TAC BACKGROUND PAPERS NO. 4

Integrated Water Resources Management

Global Water Partnership
Technical Advisory Committee (TAC)

Previously published papers in the TAC Background Papers Series:

- No 1: “Regulation and Private participation in the Water and Sanitation Sector” by Judith A. Rees (1998)
- No 2: “Water as a Social and Economic Good: how to Put the Principle into Practice” by Peter Rogers, Ramesh Bhatia and Annette Huber (1998)
- No 3: “The Dublin Principles for Water as Reflected in a Comparative Assessment of Institutional and Legal Arrangements for Integrated Water Resources Management” by Miguel Solanes and Fernando Gonzales-Villarreal (1999)

This paper is printed on swan-marked paper.

The Nordic swan mark guides consumers to the most environmentally sound products. To acquire the swan symbol, producers must adhere to strict guidelines which are revised on an ongoing basis. This paper was produced according to these guidelines.

Integrated Water Resources Management

Printed in Denmark.
First printing, March 2000.

ISSN: 1403-5324

ISBN: 91-630-9229-8

TAC BACKGROUND PAPERS NO. 4

Integrated Water Resources Management

The following members of TAC since its inception in 1996 are authors of this paper:

Anil Agarwal, India
Marian S. delos Angeles, Philippines
Ramesh Bhatia, India
Ivan Chéret, France
Sonia Davila-Poblete, Bolivia
Malin Falkenmark, Sweden
Fernando Gonzalez Villarreal, Mexico
Torkil Jønch-Clausen, Denmark (TAC Chair)
Mohammed Aït Kadi, Morocco
Janusz Kindler, Poland
Judith Rees, United Kingdom
Paul Roberts, South Africa
Peter Rogers, USA
Miguel Solanes, Argentina
Albert Wright, Ghana

Published by the Global Water Partnership

Preface and acknowledgement

After three years of operation beginning in 1996 the Technical Advisory Committee (TAC) of Global Water Partnership (GWP) felt there was a need for a clarification and formulation of certain principles and recommendations within integrated water resources management – serving a general purpose of contributing to the implementation of IWRM, but also an internal purpose of establishing a common understanding within GWP and TAC. The present paper represents the "corporate view" of TAC on integrated water resources management and has been authored by all members of TAC in the period 1996 through 1999.

The paper is the sole responsibility of TAC, but it has been developed in a joint process involving TAC members, Regional TAC Chairs, professional TAC-support staff at DHI Water and Environment and GWP Secretariat staff. Based on TAC's deliberations on the subject over its course of time, Mr. Henrik Larsen, DHI Water and Environment, provided a first draft and has functioned as the chief editor of the paper. The contribution of all who participated in this process is gratefully acknowledged.

CONTENTS

1. INTRODUCTION

Challenges require IWRM; Challenges faced by more and more countries in their struggle for economic and social development are increasingly related to water. Water shortages, quality deterioration and flood impacts are among the problems which require greater attention and action. Integrated Water Resources Management (IWRM) is a process which can assist countries in their endeavour to deal with water issues in a cost-effective and sustainable way. The concept of IWRM has attracted particular attention following the international conferences on water and environmental issues in Dublin and Rio de Janeiro held during 1992; *however* IWRM has neither been unambiguously defined nor has the question of how it is to be implemented been fully addressed. What has to be integrated and how is it best done? Can the agreed broad principles for IWRM be operationalized in practice – and, if so, how?

Common understanding of IWRM; Global Water Partnership (GWP) has committed itself to strive to facilitate the sustainable management of water resources by fostering information exchange and helping to match needs for solutions to water problems with available tools, assistance and resources. In order to be able to work together towards a common objective, there is a clear need for a common understanding among those involved of what is meant by IWRM. Hence, the purpose of this paper is to clarify internally within GWP, and among our partners, how the GWP Technical Advisory Committee (TAC) interprets the IWRM concept and process. In so doing, TAC is building on the principles to which all governments have agreed at the Dublin and Rio conferences and which have subsequently been elaborated in the UN Commission on Sustainable Development process and other fora.

No universal blueprint; Whereas certain basic principles underlying IWRM may be commonly applicable, independent of context and stage of economic or social development, there is no universal blueprint as to how such principles can be put into practice. The nature, character and intensity of water problems, human resources, institutional

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

Target group; The intended audiences for this paper are professionals and decision-makers, who are already acquainted with water resources management. Therefore, the paper assumes some familiarity with fundamental concepts and issues within water resources management. There is no intention to provide a textbook or an all-comprehensive document but rather a focused statement giving the "corporate view" of GWP TAC and placing an emphasis on those issues most fundamental to IWRM implementation.

Content; The paper has been divided into two main parts. The first part puts forward a strong case for applying IWRM globally and defines the IWRM concept and process. The second part provides additional advice and guidance on how IWRM could be implemented in different conditions. Readers with limited time may decide to concentrate on the first part and use the second part for reference when needed. The paper is structured in such a way that an executive summary is not required. However, as a separate publication providing a short and popular summary the folder *"IWRM at a glance"* is available.

PART I: WHAT IS IWRM?

2. The overall problem

Resources under pressure; The world's freshwater resources are under increasing pressure. Growth in population, increased economic activity and improved standards of living lead to increased competition for and conflicts over the limited freshwater resource. A combination of social inequity, economic marginalization and lack of poverty alleviation programmes also force people living in extreme poverty to overexploit soil and forestry resources, which often results in negative impacts on water resources. Lack of pollution control measures further degrades water resources.

Populations under water stress; The world population has increased by a factor of about three during the 20th century whereas water withdrawals have increased by a factor of about seven. It is estimated that currently one third of the world's population live in countries that experience medium to high water stress. This ratio is expected to grow to two thirds by 2025.

The impact of pollution; Pollution of water is inherently connected with human activities. In addition to serving the basic requirement of biotic life and industrial processes, water also acts as a sink and transport mechanism for domestic, agricultural and industrial waste causing pollution. Deteriorating water quality caused by pollution influences water usability downstream, threatens human health and the functioning of aquatic ecosystems so reducing effective availability and increasing competition for water of adequate quality.

Water governance crisis; The above problems are aggravated by shortcomings in the management of water. Sectoral approaches to water resources management have dominated and are still prevailing; this leads to the fragmented and uncoordinated development and management of the resource. Moreover, water management is usually left to top-down institutions, the legitimacy and effectiveness of which have increasingly been questioned. Thus, the overall problem is caused both by inefficient governance and increased competition for the finite resource.

3. The main challenges

Securing water for people; Although most countries give first priority to satisfaction of basic human needs for water, one fifth of the world's population is without access to safe drinking water and half of the population is without access to adequate sanitation. These service deficiencies primarily affect the poorest segments of the population in developing countries. In these countries, water supply and sanitation for urban and rural areas represents one of the most serious challenges in the years ahead.

Securing water for food production; Population projections indicate that over the next 25 years food will be required for another 2-3 billion people. Water is increasingly seen as a key constraint on food production, on a par with, if not more crucial than, land scarcity. Irrigated agriculture is already responsible for more than 70% of all water withdrawals (more than 90% of all consumptive use of water). Even with an estimated need for an additional 15-20% of irrigation water over the next 25 years - which is probably on the low side - serious conflicts are likely to arise between water for irrigated agriculture and water for other human and ecosystem uses. Difficulties will be exacerbated if individual water-short countries strive for food self-sufficiency rather than achieving food security through trade; by importing food countries can in effect import water from more generously endowed areas (the concept of "virtual water").

Developing other job creating activities; All human activities need water and produce waste, but some of them need more water or produce more waste per job than others. This consideration has to be taken into account in economic development strategies, especially in regions with scarce water resources.

Protecting vital ecosystems; Terrestrial ecosystems in the upstream areas of a basin are important for rainwater infiltration, groundwater recharge and river flow regimes. Aquatic ecosystems produce a range of economic benefits, including such products as timber, fuelwood and medicinal plants, and they also provide wildlife habitats and spawning

grounds. The ecosystems depend on water flows, seasonality and watertable fluctuations and have water quality as a fundamental determinant. Land and water resources management must ensure that vital ecosystems are maintained and that adverse effects on other natural resources are considered and where possible ameliorated when development and management decisions are made.

Dealing with variability of water in time and space; Almost all the freshwater available for human use originates from precipitation, which varies immensely over time and space. Most tropical and sub-tropical regions of the world are characterized by huge seasonal and annual variations in rainfall, often compounded by erratic short-term variations. Such variability manifoldly increases the demand for infrastructure development and the need to manage water demand and supply. The challenge in managing variability is clearly greatest in the poorest countries with the least financial and human resources to cope with the problem. The effects of global climate change may add further to this challenge.

Managing risks; Variations in water flows and groundwater recharge, whether of climatic origin or due to land mismanagement, can add to drought and flood events, which can have catastrophic effects in terms of large scale loss of human life and damage to economic, social and environmental systems. Water pollution creates another set of risks, affecting human health, economic development and ecosystem functions. Economic risks are also important in water resources management and development due to the often large-scale and long-term character of the investments required. Political instability and change represents yet another important risk factor for IWRM. To date, relatively little attention has been paid to the systematic assessment of risk mitigation costs and benefits across the water use sectors and to the consequent evaluation of various risk trade-off options.

Creating popular awareness and understanding; Public awareness is needed in order to mobilize effective support for sustainable water management and induce the changes in behaviour and action required to achieve this. Additionally, public awareness and subsequent pressure for action may be vital in fostering the political will to act. The

The challenge ahead for water resources management

To strike a balance between the use of the resources as a basis for the livelihood of the world's increasing population and the protection and conservation of the resource to sustain its functions and characteristics.

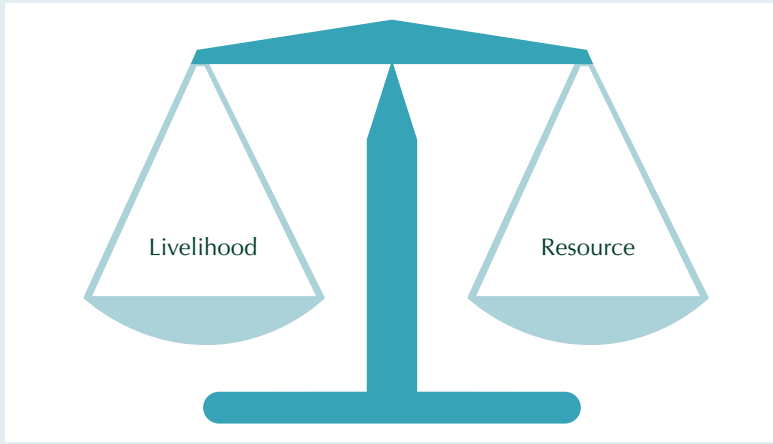


Fig. 1: The challenge of water resources management

historical development of the environmental "green" movement is an example of how public opinion and pressure has translated into political commitment and action. Time is ripe for a "blue" movement.

Forging he political will to act; In a world of scarce resources – financial as well as natural – political attention and commitment are vital to ensure good decision-making and the necessary investments in the development and management of water resources. Bringing water resources issues to the top of the political agenda is fundamental to the long-term success of sustainable water resources management.

