policies, will assist basin partners to more readily develop trust and respect for one another. Local communities have a wealth of historical hydrological knowledge and information. Thus, relevant stakeholders can collaborate in the sharing of reliable information, mutual satisfaction of their needs, and to promote collaborative efforts to resolve basin issues.

#### **d. Capacity development**

Water resource management requires a minimal level of capacity at all levels, including that of decentralized local governments. Functional community-level capacity builds resilience to hazards, and facilitates the use of knowledge and technologies, innovation and education, thereby creating a culture of safety and resilience at all levels. Local capacity development and training priorities should be expressed as a regional agenda,

to enable many partners to buy in along the research-to-development continuum, and to form collaborations where consortia, alliances, networks, and individual organizations may all find their place to both fund and benefit from it. Regional training priorities are best expressed in terms of problems of water functions that need to be addressed locally but regional synergies are possible.

Development of a community's ability to function in participatory processes is also an important part of capacity development. Consensus-building should be based on dialogue amongst stakeholders. Participants who may be adversely impacted and/or socially marginalized may be stimulated to participate within a consensus-building strategy. Jargon free terminology should be used to facilitate comprehension by important stakeholders outside the water sector. Thus, each stakeholder group would have a comprehensive vision of basin issues.

#### **e. Well-defined flexible and enforceable legal and regulatory frameworks**

To apply IWRM, it is necessary to assemble and review the full range of existing laws and regulations that apply to water-related activities and determine how existing legislation adapts or can be better adapted to accommodate sustainability and integration with regard to water resources management. The development of legal and regulatory frameworks provides the best method for proactively addressing potential issues in implementing projects over time. Water legislation can clarify the entitlement and responsibilities of stakeholders and ensure sustainable use of the resource by presenting a balanced approach between resource development for socio-economic purposes, and the protection of water quality, ecosystems and other public welfare benefits. In the

early stages this can be adequately achieved through water resources agencies, but with good coordination and linkages to other relevant agencies, including those at the national level. Ideally, one agency should be responsible for facilitating this process. This most often requires a paradigm shift in mindset, behaviour, and organizational design: from 'development, implementation, control and coordination of the process' towards facilitation of the IWRM process. This is achieved by persuading the organizations and agencies involved in the basin to contribute to IWRM objectives and by convincing decision-makers – in terms they understand – of the validity of their approach so as to gain recognition and the necessary resources.

#### **f. Water allocation plans**

Water is a shared resource among various sectors – including water supply and sanitation, irrigation, industrial sectors, and hydro-power generation – that relate individually to specific economic, social or environmental activities and that depend in whole or in part on water to fulfill their needs and roles. Water resources development coordinated among the various sectors and users is facilitated by the preparation of a master plan reflecting individual sector plans, and offering the most effective and efficient utilization of a basin's resource. Water rights should be flexible in terms of allocation to accommodate changes.

#### **g. Adequate investment, financial stability and sustainable cost recovery**

Coordination for IWRM implementation needs to be financially sustainable. Aside from the development and planning functions, adequate funding is required to improve managerial capacity and support research for technical and best practice advancement and for raising public awareness of water resources management issues through media and education.

Various combinations of government grants, public resources, user charges and taxes, donor funds, and a basin environmental trust fund can be considered as funding options. Many international financing institutions and other major donors have roles to play in encouraging and advocating greater transparency and public participation in regional planning and decision-making on developments, and in commitments to inform the public of their potential impacts.

#### **Cost recovery:**

Sustainable cost recovery should be promoted. It is essential to make the most of available resources, choose the most appropriate projects and carry them out at the lowest possible cost. Funds can be raised through tariffs, transfers, central government support, or in the case of the less wealthy countries, through external aid.

#### **Management and development:**

Many developing countries have struggled to balance management and development of the resource. Long-term management should be considered when conceiving and implementing development of the resources and infrastructure in accordance with those factors relating to finance and stability.

#### **h. Good knowledge of the natural resources in the basin**

Adequate knowledge and information on the water resources inventory and human resources of the basin is desirable. In many basins, however, it may be necessary to embark on developing a water resources management plan with incomplete data and information. Maintaining and accruing sound knowledge of the natural resources in the basin is strongly supported by scientific knowledge and views. Further scientific studies, audits and investigations can be tar-

geted at key areas for greatest improvement in resource management. Water resource managers should therefore include scientists among their resources and strengthen linkages with them throughout their activities.