Ensuring collaboration across sectors and boundaries; The traditional sectoral and fragmented approach to water resources management has often led to governing bodies representing conflicting interests. Policy objectives have been set without consideration of the implications for other water users and without consultation across sectoral and institutional boundaries. As a result available financial and

physical resources (including water) have not been employed to maximize total social welfare. There is a need to find appropriate ways to co-ordinate policy-making, planning and implementation in an integrated manner across sectoral, institutional and professional boundaries and to take into account the even more complex co-ordination issues arising over the management of international watercourses.

4. IWRM principles

Dublin principles as a guide; General principles, approaches and guidelines relevant to IWRM are numerous and each have their areas of appropriate application. The Dublin principles are a particularly useful set of such principles. They have been carefully formulated through an international consultative process culminating in the International Conference on Water and the Environment in Dublin, 1992. They aim to promote changes in those concepts and practices which are considered fundamental to improved water resources management. These principles are not static; there is a clear need to update and add specificity to the principles in the light of experience with their interpretation and practical implementation.

Principles have universal support; The Dublin principles significantly contributed to the Agenda 21 recommendations (Chapter 18 on freshwater resources) adopted at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, 1992. Since then, these principles (referred to as the Dublin-Rio principles) have found universal support amongst the international community as the guiding principles underpinning IWRM. More recently they have been restated and elaborated at major international water conferences in Harare and Paris, 1998, and by the UN Commission on Sustainable Commission (CSD) at its "Rio +5" follow-up meeting in 1998.

The four Dublin principles; The Dublin principles are:

I Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.

II Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.

III Women play a central part in the provision, management and safeguarding of water.

IV Water has an economic value in all its competing uses and should be recognized as an economic good.

Principle I: Water as a finite and vulnerable resource

A holistic approach; This principle recalls the need for a holistic approach to management, recognizing all the characteristics of the hydrological cycle and its interaction with other natural resources and ecosystems. The statement also recognizes that water is required for many different purposes, functions and services; holistic management, therefore, has to involve consideration of the demands placed on the resource and the threats to it.

Resource yield has natural limits; The notion that freshwater is a finite resource arises as the hydrological cycle on average yields a fixed quantity of water per time period; this overall quantity cannot be altered significantly by human actions (desalinization of seawater is becoming feasible in some locations but still at a very limited scale). The freshwater resource may be regarded as a natural capital asset, which needs to be maintained to ensure that the desired services it provides are sustained.

Effects of human activities; Human beings can clearly affect the productivity of the water resource. They can reduce the availability and quality of water by actions, such as mining of groundwater, polluting surface- and groundwater and changing land use (afforestation, deforestation, urbanization) which alter flow regimes within surface water systems. More positive effects can, however, arise from regulation of the natural temporal and spatial variability of flows. When water is used for non-consumptive purposes and involves return flows, planned

reuse can increase effective resource flows and the total quantity of services provided. It also has to be recognized that the value or welfare derived from the water resource assets will vary with the uses to which the assets are put.

Upstream-downstream user relations; The effects of human activities lead to the need for recognition of the linkages between upstream and downstream users of water. Upstream users must recognize the legitimate demands of downstream users to share the available water resources and sustain usability. Excessive consumptive use or pollution of water by upstream users may deprive the downstream users of their legitimate use of the shared resource. This clearly implies that dialogue or conflict resolution mechanisms are needed in order to reconcile the needs of upstream and downstream users.

A holistic institutional approach; Holistic management not only involves the management of natural systems; it also necessitates co-ordination between the range of human activities which create the demands for water, determine land uses and generate water-borne waste products. Creating a water sensitive political economy requires co-ordinated policy-making at all levels (from national ministries to local government or community-based institutions). There is also a need for mechanisms which ensure that economic sector decision-makers take water costs and sustainability into account when making production and consumption choices. The development of an institutional framework capable of integrating human systems – economic, social and political – represents a considerable challenge.

Principle II: Participatory approach

Real participation; Water is a subject in which everyone is a stakeholder. Real participation only takes place when stakeholders are part of the decision-making process. This can occur directly when local communities come together to make water supply, management and use choices. Participation also occurs if democratically elected or otherwise accountable agencies or spokespersons can represent stakeholder groups. Additionally, there are circumstances in which participation in

decision-making can take place through market processes; if appropriate pricing systems are in place, local governments, community organizations or irrigation districts could signal their demands for bulk water services. The type of participation will depend upon the spatial scale relevant to particular water management and investment decisions and upon the nature of the political economy in which such decisions take place.

Participation is more than consultation; Participation requires that stakeholders at all levels of the social structure have an impact on decisions at different levels of water management. Consultative mechanisms, ranging from questionnaires to stakeholder meetings, will not allow real participation if they are merely employed to legitimize decisions already made, to defuse political opposition or to delay the implementation of measures which could adversely impinge upon a powerful interest group.

Achieving consensus; A participatory approach is the only means for achieving long-lasting consensus and common agreement. However, for this to occur, stakeholders and officials from water management agencies have to recognize that the sustainability of the resource is a common problem and that all parties are going to have to sacrifice some desires for the common good. Participation is about taking responsibility, recognizing the effect of sectoral actions on other water users and aquatic ecosystems and accepting the need for change to improve the efficiency of water use and allow the sustainable development of the resource. Participation will not always achieve consensus, arbitration processes or other conflict resolution mechanisms will also need to be put in place.

Creating participatory mechanisms and capacity; Governments at national, regional and local levels have the responsibility for making participation possible. This involves the creation of mechanisms for stakeholder consultation at all spatial scales; such as national, basin or aquifer, catchment and community levels. However, while the creation of consultative mechanisms is necessary, it will by itself not lead to real participation. Governments also have to help create participatory capacity, particularly amongst women and other marginalized social

BOX 1

Creating participatory mechanisms

The state of Guanajuato, Mexico has created a Groundwater Technical Committee (Comité Técnico de Aguas Subterráneas-Cotas) to open an arena in which different water users and governmental officials gather to seek for solutions to the problems of water misuse and distribution. It is also a forum through which water users and authorities have direct channels of communication from top to bottom and vice-versa. This has enabled the possibility of implementing several regulatory decisions by consensus.

groups. This may not only involve awareness raising, confidence building and education, but also the provision of the economic resources needed to facilitate participation and the establishment of good and transparent sources of information. It has to be recognized that simply creating participatory opportunities will do nothing for currently disadvantaged groups unless their capacity to participate is enhanced.

The lowest appropriate level; Participation is an instrument that can be used to pursue an appropriate balance between a top-down and a bottom-up approach to IWRM. For some decisions the appropriate decision unit is the household or the farm; participation depends on the provision of mechanisms and information to allow individuals and communities to make water sensitive choices. At the other end of the spatial scale the management of international river basins will require some form of cross-national co-ordinating committees and mechanisms for conflict resolution.

Principle III: The important role of women

Involvement of women in decision-making; Women's participation as decision-makers is interwoven with gender hierarchies and roles within different cultures leading to the existence of communities that ignore or impede women's participation in water management. Although "gender issues" have been reflected in all statements on IWRM since the Dublin and Rio conferences, there is still a long way to go before

rhetoric is replaced by operational mechanisms and actions to ensure an equitable participation of women in IWRM. Therefore special efforts must be made to ensure women's participation at all organizational levels.

Women as water users; It is widely acknowledged that women play a key role in the collection and safeguarding of water for domestic and – in many cases – agricultural use, but that they have a much less influential role than men in management, problem analysis and in the decision-making process related to water resources. The fact that social and cultural circumstances vary between societies suggests that the need exists to explore different mechanisms for increasing women's access to decision-making and widening the spectrum of activities through which women can participate in IWRM.

IWRM requires gender awareness; In developing the full and effective participation of women at all levels of decision-making, consideration has to be given to the way different societies assign particular social, economic and cultural roles to men and women. There is a need to ensure that the water sector as a whole is gender aware, a process which should begin by the implementation of training programmes for water professionals and community or grass root mobilizers.

Principle IV: Water as an economic good

Water has a value as an economic good; Many past failures in water resources management are attributable to the fact that water has been – and is still – viewed as a free good, or at least that the full value of water has not been recognized. In a situation of competition for scarce water resources such a notion may lead to water being allocated to low-value uses and provides no incentives to treat water as a limited asset. In order to extract the maximum benefits from the available water resources there is a need to change perceptions about water values and to recognize the opportunity costs involved in current allocative patterns.

Value and charges are two different things; Concern has been voiced

over the social consequences of "the economic good" concept: How would this affect poor people's access to water? (While the Dublin principles refer to water as an economic good, water is referred to as an economic *and social* good in Chapter 18 of Agenda 21). To avoid confusion over this concept there is a need to distinguish clearly between *valuing* and *charging* for water. The *value* of water in alternative uses is important for the rational allocation of water as a scarce resource (using the "opportunity cost" concept), whether by regulatory or economic means. *Charging* for water is applying an economic instrument to affect behaviour towards conservation and efficient water usage, to provide incentives for demand management, ensure cost recovery and to signal consumers' willingness to pay for additional investments in water services.

Useful water value concepts; The following concepts of water value have been found useful within IWRM. The full value of water consists of its use value – or economic value – and the intrinsic value. The economic value which depends on the user and the way it is used, include: value to (direct) users of water, net benefits from water that is lost through evapotranspiration or other sinks (e.g. return flows), and the contribution of water towards the attainment of social objectives.

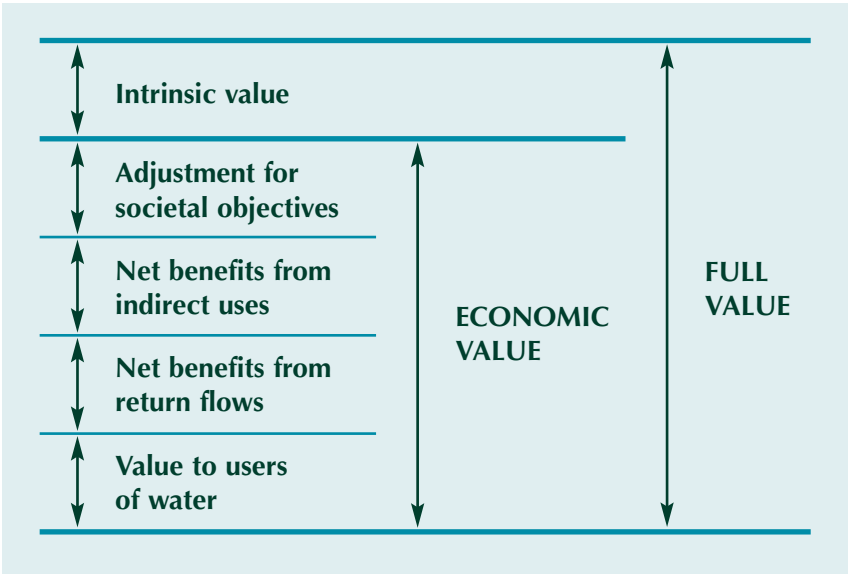
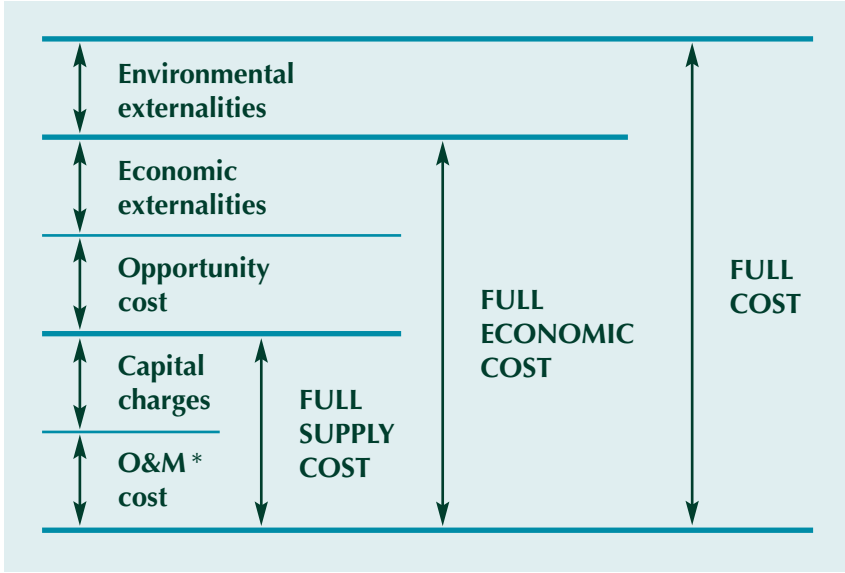


Fig. 2a: General principles for valuing water

The intrinsic value includes non-use values such as bequest or existence values (see Fig. 2a).

Useful water cost concepts; The full cost of providing water includes the full economic cost and the environmental externalities associated with public health and ecosystem maintenance. The full economic cost consists of: the full supply cost due to resource management, operating and maintenance expenditures and capital charges, the opportunity costs from alternative water uses, and the economic externalities arising from changes in economic activities of indirectly affected sectors (see Fig. 2b).



* O&M = Operation and Maintenance

Fig. 2b: General principles for costing water

The goal of full cost recovery; The recovery of full cost should be the goal for all water uses unless there are compelling reasons for not doing so. While, in principle, the full cost needs to be estimated and made known for purposes of rational allocation and management decisions, it need not necessarily be charged to the users. The cost, however, will have to be borne by someone. Estimation of full cost may be very difficult. In situations involving conflict over water

attempts should be made to at least estimate the full economic cost as the basis for allocation.

Managing demand through economic instruments; Treating water as an economic good may help balance the supply and demand of water, thereby sustaining the flow of goods and services from this important natural asset. When water becomes increasingly scarce, continuing the traditional policy of extending supply is no longer a feasible option. There is a clear need for operational economic concepts and instruments that can contribute to management by limiting the demand for water. Importantly, if charges for water goods and services reflect the full cost involved, managers will be in a better position to judge when the demand for different water products justifies the expenditure of scarce capital resources to expand supply.

Financial self-sufficiency versus water as a social good; In order for water resources management agencies and water utilities to be effective there is a need to ensure that they have adequate resources to be financially independent of general revenues. Thus, as a minimum, full supply costs should generally be recovered in order to ensure sustainability of investments. But high supply costs and social concerns may require direct subsidies to specific disadvantaged groups. While subsidies "across the board" generally distort water markets and should be discouraged, direct subsidies for targeted groups may be relevant, but they need to be *transparent.* There are, however, several institutional prerequisites for the successful implementation of targeted subsidies; these include adequate taxation or general revenue collection systems, mechanisms to identify the target groups and the capacity to monitor and follow up on fund utilization. Transparent financial linkages among different organizations and between users and management agencies are fundamental to successful implementation of water policies. The principle "subsidize the good, tax the bad" has considerable merit when exercised in a transparent manner, although it has to be recognized that all subsidies have to be paid for by someone. In general, subsidies paid for from taxation will be less distorting than systems which rely on cross-subsidies between different groups of consumers; however, it is acknowledged that in many administrations cross-subsidies are easier to implement.

5. Definition of IWRM

IWRM practices depend on context; At the operational level the challenge is to translate the agreed principles into concrete action. The response to this is often referred to as *Integrated Water Resources Management (IWRM)*, with the *"M" referring to both "development and management"*. However, the concept of IWRM is widely debated and an unambiguous definition of IWRM does not currently exist. Hence, the regional and national institutions must develop their own IWRM practices using the collaborative framework emerging globally and regionally. To guide further work a number of elements, which have been highlighted in conceptual discussions within and outside GWP, are given below.

IWRM definition; For the purposes of providing a common framework the following definition of IWRM is used:

BOX 2

Definition of IWRM

IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

"Integration" in IWRM

Integration necessary but not sufficient; According to the Webster Dictionary the need for *integration* arises when dealing with the situation of "regular interaction of interdependent groups of items forming a uniform whole". *Integration*, then, is the "art and science" of blending the right proportions of these items into a whole. However, those involved in water resources management know that *integration per se* cannot guarantee development of optimal strategies, plans and management schemes (mixing two poor ingredients does not make a good meal).

Natural and human system interaction; The concept of *Integrated* Water Resources Management – in contrast to "traditional", fragmented water resources management – at its most fundamental level is as concerned with the management of water demand as with its supply. Thus, integration can be considered under two basic categories:

- the natural system, with its critical importance for resource availability and quality, and
- the human system, which fundamentally determines the resource use, waste production and pollution of the resource, and which must also set the development priorities.

Integration has to occur both within and between these categories, taking into account variability in time and space. Historically, water managers have tended to see themselves in a "neutral role", managing the natural system to provide supplies to meet externally determined needs. IWRM approaches should assist them in recognizing that their behaviour also affects water demands. Clearly, consumers can only "demand" the product supplied, but water can be supplied with very different properties, for instance in terms of quality and availability in low flow or peak demand periods. Price and tariff design will also affect water demand, as will investments in infrastructure which translates potential into effective demand.

Natural system integration

Integration of freshwater management and coastal zone management; Freshwater management and coastal zone management should be integrated, reflecting the "continuum" of freshwater and coastal waters. Freshwater systems are important determinants of conditions in the coastal zone and hence freshwater managers should consider the requirements of the coastal zone when managing water resources. This is a special case of the upstream-downstream issue, which is receiving increased attention in all countries, notably through the recent UN declaration on land-based sources of pollution, which has led to the Global Programme of Action – GPA and the Global International Waters Assessment – GIWA.

Integration of land and water management; An integrated approach to the management of land and water takes as its departure the hydrological cycle transporting water between the compartments air, soil, vegetation, surface and groundwater sources. As a result, land use developments and vegetation cover (including crop selection) influence the physical distribution and quality of water and must be considered in the overall planning and management of the water resources. Another aspect is the fact that water is a key determinant of the character and health of all ecosystems (terrestrial as well as aquatic), and their water quantity and quality requirements therefore have to be taken into account in the overall allocation of available water resources. The promotion of catchment and river basin management is an acknowledgement that these are logical planning units for IWRM from a natural system perspective. Catchment and basin level management is not only important as a means of integrating land use and water issues, but is also critical in managing the relationships between quantity and quality and between upstream and downstream water interests.

"Green water" and "blue water"; A conceptual distinction can be made between water that is used directly for biomass production and "lost" in evapotranspiration ("green water") and water flowing in rivers and aquifers ("blue water"). Terrestrial ecosystems are "green water" dependent, whereas aquatic ecosystems are "blue water" dependent.

Most water management, including the literature on IWRM, tends to focus on the "blue water", thus neglecting rain and soil water management. Management of "green water" flows holds significant potential for water savings (crop per evaporated drop in rainfed and irrigated agriculture), increasing water use efficiency and the protection of vital ecosystems.

Integration of surface water and groundwater management; The hydrological cycle also calls for integration between surface and groundwater management. The drop of water retained at the surface of a catchment may appear alternately as surface- and groundwater on its way downstream through the catchment. Large proportions of the world's population depend on groundwater for water supply. The widespread use of agro-chemicals and pollution from other non-point sources already pose significant threats to groundwater quality and force managers to consider the linkages between surface- and groundwater. Groundwater pollution is frequently, for all practical purposes, irreversible over a human timescale given present technologies and the remedy costs involved.

Integration of quantity and quality in water resources management; Water resources management entails the development of appropriate quantities of water with an adequate quality. Water quality management is thus an essential component of IWRM. The deterioration of water quality reduces the usability of the resource for downstream stakeholders. Clearly, institutions capable of integrating the quantity and quality aspects have to be promoted to influence the way human systems operate in generating, abating and disposing of waste products.

Integration of upstream and downstream water-related interests; An integrated approach to water resources management entails identification of conflicts of interest between upstream and downstream stakeholders. The consumptive "losses" upstream will reduce river flows. The pollution loads discharged upstream will degrade river water quality. Land use changes upstream may alter groundwater recharge and river flow seasonality. Flood control measures upstream may threaten flood-dependent livelihoods downstream. Such conflicts

of interest must be considered in IWRM with full acknowledgement of the range of physical and social linkages that exist in complex systems. Recognition of downstream vulnerability to upstream activities is imperative. Once again management involves both natural and human systems.

Human system integration

Mainstreaming of water resources; When it comes to analysing human activities or service systems, virtually all aspects of integration involve an understanding of the natural system, its capacity, vulnerability and limits. Such integration is inevitably a complex task and perfect integration is unrealistic. It involves:

- attempting to ensure that governmental policies, financial priorities and planning (physical, economic and social) take account of the implications for water resources development, water related risks and water use;
- influencing private sector decision-makers to make technological, production and consumption choices based on the real value of water and the need to sustain the natural resource assets over time; and
- providing fora and mechanisms to ensure that all stakeholders can participate in water resource allocation decisions, conflict resolution and trade-off choices.

Integrative measures are needed at all levels from the individual household to international product markets.

Cross-sectoral integration in national policy development; The IWRM approach implies that water- related developments within all economic and social sectors should be taken into account in the overall management of the water resources. Thus, water resources policy must be integrated with national economic policy, as well as with national sectoral policies. Conversely, economic and social policies need to take account of the water resource implications, for instance, national

energy and food policies may have a profound impact on water resources – and vice versa. Hence, developments must be evaluated for possible impacts on – or requirements for – the water resource, and such evaluations should be considered when designing and prioritizing development projects. The development and management of water resources has an impact on the economy and society through various pathways, such as migration, settlement growth, and changes in the composition of industries. Consequently, the water resources management system must include cross-sectoral information exchange and co-ordination procedures, as well as techniques for the evaluation of individual projects with respect to their implications for the water resources in particular and society in general.

Macro-economic effects of water developments; In situations where large amounts of capital are mobilized for water sector investments the macro-economic impacts are often quite large and deleterious to overall economic development. The increased demand for goods and services in the non-water sectors caused by the capital inflows raises their prices and thus leads to inflation. This has often induced long-term macro-economic effects that are far from desirable.

Basic principles for integrated policy-making; Cross-sectoral and "integrated" policy-making is extremely hard to achieve in practice but there are basic principles, such as:

- economic planners must carefully assess the inflation, balance of payments, and macro-economic growth impacts before embarking on any large-scale capital investment program in the water sector;
- land use policy-makers must be informed about the water consequences downstream and the *external* costs and benefits imposed on the natural water system (e.g. deforestation or urbanization of catchments could alter water flow regimes and exacerbate risks such as floods). This does not mean that these external costs should not be incurred but that the relevant policy-makers weigh these costs against the expected benefits arising from their policy or plan;

- policies which act to increase the demand for water, including its use to remove waste products, should be developed with knowledge of the full incremental costs involved (Fig. 2b);
- policies which effectively allocate water between various uses should take into account the relative values in use, measured in economic and social terms;
- policy-makers need to be aware of the trade-offs between short-term benefits and long-term costs and of situations where the application of the precautionary principle can reduce total costs over time;
- policy-makers should be aware that subsidiarity in water resources management is essential so that different tasks are undertaken at the lowest appropriate level.