### **i. Comprehensive monitoring and evaluation**

Monitoring and evaluation are essential for ensuring that the current management of water resources is properly implemented and to identify the needs for adjusting management strategies. Effective monitoring requires accessible data, analytical tools and adequate information. Regular evaluation is necessary. The basic factors which can be used to assess basin sustainability include:

- The health or condition of the natural resources of the basin.
- Changes in the basin.
- The negative phenomena that are occurring or likely to occur and in which parts of the basin.
- The key parameters to respond to global/local changes.
- Indicators to link the assessment findings to the goals.
- Financial operations.
- Economic benefits.
- Internal indicators such as accountability, consultation on the costs of data collection, and budget limitations.
- Such assessment should not only be done internally but in an open and transparent manner, with the findings widely publicized.

Keep water managers updated on the latest technology. Local and central water managers should be updated on the use of current and emerging technologies and models such as:

- Satellite monitoring systems being developed internationally, which aim to provide information for adaptation and mitigation for climate change, reducing damage from disasters caused by nature and human beings, and improving water resource management through better understanding of the water cycle.
- Improvements in rainfall prediction methods connected with run-off models and information technologies. These would be useful in reducing disaster damage in basins affected by frequent flooding.
- The evolving role of communication technologies such as mobile phones, which can be powerful tools for transmitting data.
- Remote control of water storage and delivery systems in the basin. This can enable optimized water supplies in basins affected by water scarcity.
- Developments in scientific models to augment and interpret data in data sparse environments.

## **4.3. RIVER BASIN ORGANIZATIONS**

### **Role of a basin organization**

Although their existence is not essential to begin the IWRM process at the river basin level, river basin organizations provide a good institutional mechanism to facilitate implementation. A major role of basin organizations is basin-wide planning to cater for all users needs for water resources and to provide protection from water-related hazards. Their role involves wide public and stakeholder participation in decision-making, group involvement and empowerment at all levels. Attention should be paid to gender and minority issues, effective demand and bulk water management, agreements on commitments within a basin relating to the

quantity, quality, and efficiency of resource management and mechanisms for monitoring those agreements, and adequate human and financial resources. Basin organizations are successful when they are structured to provide partnership and consultation processes among the members, involving high-level decision-makers and expertise in all aspects of integrated natural resource planning, implementation and management.

#### **Forms of basin organization**

The application of IWRM by basin organizations varies according to each river basin's specific conditions and requirements. Many river basins have set up coordinating bodies to facilitate river basin management. These may take the form of informal committees or authorities with important mandates and authorization. Decentralization and participation of the private sector has opened the way, in some countries, for the adoption of institutional mechanisms based on the concept of integrated management of river basins, through the transfer of responsibilities for the management of the resources from the ministries of the central government to local governments, to autonomous public corporations or to the private sector.

#### **4.4. TRANSBOUNDARY ISSUES**

Potential conflicting interests in transboundary water situations can be overcome through mutual trust and understanding, appropriate legal and institutional frameworks, joint approaches to planning and management, and sharing of the ecological and socio-economic benefits, and related costs. Any basin corporation may face a wide array of challenges depending on its unique situation. The establishment of transboundary cooperation is a complex, long process and requires patience. Approaching transboundary issues may require flexibility in national policies. Nevertheless, the overall water management process at the basin level does not greatly differ. More options, including multi-purpose uses and joint projects, appear when issues and relations between riparian countries and related sectors are treated together. Approaching transboundary issues may require changes in national policies and legislation. Top-down basin-wide approaches based on constructive ambiguity principles are often essential to foster trust and trigger action for cooperation due to the political nature of allocation of transboundary water resources.



# 5. Enhancing performance and accountability

## KEY MESSAGES

- Water managers have a responsibility to inform the public and other stakeholders and conduct self-assessments (5.1)
- Enhancing performance and accountability through regular assessments using performance indicators and benchmarking, reporting and knowledge networks are keys to moving up the spiral to better integrated water resources management (5.1, 5.2, 5.3)
- Performance benchmarking systems and peer review programmes provide pragmatic perspectives for assessment and improvement of basin management performance (5.3).

### 5.1. REPORTING

Basin organizations have the responsibility to report on the status of planning and management, basin inventory and any changes in the basin's water resources to local governments, private sectors, NGOs and other stakeholders. A framework for regular self-assessment should be established. An annual 'state of the basin' report may support the IWRM process and promote public accountability.