Influencing economic sector decisions; The decisions of economic sector actors (from trans-national or large state-owned companies to individual farmers or households) will in most countries have significant impact on water demands, water-related risks and the availability and quality of the resource. These decisions will not be water sensitive unless clear and consistent information is available on the full costs of their actions; importantly, incentives to take account of the external costs of their decisions have to be given. Education and shifts in cultural attitudes can play an important role. Consistency of message is, however, crucial; it is, for example, clearly counterproductive to publicize water conservation or pollution control benefits while providing free water or wastewater discharge. Likewise, information on water-related risks is pointless unless the means to reduce those risks are actually available at affordable costs.

Integration of all stakeholders in the planning and decision process; The involvement of the concerned stakeholders in the management and planning of water resources is universally recognized as a key element in obtaining a balanced and sustainable utilization of water. But in many cases stakeholders represent conflicting interests and their objectives concerning water resources management may substantially differ. To deal with such situations the IWRM should develop operational tools for conflict management and resolution as well as for the evaluation of trade-offs between different objectives, plans and

actions. An important issue here is the need to identify and designate water resources management functions according to their lowest appropriate level of implementation; at each implementation level the relevant stakeholders need to be identified and mobilized.

Integrating water and wastewater management; Water is a renewable and reusable resource. Where use is non-consumptive and returned after use, mechanisms are needed to ensure that wastewater flows are a useful addition to resource flows or water supply. Without co-ordinated management waste flows often simply reduce effective supplies by impairing water quality and increasing future costs of water supply. Incentives for reuse can be provided to individual users but to be effective reuse opportunities have to be designed into the political, economic, social and administrative systems.

The cross-sectoral integration between water use sub-sectors, and the role of IWRM in their linkage, is illustrated in the "GWP comb" below:

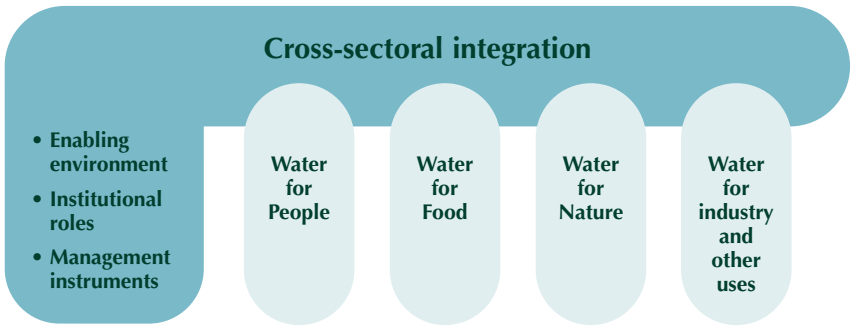


Fig. 3: IWRM and its relations to sub-sectors

Overriding criteria; In pursuing IWRM there is a need to recognize some overriding criteria that take account of social, economic and natural conditions:

- *Economic efficiency in water use:* Because of the increasing scarcity of water and financial resources, the finite and vulnerable nature of water as a resource, and the increasing demands upon it, water must be used with maximum possible efficiency;
- *Equity:* The basic right for *all* people to have access to water of adequate quantity and quality for the sustenance of human well-being must be universally recognized;
- *Environmental and ecological sustainability:* The present use of the resource should be managed in a way that does not undermine the life-support system thereby compromising use by future generations of the same resource.

Important elements; The IWRM framework and approach recognize that complementary elements of an effective water resources management system must be developed and strengthened concurrently. These complementary elements include (see Fig. 4):

- *the enabling environment* – the general framework of national policies, legislation and regulations and information for water resources management stakeholders;
- *the institutional roles* and functions of the various administrative levels and stakeholders; and
- *the management instruments*, including operational instruments for effective regulation, monitoring and enforcement that enable the decision-makers to make informed choices between alternative actions. These choices need to be based on agreed policies, available resources, environmental impacts and the social and economic consequences.

These three basic elements are described in the following Part II.

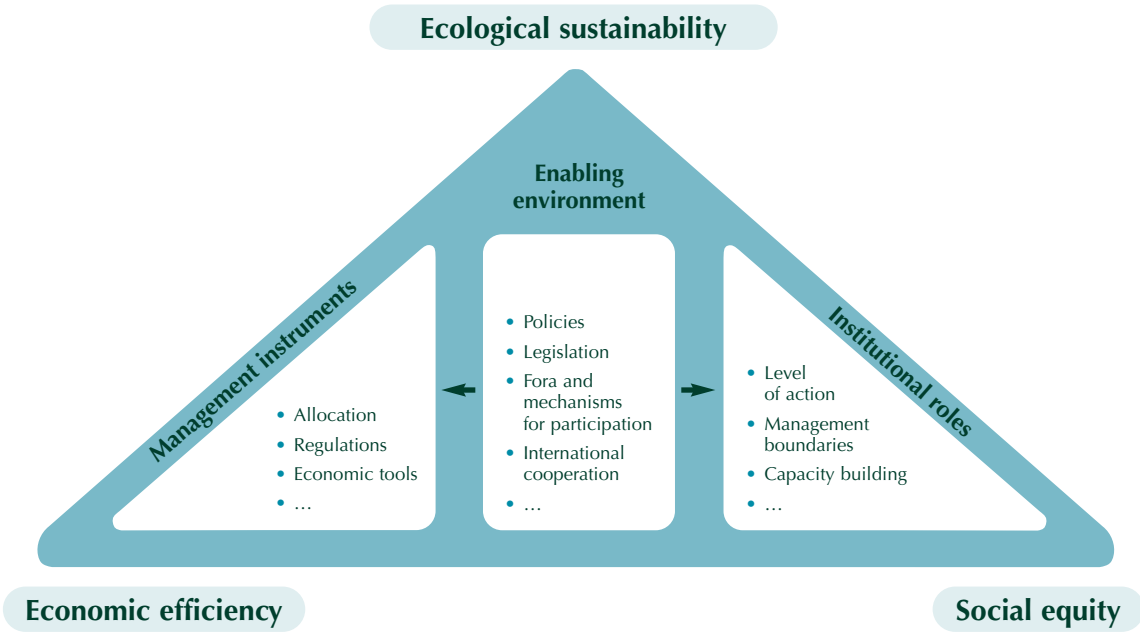


Fig. 4: General framework for IWRM

PART II: HOW TO IMPLEMENT IWRM

6. The enabling environment

Enabling environment; A proper enabling environment is essential to both ensure the rights and assets of all stakeholders (individuals as well as public and private sector organizations and companies), and also to protect public assets such as intrinsic environmental values. The enabling environment is basically national, provincial or local policies and the legislation that constitutes the "rules of the game" and enable all stakeholders to play their respective roles in the development and management of water resources; and the fora and mechanisms, including information and capacity building, created to establish these "rules of the game" and to facilitate and exercise stakeholder participation.

From top to bottom; In order to achieve efficient, equitable and sustainable water management within the IWRM approach, a major institutional change will be needed. Both top-down and bottom-up participation of all stakeholders will have to be promoted – from the level of the nation down to the level of a village or a municipality or from the level of a catchment or watershed up to the level of a river basin. The principle of subsidiarity, which drives down action to the lowest appropriate level, will need to be observed.

From companies to communities; Apart from government agencies, private companies, community based organizations which have full participation of women and disadvantaged groups, NGOs and other sections of civil society should be involved. All these organizations and agencies have an important role to play in enhancing access to water, in bringing about a balance between conservation and development, and making water an economic and social good.

The role of government

Government as an enabler; The participatory approach involves raising awareness of the importance of IWRM among policy-makers and the general public. The enabling role of government implies that

prescriptive, central approaches to developments within the water sector should be replaced by the creation of a framework within which participatory, demand-driven sustainable development can take place. If governments adopt a facilitating and arbitrating role, the burdens on the state can be alleviated and the performance of public functions enhanced. governments need to create the conditions under which all the actors having a stake in a particular issue can become involved and can negotiate amongst themselves to achieve acceptable solutions to water problems. However, participation does not mean that governments can abdicate their responsibilities.

Government as regulator and controller; Policy-making, planning, water allocation, monitoring, enforcement and final conflict resolution still need to be the responsibility of government. It is now generally recognized that government – where possible – should play a decreasing role as service provider and concentrate more on being the regulator and controller of specialist service providers. Others, such as the private sector or independent parastatals, may then provide water services subject to monitoring and control by some regulatory entity. The trend away from government provision has been fuelled not only by concerns over inefficiencies, conflicting interests and the lack of management transparency but also by the increasing difficulties faced by many governments in financing the necessary investments in water resources.

Government as service provider; While all governments should make a whole-hearted attempt to transfer service provision tasks to non-governmental stakeholders, this may take many years to achieve in some countries. Moreover, given that water services contain clear public good elements (e.g. flood protection and the bulk disposal and treatment of waste products) continued public investment will be necessary. Where governments retain provision functions it is an important principle that provision agencies should not regulate themselves; separation of regulatory and implementation functions helps ensure transparency and accountability.

Improvement of public sector performance; The fact that a fifth of the world's population (in general the poorest people) is without access

to safe drinking water and half of the population is without access to adequate sanitation, has been regarded as an indictment of public service provision and has pushed many governments and cities to resort to the private sector. Private sector participation should not, however, be assumed to be a panacea that can immediately solve capacity and investment problems. Perhaps its greatest impact will be to stimulate accountability and competition and, therefore, better performance by public utilities. Although there is a trend towards privatization and governments have a key role to play in facilitating greater private sector participation, the fact remains that public utilities will, for the foreseeable future, serve the vast majority of users. Hence, it is critical that greater attention be paid to improving public sector performance. Improvement of utility efficiency, be it public or private, has to be accompanied by government decisions to address key problems such as water pricing, overstaffing, the needs of the urban poor, and to provide the legal and institutional framework for successful operations.

Government role under private sector involvement; By private sector, we mean here both the corporate sector and the community based organizations. Contemporary thinking has it that private sector involvement in providing water services, notably in the water and sanitation sub-sector, will contribute to reducing government's role and burden in water management. This is not necessarily so: the tasks will change as the operational functions are transferred to private actors, but public entities need to have the capacity and capability to monitor and regulate service delivery to ensure adequate provision at reasonable prices. In short, private sector involvement typically requires *more* government regulation, not less. Moreover, involvement of poor communities will need catalytic financial support from government and other external sources.

Government and water markets; All markets require the support of governments to provide the legal, social and economic environment in which trade and competition can flourish. In principle, available water resources can be traded in a market place to allow the water to be employed in the highest value uses. Although theoretically more efficient, water markets can only function given appropriate institu-

tional arrangements. Mechanisms will also be needed to ensure that trading does not impose external costs on other water users (including the environment), or allow powerful interest groups to monopolize supplies and exclude disadvantaged groups from access to essential services. When governments choose to give a greater role to market mechanisms, both in the allocation of raw water and in the supply of services to end users, it is essential that legal and regulatory systems are in place to cope with market failures.

Water legislation

Legislation is part of a framework for action; Legislation provides the basis for government intervention and action and establishes the context and framework for action by non-governmental entities; hence it is an important element within the enabling environment. Specific water laws have been enacted in a considerable number of countries, but some still lack a water resources law *per se*. Although references to water resources may be found in the national legislation, these are often dispersed in a multitude of sectorally oriented laws and may be contradictory or inconsistent on some aspects of water resource usage.

Legislation and the political will to enforce it; The more scarce water or capital is, and the more conflicts arise over water, the more important it is to have in place a coherent and comprehensive water law. It requires considerable time to establish coherent and comprehensive water legislation from a fragmented and outdated legislative patchwork. Such a comprehensive revision process should not, however, serve to hold back sound initiatives which address pressing short-term issues. In many cases the biggest problem is not lack of adequate legislation but lack of the political will, resources and means to enforce the existing legislation.

BOX 3

An IWRM case from Tamil Nadu, India

Although it is too early to review its success, several components of IWRM are being used in the Vaigai basin of Tamil Nadu in South India, including:

- participation of stakeholders ranging from government agencies to washerwomen;
- a decision support system to quantify implications and trade-offs of alternative water allocation and policy decisions; and
- political and administrative support from the government and other agencies.

Problems in the Vaigai river basin, a very water-short basin, include:

- conflicts between stakeholders because of multiple uses of water;
- involvement of multiple institutions in various, often overlapping, aspects of basin planning and management;
- upstream/downstream conflicts; and
- cross-sectoral conflicts resulting from rapidly increasing urbanization even as traditional water demands remain.

The future poses major challenges for allocation of water and the development of a co-operative framework to make decisions based on full stakeholder participation. This is not possible without holistic river basin management. A stakeholder group has been set up by the Government of Tamil Nadu to evaluate various water allocation options.

In order to analyse alternative future scenarios, areas with significant trade-offs and impact changes in policies, agricultural cropping patterns, a Decision Support System called THANNI ("water" in Tamil Language) has been developed. THANNI includes an information system and an optimization model to maximize the benefits from water use subject to a variety of hydrological, economic, legal and policy constraints. The interface has also been converted into local Tamil language for greater communication capability. The system provides decision-makers a tool for policy and scenario analysis and stakeholders a focal point for discussions. Next steps include stakeholder groups further developing THANNI to provide a new interactive paradigm for co-ordinated and co-operative decision-making.

Requirements of legislation; Water legislation should:

- be based on a stated national water resources policy that cuts across sectoral and stakeholder divisions, addresses water as a resource and stresses the societal priority for basic human needs and ecosystem protection;
- secure water (use) rights to allow private and community investment and participation in water management;
- regulate monopolized access to raw water and water services, and prevent harm to third parties;
- present a balanced approach between resource development for economic purposes and the protection of water quality, ecosystems and other public welfare benefits;
- ensure that developmental decisions are based on sound economic, environmental, and social assessment;
- ensure the possibility of employing modern participatory and economic tools where, when and to the extent needed.

Legislation, regulations and by-laws; Amendment of water legislation is usually a tedious and time-consuming process, and therefore legislation should be kept at a sufficiently general level, establishing the rights and obligations of all stakeholders in water management, the powers and functions of regulatory bodies and the penalties for infractions of the law. Detailed guidelines and provisions for enforcement and implementation should be incorporated in the more dynamic parts of the legislative system, for example the framework of regulations and by-laws that may be amended in a continuous process as circumstances change.

The cross-sectoral and upstream-downstream dialogue

Allocation following dialogue; A critically important element of IWRM is the integration of various sectoral views and interests in the decision-making process, with due attention given to upstream-downstream relationships. The idea is to incorporate consultation and to seek consensus with all relevant line ministries at all tiers of government, as well as with other stakeholders located in different parts of a river basin. Only in this way is it possible to plan water allocation

across the entire basin and to avoid misallocation of water resources to one particular sector when higher value uses and users are denied services. Putting on one table, and transparent to all sectors and stakeholders, the combined demands placed upon water (quantity and quality) will help determine what is feasible in order to achieve sustainable water resources management.

Co-ordination at the highest level – implementation by line agencies; In order to ensure the co-ordination of water management efforts across water-related sectors and throughout the entire basin, formal mechanisms and means of co-operation and information exchange need to be established. Such co-ordinating mechanisms should be created at the highest policy level. The implementation of policies should then be left to those line agencies and private corporate and community institutions which would be best able to realize the full advantage of independent decision-making and economies of scale. To ensure efficiency of integration there is a need to establish proper financial linkages between the relevant institutions. This would provide incentives for cross-sectoral action.

Financing structures and investment allocations for water resources infrastructure

The different investments needed; When looking at the investments needed for water resources infrastructure, one has to distinguish between the different actors who bear the responsibility for ensuring (but not necessarily providing) each type of investment:

- Investments to reduce the spatial and temporal imbalances in water availability, to protect people from extreme flood and drought events and to provide public goods are the responsibility of public authorities, be they national or sub-national;
- Investments designed to deliver water to a large number of users (households, industry, energy producers or irrigators) and remove waste or surplus water are the responsibility of local or regional governments, special irrigation institutions or water authorities of various types; and

- Investments that enable each user, on their own property, to solve their own water problems falls within the realm of personal responsibility.

Private financing assumes investment security; It is the responsibility of government to ensure and facilitate the overall investments needed to develop and maintain an adequate water infrastructure. Given the growing pressure in many countries for public sector reforms (often synonymous with cuts in the size and budget of the public sector), and the increasing competition for scarce development assistance resources, this challenge becomes increasingly difficult for developing country governments to meet. These problems favour the increased involvement of private sector financing but such financing will only take place if legislation provides for investment security.

Conditions for private sector involvement; The private sector has a role to play in many countries in improving the technical and managerial capacity of utilities and providing essential investment capital. However, investment by private companies will only take place if the rates of return earned on capital are commensurate with the perceived risks involved. In this respect there is a need to separate commercial and political risk and particular attention has to be given to financial and economic risk assessment. Although to attract investment protection from some forms of risk will be needed (e.g. asset expropriation or undue political intervention in management), this does not mean that all risks and incentives for efficient operations should be removed. To do so would not only leave the public sector or water users to shoulder the brunt of investment risks but also the efficiency advantages of private sector operations would be lost. When settling water service delivery contracts, authorities should study very carefully the question of risk sharing with contractors, and especially the issues of interest and exchange rates, financial conditions, and unlimited compulsory purchases of outputs. Financing is best attracted by ensuring long-term sustainability, i.e. by facilitating recovery of costs through reasonable pricing and independent regulation. Traditionally, the heaviest involvement of private companies has been in the water and sanitation subsector and has ranged from service contracts (single function contract to perform a specific service for a fee) to full divestiture (full transfer of

assets through sale, and private sector responsible for all capital investment, maintenance, operations and revenue collection). Community based organizations also make investments to develop and manage water supply systems when they are legally empowered to do so, their water rights are clearly delineated, efforts are made by NGO's, social workers or government agencies to develop effective community institutions and there is catalytic financial assistance available from the government or other external sources.

Conditions for private sector performance; While private sector enterprises may be more sensitive to productivity gains and to customer satisfaction, because their earnings and survival in business depend essentially on these factors, there are no guarantees that privatization will actually yield the desired performance improvements. Simply converting a public sector monopoly into a private one provides no competitive incentives for the utility to operate efficiently, make appropriate investments or respond to consumer demands. Likewise, privatization *per se* may do little to improve sector performance if governments are unwilling or unable to tackle such underlying problems as financing the provision of public and merit goods, curbing over-manning, restricting over-intrusive political intervention and allowing for flexibility in water pricing. The conditions under which the private sector will operate need to be clearly spelled out in tender documents, in the contract and in the regulatory procedures. Among these is a clear agreement on the quality of services to be provided, on the pricing policies, especially the subsidies or cross-subsidies for the poor, and on the range of decisions which have to be taken at the public authority level, and those that lie with the private company alone.

Charging the full cost of water; In principle, charging the full cost for water assures the long-term viability of the water supply service and effectively constrains water demand thereby ensuring sustainability of the resource. These sustainability considerations require that over time and wherever feasible both the direct and indirect beneficiaries of water use should face prices that reflect the full cost of water. In cases where broader social concerns constrain the application of full cost pricing, it may be appropriate over the short term to base prices on full

economic cost recovery or at the very minimum on full supply costs. Implied or explicit subsidies need to be identified, targeted and implemented in a transparent manner.

Sources of public investment; There are important characteristics of water that warrant a role for public investment in water-related infrastructure. For instance, control of floods and waterborne diseases are public goods, which cannot easily be charged for on the basis of individual benefit and use. In addition, the large size and extremely long time horizons of some investments, combined with the inherent risk of political interference, may reduce the incentives for private investment. To ensure adequate financing of the water sector, actions need to be taken to improve donor-recipient dialogue over financial resource mobilization and its allocation to water resource development. The international community and governments (donors and recipients alike) should be urged to maintain and increase their assistance to the water resources sector, targeted to solving specific problems. Value can be added by improving communication and co-operation between financiers (public, private, national, bilateral and international), by introducing enabling measures to mobilize the largely untapped community financing resources and by the provision of credit mechanisms which foster self-reliance efforts by individuals.

Co-operation within international river basins

Vulnerability of downstream riparians; Roughly half of all land in the world lies within river basins covering parts of the territory of two or more countries. Downstream riparians are especially vulnerable since the origin of the water on which they depend is not within their national territory. This issue has created and still creates substantial political tensions and conflicts at the regional level around the world.

Sovereignty requires special conflict resolution mechanisms; The issue is similar in nature to the classical upstream-downstream issue often encountered at the national or local level but exacerbated here by the mixture of national sovereignty. The conflict resolution or priority-setting mechanisms implemented at national or local level do not

automatically translate into validity at the international level because of the well established overriding international principle of national sovereignty.

Constraints on and potential for sharing transboundary waters; The enabling environment equivalent to national or local legislation is international agreement on the principles for managing and sharing transboundary waters. Although there are substantive principles in international water law such as equitable utilization and prohibition of significant harm, there are formal constraints on their application because countries are not obliged to resort to any third party unless they agree on a specific conflict resolution procedure. The Helsinki Rules, the International Law Commission and the UN Convention on the Use and Protection of Non-navigational Waters are international instruments designed to facilitate collaboration. At the regional level Protocols have been developed, as for example the Protocol on Shared Watercourse Systems in the Southern Africa Development Community (SADC) Region. At the river basin level (including shared lakes and groundwater aquifers) a large number of commissions and agreements have been established. Common to most of these agreements is the large gap between rhetoric and action, not only at the political level in terms of willingness to cooperate, but also at the practical level of establishing the proper data and information base and the analytical tools needed for meaningful collaboration.

The need for negotiated agreements for water use; While there are extreme positions in the law of international watercourses, such as absolute sovereignty and absolute territorial integrity, international courts have favoured the concept of community of interests among riparian countries. Riparian States should co-operate on transboundary water resources, searching for negotiated agreements respecting all riparian countries' interests and based on equitable and reasonable use of water. The international community and water-related organizations could act as catalysts and brokers for reaching such negotiated agreements. Such agreements are often part of more global agreements where it may be easier to reach a satisfactory balance between the interests of the parties.

BOX 4

International co-operation

Ten countries share the Nile basin. Building on earlier cooperative efforts, nine of these countries have agreed to form a regional partnership known as the Nile Basin Initiative (NBI). Launched in February 1999, the NBI seeks to harness the tremendous potential of the Nile through sustainable development and management of its waters for mutual benefits.

The shared vision of the NBI is "to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources."

The NBI is governed by a council of ministers responsible for water affairs in the Nile Basin countries. The council is supported by a Nile Technical Advisory Committee and it maintains a secretariat in Entebbe, Uganda.