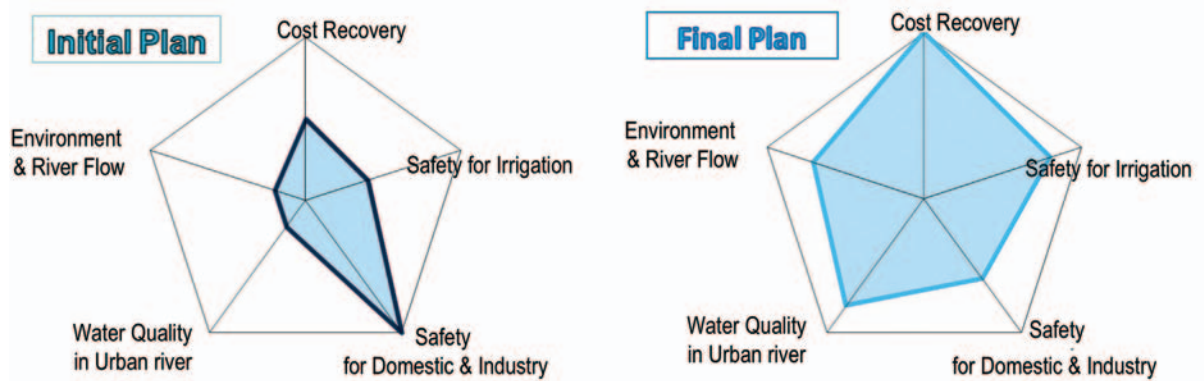
### 5.2. KNOWLEDGE NETWORKS

Exchange of information, good practices and advice among river basins over regional or international networks will mutually benefit river basin organizations. The number of indicators can be gradually increased as more data, information and research become

available. Well-coordinated mechanisms for interactive generation of information and indicators should be set up globally. Development banks and international organizations can contribute by establishing knowledge network mechanisms leading to standardized reporting at the river basin level.

### 5.3. PERFORMANCE INDICATORS AND BENCHMARKING

The establishment of evaluation indicators provides a useful tool for assessing the resources and health of a river basin, monitoring developments, implementation and results as well as identifying challenges. Indicators should also be able to measure stakeholder satisfaction with the management of water resources, and provide a valuable basis from which to assess progress and carry out



■ Fig. 5.1 Assessment tool – Pentagram

analysis of the situation. These indicators must be developed with clear objectives for the natural resource attributes, from the initial stages of management planning, areas of productivity and resource utilization. Performance benchmarking systems and peer review programmes promoted by organizations such as NARBO (Network of Asian River Basin Organizations) can provide useful pragmatic perspectives for assessment and improvement of basin management performance.

#### Pentagram as an assessment tool

Graphical tools such as a pentagram (See Fig. 5.1) can provide an objective comparison of alternative plans. Relative indices to be compared are placed at the end of the axis and the evaluation results are plotted on the axis. The points are then connected to create a pentagram. If there are six indices it will become a hexagram. A better balanced diagram spanning all axes can provide visual indication of a better plan.

### 5.4. ADAPTIVE MANAGEMENT BASED ON ASSESSMENT RESULTS

A pentagram can be used to illustrate a set of decision variables such as the 'triple-bottom line', which assesses economic, social and environmental success as indicators of sustainable development. This enables stakeholders to compare the potential success of proposed plans.

Monitoring and evaluation results can help detect changes and improvements. This can help plan actions to enable basin management to move to the next level of the IWRM spiral. Adaptation to enhance performance and accountability is the key to moving up the spiral towards better-integrated water resources management. This is facilitated through regular assessment using benchmarking, performance indicators, reporting, and knowledge networks.

## 6. Organization of Part 2

### 6.1 FEATURES

Part 2 of the Guidelines is intended for practitioners involved in IWRM coordination and implementation. It can be used as introductory guidance for those who are tackling IWRM for the first time, or as training material for intermediary practitioners and trainers of IWRM. For IWRM experts, it can be used as a reference guide for tackling various issues and problems they face in their IWRM activities.

The modular approach ensures that users do not have to read the entire document. These Guidelines are designed in such way that users can consult only the relevant areas to suit their individual needs. This allows users to easily navigate through the Guidelines and to move to the section that is most relevant for them.

### 6.2 CONTENTS

Part 2-1 is titled 'The Guidelines for IWRM Coordination' and consists of 5 parts, 1) Sectoral Perspectives, 2) Key for Success,

3) IWRM Process, 4) Good Examples, and 5) Useful Tools.

The five elements below are linked in the document as shown in Fig. 6.1.

These elements are linked by reference indices, which allow the user to jump from one section to another in the way most convenient to them. These sections are described below:

#### Chapter 2/Sectoral Perspectives in IWRM

This section illustrates the principles of the actions and interests of water-related sectors in water management and IWRM. Each sector values water and interacts with water differently. This section provides information on how individual water-related sectors tend to think and act, how these sectors typically relate to water management and IWRM, and what they would want to convey to the other sectors.