Joint committees as a mechanism for management; Often, a useful step towards the joint management of shared waters is the setting up of a joint committee or commission with the objective of sorting out and agreeing on facts about the present status and use of the shared water resources.

7. The institutional roles

Flawed demarcation as a constraint on IWRM; When discussing the roles and functions of organizations at different levels, it is important to stress that there can be no blueprints valid for all cases. This is an area where stage of development, financial and human resources, traditional norms and other specific circumstances will play an important part in determining what is most appropriate in a given context. Nevertheless, institutional development is critical to the formulation and implementation of IWRM policies and programmes. Flawed demarcation of responsibilities between actors, inadequate co-ordination mechanisms, jurisdictional gaps or overlaps, and the

failure to match responsibilities, authority and capacities for action are all major sources of difficulty with implementing IWRM. The agencies involved in water resources management have to be considered in their various geographic settings, taking into account the political structure of the country, the unity of the resource in a basin or aquifer and the existence and capacities of community organizations. Institutional development is not simply about the creation of formally constituted organizations (e.g. service agencies, authorities or consultative committees). It also involves consideration of a whole range of formal rules and regulations, customs and practices, ideas and information, and interest or community group networks, which together provide the institutional framework or context within which water management actors and other decision-makers operate.

The importance of effective co-ordination mechanisms; A key issue is the creation of effective co-ordination mechanisms between different agencies. It should not be assumed that *integration* in the sense of organizational consolidation automatically leads to co-operation and co-ordination which in turn leads to the improved effectiveness of water resources management. Fragmented and shared responsibilities are a reality and are always likely to exist. There are many examples where agencies or responsibilities have been merged without significant performance improvements; conversely, there are several examples where the existence of effective co-ordination mechanisms has allowed problems to be handled well despite the need to involve several agencies. It is clear that the simple act of putting all water functions within one agency will not necessarily remove conflicts of interest; decisions about priorities are then made within the agency with the danger of loss of transparency.

Roles and functions of organizations at different levels

National level bodies; In many cases the establishment of an *"Apex"* body at the national level may be desirable for the accomplishment of IWRM. It should at least be responsible for developing policies and strategies, and for co-ordination and national planning regarding water resources. Preferably, it should be independent of major users of water

and should report to government at a high level. National organizations may also have an information gathering and dissemination role and under some conditions may act to regulate and monitor the performance of lower tier organizations.

Bottom-up and top-down strategies; In developing policy-making, implementation mechanisms, consultative, co-ordinating and regulatory bodies, attention has to be paid to the appropriate scale at which they operate. A key tenet of IWRM is that traditional top-down approaches to management have to be supplemented by, and indeed partly replaced by, bottom-up strategies to ensure that the water sector is demand-driven and can deliver welfare gains to the whole range of end users. For bottom-up strategies to be effective new institutions are likely to be needed. In many situations it will be essential to create community based organizations, which can actively participate in the development and management of water supply systems. In other situations democratically elected and representative consultative committees and market mechanisms may be the appropriate means by which users can convey their demands for water goods and services to providers. Bottom-up strategies do not mean that the complete devolution of decision-making to the local or community level is desirable or feasible; an appropriate balance has to be struck between community-level organizations and governmental bodies.

State/provincial/regional level management; In many countries water is managed at the State/provincial/regional level rather than at the national level. Being normally closer to both the resource and service users, this level of government would typically need to consider such issues as the allocation of water and wastewater discharge permits, charging for water, enforcement of standard or permit conditions, monitoring and assessment of water resources, adjudication of conflicts and broad landuse planning issues. Some countries have grouped municipalities, industries and other water users into special-purpose organizations in order to implement water management measures. Sub-national level organizations may also have regulatory functions to ensure that local level service providers are fulfilling their duties effectively.

BOX 5

River basin management in France

A law in December 1964 divided the whole territory of France among six Water Agencies, their spatial limits following hydrological divisions. Each Agency is organized as follows:

- the staff prepares the program, and implements it after approval **(the conscience)**;
- a committee of about 60 representatives of all stakeholders involved approves the program, the fees, the grants and loans **(the forum)**.

Each Agency has the following duties:

- establish five years' water management investment programs;
- collect fees for each m^3 of water abstracted from the natural water resource and for each ton of waste discharged into the natural water resource;
- issue grants or low-interest loans to all actors (cities, industries, etc.) who contribute to the implementation of the five-year program. Expenses and revenues have to be in balance over this five-year program **(the budget)**.

River basin/aquifer/catchment management structures; Water flows according to natural characteristics and does not respect administrative boundaries – therefore the question arises: should water be managed and management structures defined according to existing administrative boundaries or according to natural boundaries, usually taken to be river basins? From a pure water resource point of view there might be much logic in adopting a river basin approach, or at least considering the river basin as the logical planning unit. However, in accordance with the principle of demand-driven development, a river basin organization should only be established in response to a perceived and expressed demand, typically expressed by multiple users. Existing administrative divisions and regulatory conditions might discourage the management of water according to river basin boundaries. It should also be noted that river basin agencies cannot in themselves ensure the sustainable development of the resource. They will need to be supported by a range of institutions that help determine the demands placed on the resource by economic, social and political change.

Elements for the success of a basin organization; Depending on the actual conditions and priorities, river basin (or lake basin or aquifer) organizations may range from being executive bodies with mandates for the allocation of water rights and fee collection to purely advisory bodies advising existing administrative and executive bodies. As an example, the French experience with this system suggests that three elements are essential for the success of an active organization:

- *A conscience,* embodied in the staff and responsible for the collection and assessment of water resources information in the basin, facilitation of co-ordination and negotiation between stakeholders, preparation of plans and proposals for investment and collection of fees for water use and wastewater discharge.

- *A forum* for all stakeholders to discuss and make actual decisions on water resources issues, acting as a kind of a "water parliament" for the river basin. Its responsibility is to supervise the "conscience", to discuss, modify and approve its proposals. The forum should also approve the budget of the river basin organization. Central government should participate in the forum and the national parliament be informed of the river basin organization activities, in order to ensure the necessary links with national policies.

- *A budget* to sustain the organization, and to finance the necessary operations and investments in water-related infrastructure. The budget might be based on charges for water use and wastewater disposal. The river basin organization may encourage sustainable water use by allocating loans and grants to cities, industries or individuals willing to invest in facilities that contribute to the overall goals of IWRM in the basin. Hence, there is a direct link between what is charged for water and what is invested in water.

An international role for basin organizations; River basin organizations may also provide a useful mechanism for management of international water resources. There are numerous examples of such bodies, with varying objectives and functions from around the world, which

suggests that they may contribute to the peaceful, equitable and negotiated management of shared waters. The mere existence of such bodies, providing a forum for the articulation of views and negotiation, encourages states to discuss and solve their mutual problems before disagreements escalate to a crisis level.

The role of local government; In a number of countries the provision of water supply and sanitation services is devolved to local governments. While this should help ensure that service delivery is more attuned to consumer priorities, and that providers are more accountable for their actions, several important issues are raised by devolution:

- To achieve efficiency it is important to distance the provider from short-term political interference;
- The finances of the provider need to be clearly differentiated from the general accounts of the local government unit;
- To minimize the danger of capture, performance monitoring, benchmarking and some aspects of regulation may be more appropriately entrusted to a higher tier of government or some independent agency;
- Institutions are needed to ensure that local providers cannot ignore the effects of their actions on downstream water users or other stakeholders in the catchment;
- Provision of co-ordination mechanisms may be necessary if the boundaries of local governments fail to cover all customers or if more than one local authority exists in an area;
- Small municipalities may need to consolidate their water service facilities and/or activities in order to fully realize economies of scale and scope; and
- It is important that local government recognizes that land use planning, economic development and social policies can all have a profound effect on water demand and the production of waterborne waste.

Civil society and community participation; These groups should be encouraged to participate in operational water resources management. For instance, irrigation schemes may be transferred, with appropriate

regulations, from the government to farmer associations, and community based organizations may be made responsible for the operation and maintenance of local water supply systems. In this way, there is a better chance of establishing a sense of ownership, which is often a precondition for improved and more sustainable management of assets and resources. As mentioned earlier there is also considerable scope for public-private partnerships and private operators, including communities and NGOs, to play a role in water resources management. The exact role played by each of these actors needs to be assessed in the light of local economic, social and political circumstances.

Institutional capacity building

Capacity building for problem solution; Institutional capacity building is a means of enhancing performance. In the context of IWRM, capacity building is the sum of efforts to nurture, enhance and utilize the skills and capabilities of people and institutions at all levels – locally, nationally, regionally and internationally – so that they can make better progress towards a broader goal. At the basic conceptual level, building capacity involves empowering and equipping people and organizations with appropriate tools and sustainable resources to solve their problems, rather than attempting to fix such problems directly. When capacity building is successful, the result is more effective individuals and institutions that are better able to provide products and services on a sustainable basis.

Training accompanied by incentives; Human resources development through training, education and provision of information is a key dimension of capacity building. Training is not, however, enough. If new skills or ideas are actually to be used, institutions and individuals need incentives to change practices and approaches; such incentives will need to be consistent with the broader goals of the institutions concerned. Improved human resources are a key factor in bringing about institutional capacity building. The ability of an institution to adapt to changing demands depends to a large extent upon its ability to adapt its human potential – the knowledge, perspectives and skills of its staff.

Conditions for fulfilment of institutional mandates; Equally important for an institution's capacity to fulfil its mandate is the proper devolution of institutional responsibilities, functions and jurisdictions. This is likely to involve solving problems of jurisdictional overlaps and competition between institutions, in addition to the creation of proper and sustainable financing mechanisms.

8. Management instruments

The importance of a "tool box"; The management instruments for IWRM are the tools and methods that enable and help decision-makers to make rational and informed choices between alternative actions. These choices should be based on agreed policies, available resources, environmental impacts and the social and economic consequences. A wide range of quantitative and qualitative methods is being offered by systems analysis, operations research and management theory. These methods, combined with a knowledge of economics, hydrology, hydraulics, environmental sciences, sociology and other disciplines pertinent to the problem in question, are used for defining and evaluating alternative water management plans and implementation schemes. The art of IWRM is about knowing the available elements of the "tool box" and selecting, adjusting and applying the mix of tools appropriate to the given circumstances.

Water resources assessment: availability and demand

The importance of water resources assessments; Management of water resources requires an understanding of the nature and scope of the problem to be managed. How are all relevant water resources problems identified? How can we make sure that we acquire useful information which enables us to identify and assess existing and potential future water resources problems and solutions? Carrying out water resources assessments is a useful way of acquiring such information as a basis for management.

The need for a water resources knowledge base; In many countries available information about the water resources situation is scarce, fragmented, outdated or otherwise unsuitable for management purposes. Without adequate access to scientific information concerning the hydrological cycle and the associated ecosystems it is not possible to evaluate the resource or to balance its availability and quality against demands. Hence, the development of a water resources knowledge base is a precondition for effective water management. It takes stock of the resource and establishes the natural limits for management.

Objective of water resources assessments; The concept of water resources assessments is here interpreted to imply a holistic view of the water resources situation and its interaction with societal use in a country or region. The assessment should address the occurrence in space and time of both surface- and groundwater quantities and associated qualities, and give a tentative assessment of the water requirements for the assumed development. In this respect there is a distinct need for comparative measures of water use efficiency and intensity in use (i.e. product per drop). At the initial stage the assessment would preferably be based – to the largest extent possible – on existing data and knowledge in order to avoid any unnecessary delay in the process of implementing management improvements. The objective of the assessment is not to solve the problems but to identify and list the problems and identify priority areas within which more detailed investigations may be carried out.