#### Chapter 3/Key for Success

A 'Key for Success' is a key that can be used

to help make IWRM succeed in practice. It is a key to establishing breakthroughs in challenging situations that might arise, or to opening the door to better IWRM. Many of the keys have been proven in practice. Some are generic, i.e. they apply to all successful examples of IWRM, others may apply only to specific situations, while some may not be in place as yet. It helps to find the key appropriate for the given circumstances in the IWRM process in the basin.

**Chapter 4/IWRM Process**

The ‘IWRM Process’ describes a typical process of IWRM implementation. It first details the conceptual model of the ‘IWRM Spiral’, introduced in this part as an evolving process. This is then followed by a schematic description of the ‘IWRM Process’ and its phases, each linked to a ‘Key for Success’. It helps you to orient yourself through the process and serves as a map for finding directions or locating the ‘key’ to enhance water resources management.

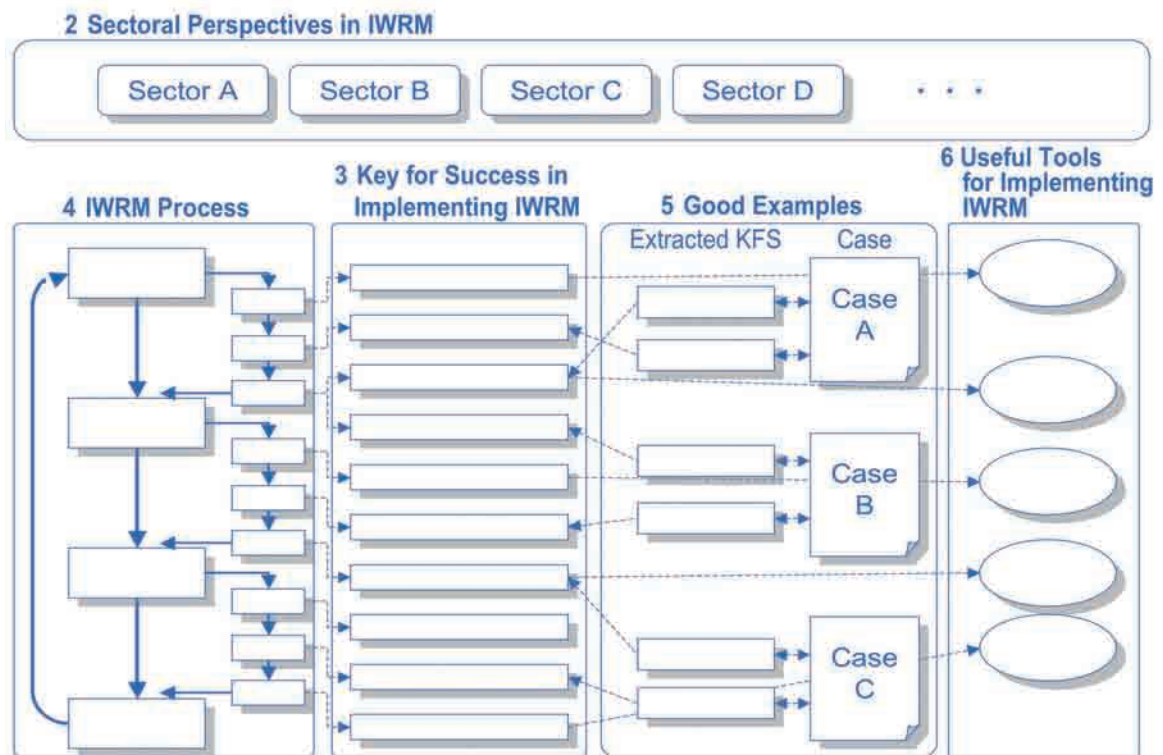
**Chapter 5/Good Examples**

‘Good Examples’ includes best practice examples of IWRM at the river basin level in the form of: 1) case stories illustrating actual IWRM efforts, and 2) ‘Extracted Key for Success’ highlighting elements of success instrumental in enhancing IWRM, based on interviews with local resource persons conducted at the sites.

**Chapter 6/Useful Tools**

‘Useful Tools’ provides useful ideas/information that can be used in the application of keys for success.

Part 2-2, titled ‘The Guidelines for Flood Management’ has the same structure as Part 2-1, while Part 2-3, titled ‘Invitation to IWRM for Irrigation Practitioners’ consists of three separate parts: 1) Sectoral Perspectives, 2) Key for Success, and 3) IWRM Process.



**Fig. 6.1 Structure of Part2-1 ‘The Guidelines for IWRM Coordination’**

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