Demand as a function of user behaviour and preferences; It is important to stress that the water knowledge base must include data on the variables which influence demand; only with such data can a flexible and realistic approach to assessing water demands be taken. If not considered in a context of water scarcity and competition, sectoral planners may be overly optimistic about possible development and associated water requirements. Effective demand management may influence demand figures significantly. The use of scenario building for water demand projections may be advantageous and serve to identify possible ranges for various categories of future water demands. In addition, assessing effective demand by analysing the behaviour of

users as they react to water scarce situations provides key information that is vital to determining appropriate pricing policies.

The importance of monitoring and gauging systems; The assessment of water resources availability and quality, and their possible long-term changes through consumptive water use, climate or land use change, are highly dependent on reliable data from monitoring and gauging systems; this indicates the need for resources to be allocated for the investment, operation and maintenance of this aspect of water infrastructure. This is sometimes neglected in favour of allocation of financial resources to the construction of more tangible assets such as water supply systems or dams. However, considering the potential economic implications of, for example, deciding to build a hydropower plant based on unreliable river flow data, it turns out that money spent on the collection of water resources data may entail considerable savings in investment costs.

Environmental Impact Assessments (EIA); EIA plays a central role in acquiring information on the social and environmental implications – including water resources implications – of development programmes and projects, identifying the measures necessary to protect the resource and related ecosystems and then ensuring that such measures are implemented. The IWRM approach implies that sectoral developments are evaluated for possible impacts on the water resource and that such evaluations are considered when designing as well as giving priority to development projects. EIAs are concerned not only with impacts on the natural environment but also with effects on the social environment. Hence, the EIA touches the heart of the need for cross-sectoral integration involving project developers, water managers, decision-makers and the public, and provides a mechanism or tool to achieve this.

Risk assessment tools; Risks associated with IWRM come in different shapes – usually related to extreme climatic events, public health and environmental damage (in addition to business related risks). It is never possible to eliminate risk. Well-established techniques are available to undertake hazard (frequency and magnitude of events) and

risk assessments. However, such assessments, which rely heavily on science, technology and economics, neglect the question of what levels and types of risks are acceptable within civil society. This is a perceptual cultural issue that can only be addressed within a participatory approach to IWRM.

Risk management; Risk mitigation is never costless and, in real world circumstances of capital and human capacity constraints, trade-offs will inevitably have to be made not only over the levels of risk which people may have to accept but also over the types of hazards which can be tackled in particular countries and at different points in time. Essentially, risk management is about achieving an appropriate balance between the benefits of risk taking and the losses incurred, and about preparing the means by which people and property can be safeguarded when adverse conditions arise.

The precautionary principle; From an environmental point of view the precautionary principle in risk management may be warranted in some instances. One key lesson, for example, is that actions to avoid potentially irreversible environmental damage should not be postponed on the ground that scientific research has not fully proved and quantified a causal link between cause and potential damage. The principle here is that a precautionary approach may reduce costs by preventing the damage rather than having to remedy the damage after the event, but not that all possible risks should be avoided.

Communication and information systems

Communication for enhancement of stakeholder involvement; The principle of stakeholder participation in water resources management requires a serious effort of awareness raising among politicians, decision-makers in the water sector, professionals, interest groups and the public at large. In any attempt to attract attention and support for water management from these groups, success will depend upon the mechanisms of communication and the quality and relevance of available information. Communication and information systems should address the question of opportunity cost and trade-offs between

alternative water uses and projects on the one hand, and other social investments on the other.

Information needs for stakeholder involvement; In order to encourage stakeholder participation in water resources management, and in order for the participatory process to be effective, the availability of timely and relevant information to all concerned is an essential precondition. Therefore, adequate official surveys and inventories of water sources and supplies, up-to-date registers and records of water uses and dischargers, water rights, and the beneficiaries of such rights, with their respective water allocations, should be made available to the public. In addition the results of benchmarkings and performance evaluations of service providers should be made publicly available as this contributes to the competitive and transparent provision of water services.

Stakeholder communication strategies; Concrete strategies for communication with all actors and stakeholders need to be devised. In the area of EIA there have been attempts to institutionalize public participation through, for instance, public information sessions, expert panel hearings, citizen juries and similar methods. The "water sector" might take advantage of the experiences gained in this area. However, the most appropriate method in each case needs to take account of local social, political, cultural and other factors.

Openness and transparency; Some countries have little experience of conducting water resources management in an open and transparent manner with full public access to information. Decision-making has often been left to professionals and scientific experts, thus excluding other stakeholders from the process. A continuation of this approach will be counterproductive to assuring broad participation and private sector investment in water management.

International exchange of information; Especially when dealing with international water courses, openness and sharing of information are key to the achievement of IWRM since all involved riparian countries have "natural monopolies" in data collection and dissemination within their national territories.

Water allocation and conflict resolution

Issues in allocation; To allocate water efficiently and effectively to competing users, the following issues have to be addressed:

- When markets do not fully capture the total value of water other mechanisms have to be used to allocate water to the highest value uses and users;
- Market mechanisms (trading systems and/or full cost pricing through valuation) could be improved in conjunction with the formulation of appropriate regulatory systems; and
- Conflict resolution mechanisms may be used to facilitate water sharing among competing users such as upstream and downstream stakeholders

Allocation by market-based instruments; Normal goods and services that are exchanged through perfectly functioning markets get allocated to their highest valued use. In the water case, because of the intrinsic attributes of the resource and because of the way it has been managed historically, not all water values (including social and environmental values) are or indeed can be reflected in market prices. Thus, full cost pricing tools through valuation and enhanced water trading are needed to complement and correct the faulty market valuation processes.

Using valuation to resolve conflicts; The process of determining the value of water to various stakeholders could enhance their participation in decision-making and contribute to resolving conflict. These tools would not only ensure that existing water supplies are allocated in a sustainable fashion to the highest-value uses but would also enable water managers to determine when the users are willing to pay the costs of investing in additional water-dependent services.

Resolution of upstream-downstream conflicts; Conflicts among upstream users and downstream users within a country tend to be pervasive and usually result in undue delays in the implementation of water resources development projects. Currently, such conflicts may be resolved through political negotiations or the involvement of the judiciary. However, experience shows that the involved parties often

use such negotiations to postpone agreements on water sharing. It is important to note that resolving upstream-downstream conflicts requires acceptable estimates of water resource availability over time, taking into account return flows and the effects of catchment development on evaporation losses and run-off. One way to resolve such conflicts is to involve water users and other stakeholders who will be affected by the water resources development project. As a safeguard for parties negatively affected by the status quo, governments should also always have a default compulsory jurisdiction function for conflict adjudication. Unless governments have such powers the parties benefiting from the status quo have no incentives to enter negotiations or accept mediation to solve the allocative conflicts from which they derive a benefit.

Conflict management techniques; A wide range of conflict management techniques, involving both consensus building or conflict prevention and conflict resolution, is available to assist stakeholders in their negotiations. Decision-makers could integrate this expertise and experience more widely in the water sector. Empirical research is required to evaluate and learn from the experience so far gained (e.g. in USA, Australia) in attempts to resolve conflicts between upstream and downstream users and between different sectoral interests.

Valuation by conflict resolution methods; The fact that not all services provided by water and water- related ecosystems can be valued in an objective and quantitative manner, independent of the value systems of those involved, also links valuation directly to conflict resolution techniques. In the presence of a market, the agreed price is an indicator of the value of the good or service and serves to prevent conflicts. In the absence of a market, values can be approximated through explicit valuation techniques that transform attributes into their monetary units, or they can be determined implicitly through conflict resolution methods (i.e. every agreement reached also implies an agreed value of the goods and services provided in the uses considered in the conflict).

Valuation research on environmental benefits; There is a special need to develop further methodologies for valuing the benefits of

ecological services provided by nature. Although some attempts have been made to put values on direct environmental and ecological services such as fishing, grazing and forestry, the main problems appear to be in assigning economic values to non-market benefits, such as biodiversity and intrinsic value. One key problem is how to include the value of the environment in providing water services, including the sustainable provision of the water resource itself. The value of catchment protection to downstream users and the value of groundwater recharge areas have not been adequately incorporated in planning methodologies. In practical terms, as with many aspects of environmental planning, the first requirement is to broaden the scope of valuation exercises, through linking the expertise of economists to the analyses of hydrologists and ecologists. Valuation of ecosystem costs and benefits has not been on the practical water management agenda so far; multidisciplinary research is needed for this.

Regulatory instruments

Three groups of regulatory instruments; A multitude of regulatory instruments is at the disposal of water authorities in setting up appropriate management structures and procedures. These fall into three main groups: direct controls, economic instruments, and encouraged self-regulation. In most situations authorities will need to employ a mix of instruments to ensure effective and low-cost regulation.

Direct controls

Executive regulations; There is a need for management instructions and rules interpreting and detailing water legislation. If sustained by enabling laws, containing both basic substantive principles and authorization for delegation of authority and issuance of regulations, the usefulness of executive regulations lies in the fact that they – contrary to laws – can be made and amended at short notice, quickly responding to changing environmental, economic or social circumstances. Typically, executive regulations are needed for abstraction of water and discharge of wastewater and may order users – or certain

categories of users – to obtain permits for abstraction or discharge of water. The regulations would describe the procedures to be followed in applying for permits and the criteria for granting permits. As a general rule it should be ensured that only executive regulations which are enforceable be implemented. If the existing enforcement capacity is deemed insufficient, regulations should be simplified or abandoned.

Water right systems; While in most countries water is considered a national asset under public ownership, there are some countries which implicitly treat water as an unlimited resource, where it is de facto a "common resource" without clearly defined property rights. In other countries water rights are linked to land tenure, with inadequacies and conflicts occurring because of the non-stationary nature of water and inter-connections within the hydrological cycle (who owns the water flowing in the river, and how can the necessary multiple use of water be accounted for?). Stable and secure water rights should be pursued because they are an important incentive for private investment. In granting water rights it is, however, equally important to prevent the waste of water, monopolization, harm to third parties and environmental degradation. Thus, water rights are rights to use certain amounts of water rather than the right to the ownership of the resource itself. Many systems also include provisions for penalizing the non-use of allocated resources.

Standards and guidelines; These instruments have been widely applied to:

- control the quantity of water withdrawn by users from the natural water system within set time periods;
- control the discharge of waste products into water courses (controls can be placed on the quantity, quality, timing and location of discharges);
- require specific technologies to be employed (technology standards) to either reduce water use or waste loads; and
- specify product standards, both for water provided for specific users and for goods which are potentially polluting (e.g. water efficiency standards).

Standards and other direct regulations have been heavily criticized as being inflexible, costly to implement, prone to imperfect implementation and evasion and for failing to allow users the freedom to employ a range of techniques to conserve water or reduce waste disposal. These defects have been one reason why the use of economic instruments have been increasingly advocated.

Land use planning controls; Some water authorities have long employed land use controls to protect their supply sources; for example, land uses may be regulated in upstream recharge areas and around reservoirs to prevent pollution, siltation and changed run-off regimes. However, their ability to do this will clearly depend upon their functional and spatial jurisdiction. Likewise, some water authorities have been regarded as legitimate consultees when development decisions (industrial sites, housing developments, etc.) are made in order that water supply and pollution issues are taken account of in the planning process. In the context of IWRM the management of land use is as important as managing the water resource itself since it will affect flows, patterns of demand and pollution loads. Moreover, effective land use planning can also help promote water recycling and planned reuse.

Position of consumptive and non-consumptive users within the basin; When water is taken from a river in order to irrigate land, practically no water comes back immediately to the river and most of it is either evaporated, or infiltrated into the soil and is lost to other uses for a substantial period of time. In contrast, when water is employed for domestic or industrial purposes, a significant proportion returns to the river very quickly and can be reused by others subject, of course, to appropriate treatment. “Consumptive” water use raises questions about the exact location of each user along a river, suggesting that the possibilities for sequential use of water be considered when locating water-depending activities. However, it should be noted that ‘non-consumptive’ users, who return waste flows to the river system, can ‘consume’ resource value if the untreated wastes cannot be reused and if they destroy valued ecosystems.

Utility regulation (both private and public owned); Water supply and sanitation is a monopoly industry providing essential services. Government needs to regulate the industry and has to strike a balance between providing actors with the incentives to invest and operate efficiently, and ensuring that the interests of society at large are protected. Because of aspects such as the monopoly of water as a product, capital intensity and sunk costs for infrastructure, unregulated competition on a free market is not an option for the water sector. Some of the major regulatory tasks involve defining and dealing with risks, setting up appropriate contractual operating arrangements, defining performance indicators, monitoring compliance and performing transparent benchmarking assessments.

Economic instruments

Efficiency of economic tools; The use of economic instruments is on the increase but has far from reached its full potential. Until now most governments have relied primarily on direct regulation in water resources management. However, economic tools may offer several advantages, such as providing incentives to change behaviour, raising revenue to help finance necessary investments, establishing user priorities and achieving management objectives at the least possible overall cost to society. Prerequisites for successful application of most economic instruments are appropriate standards, effective administrative, monitoring and enforcement capacities, institutional coordination, and economic stability. Designing appropriate economic instruments requires simultaneous consideration of efficiency, environmental sustainability, equity, and other social concerns, as well as the complementary institutional and regulatory framework. Some notable examples of economic instruments include water prices, tariffs and subsidies, incentives, fees and fee structures, water markets, and taxes.

Water prices, tariffs and subsidies; According to the principle of managing water as an economic and social good, the recovery of full costs should be the goal for all water uses, unless compelling reasons indicate otherwise. Yet, this principle entails inherent difficulties: How can principles of equitable access to water used for basic human needs

BOX 6

Focal subsidies – Chilean experience

Chile has been able to implement a well-working system of focal subsidies in the water and sanitation sector. The success of the system depends on the concerted effort and institutional capabilities of the national government, the municipalities and the water companies.

Other countries in Latin America have attempted to replicate the very successful Chilean experience. However, the funds available did not match the needs of the users, neither did the institutional capability of governments match the monitoring requirements of system implementation and enforcement. For this reason some countries, such as Argentina, have resorted to traditional cross-subsidies, despite the obvious drawbacks of the system.

The lesson is that before suggesting either focal or cross- subsidies, countries and financing institutions should ensure not only financial and economic viability, but also that institutional structures do allow efficacious implementation.

be taken into account at the same time? At a minimum, full supply costs should be recovered in order to ensure sustainability of investment and the viability of service providers. However, in many situations, even the achievement of this objective may require direct subsidies for years to come. Poverty alleviation policies might be incompatible with abrupt implementation of full supply cost recovery in, for instance, some surface irrigation systems. In the provision of municipal and rural water supply there are well-established practices of cross-subsidization from better-off water users to the poor. The use of cross-subsidies does not necessarily compromise the financial sustainability of utilities but they distort prices and patterns of demand. For management purposes such subsidies should be made in a transparent manner and, where possible, direct subsidies are the preferred option to reduce distortions in the system. Under normal circumstances industries should meet at least the full economic cost of the supplied water.

Tariffs as incentives; In the domestic sector the scope for reducing water consumption may be relatively small because of the need to provide enough water to meet basic health and hygiene requirements.

Nevertheless, reductions are possible and overall, tariff or fee setting that sends the right price signals to water users is an important element of much-needed demand management. In irrigation, pricing may be used to encourage a shift from water-intensive crops to other crops.

Fee structures; Water tariffs provide little incentives for the sustainable use of water if charged at a flat rate independent of the amount used. In such cases, setting the right fee structure, imposing progressively higher unit cost prices on high-volume users, may induce the more judicious use of the resource, although the level of demand reduction will depend upon the nature of the high-volume users. Such a structure also contributes to the financial sustainability of water authorities and to covering the cost of administering water resources management.

BOX 7

Tariffs and fees

There is scattered but compelling evidence that improved policies can have major impacts and at least 20-30% of water used by households and industries can be saved by applying appropriate policy instruments. Experience shows that higher water prices and pollution charges result in a "win-win" situation of water conservation and reduced water pollution. Two examples are reported below:

In Bogor, Indonesia, as a result of a tariff increase of 200-300% for different consumer groups in 1990, a household with a monthly consumption of more than 30m^3 had to pay $0.42 for a cubic meter of water (exceeding consumption of 20m^3) instead of $0.15. This produced significant reductions - around 30% - in water use for the affected groups.

In Sao Paulo, Brazil, in 1980, three industrial plants were requested to pay effluent charges to the central effluent treatment facility. The companies decided to economize production through changes in processes, substitution of inputs, use of more efficient equipment, and use of mechanical washing instead of manual washing. In the pharmaceutical industry, the volume of effluent (and of water consumption) per unit of output in 1982 was 49% less than in 1980. In the food processing industry, effluent and water consumption were lower by 42% per unit of output compared with 1980. The steps taken to achieve these reductions were changes in washing processes and effluent recycling, and modifications in cleaning processes. In the dairy industry, the effluents and water use were lowered by 62% through improvements in the washing process and expansion of the on-site treatment plant.

Fees for wastewater discharges; In accordance with the 'polluter-pays-principle', effluent fees may be levied on waste water discharges; these should be set to reflect both the cost of environmental externalities and those associated with treating polluted wastewater or the recipient waters. The fees can be related to both the quantity and quality of individual discharges and then adjusted carefully to create optimum incentives for polluters to introduce improved treatment technology, reuse water and minimize the pollution of water resources. This tool needs to be combined with regulatory measures to control and monitor the contaminants discharged and is especially suited for industrial polluters. A judicious mix of progressive water tariffs and pollution charges will provide adequate incentives for water conservation, recycling and reuse within industries.

Water markets; Under the right circumstances water markets can improve the efficiency of water resources allocation and help ensure that water is used for higher-value purposes. This, however, requires an appropriate regulatory and institutional framework in order to account for market imperfections and other external effects, as described in the section "The role of government".

Taxes; Product charges or taxes on environmentally damaging products may be a powerful tool in affecting behaviour and are especially suitable where the users have alternative production or waste disposal choices which are less environmentally harmful. This tool could be applied for both products involving high water consumption and products which contribute to water pollution. For non-point pollution problems, especially those related to the use of agrochemicals, this option has proved to be the most useful tool, since direct discharge control or treatment options are not feasible here. Hence, the reduction of pollution is achieved through decreased use of agrochemicals as a response to higher product prices. However, any adverse effects on food production of higher prices for fertilizers and pesticides would have to be considered.

BOX 8

Water markets

Water markets are widely utilized in the American West. Available water supplies and water rights are quantified and recorded. Water rights are granted under conditions of effective and beneficial use. Transfers are supervised and monitored by regulatory institutions. These markets have been active.

Other countries have implemented water markets without requirements of effective and beneficial use. Government supervision is minimal. These markets have not been active.

The lesson learnt is that markets that operate under close government regulation, under the principles of effective and beneficial use, and prevention of harm to third parties and the environment, have promoted efficient and equitable water reallocations.

Encouraged self-regulation

Guidelines and information; Controlling information can be a low-intervention mode of regulation. Two common versions exist: mandatory disclosure of performance data or labelling of products and controls over false or misleading information. Transparency of information can not only provide water service providers with incentives to improve their performance (e.g. benchmarking league tables) but also allows civil society and governmental bodies to judge and push for performance improvements. In recent years the high costs of command and control regulation has encouraged the development of ”self-regulatory” mechanisms, supported by appropriate procedures for performance monitoring. For example, professional organizations may produce best practice guidelines or governments may introduce ”quality” hallmarking schemes; such schemes are now quite common in the environmental and product safety areas and may be a useful addition to the water sector tool box.

Technology

Technological advances towards sustainability; In evaluating the range of available management tools, the role of and scope for technological advances should still be carefully considered as a factor that may help achieve sustainable water resources management. There is scope for substantial progress both in technology refinement within the water sector itself and in those other productive sectors which critically affect the supply of and demand for water services. Traditional technologies like rainwater harvesting can also play a key role.

Research and development in technology; Technological innovation and adaptation are key components of many efforts within the water sector. At the conceptual level models and forecasting systems are being improved, particularly as a result of advances in computer technology, to allow better predictions of temporal and spatial variations in the quantity and quality of available water resources. This may help to reduce uncertainties and risks in the use and management of the resources. Water saving technologies in irrigation (e.g. drip irrigation), improved and cost-effective methods for the treatment and reuse of wastewater in industries and domestic systems, aquifer recharge technologies, human waste disposal systems that require no or extremely small quantities of water, and cheap but effective water purification systems for villages are other examples of promising innovations which can promote the sustainability of future water resources. However, achieving such technological advances requires both appropriate incentives and the willingness of more wealthy countries, particularly the more wealthy industrialized nations, to invest in research with a long-term return.

Technology assessment; What could be labelled as "auxiliary" technological achievements may also be usefully considered in water management. These are technologies that are developed for purposes other than water saving and water management but may have considerable effects on the water sector. Examples include genetically modified crops resistant to pesticides and with lower water needs, optimization of crop selection to better match climatic conditions, and reductions in the costs of producing energy, which could allow the

wider application of desalinization as a cost effective method for fresh-water provision. Water managers must keep abreast of developments and be willing to experiment and co-operate with other sectors.

Technology choices; In addition to the above-mentioned promising prospects, a word of caution is warranted on the issue of technology. Many projects in the water sector have failed due to the uncritical application in developing countries of technologies that have worked in industrialized nations but in totally different physical, social and economic settings. It has to be realized that technological choices must take account of specific conditions prevailing at the location of use. This means that the most advanced and modern technology is not necessarily the optimal choice in all cases. If the system cannot be sustained because of lack of spare parts, skilled manpower or economic resources for operation, it is not the most appropriate solution. Moreover, high-cost technologies can prevent community and household involvement in water management.

List of abbreviations

BAT	Best Available Technology
GPA	Global Programme of Action
CSD	Commission of Sustainable Development
EIA	Environmental Impact Assessment
GWP	Global Water Partnership
GIWA	Global International Waters Assessment
IWRM	Integrated Water Resources Management
NGO	Non-Governmental Organization
O&M	Operation and Maintenance
SADC	Southern Africa Development Community
TAC	Technical Advisory Committee
UNCED	United Nations Conference on Environment and Development

Global Water Partnership (GWP), established in 1996, is an international network open to all organisations involved in water resources management: developed and developing country government institutions, agencies of the United Nations, bi- and multilateral development banks, professional associations, research institutions, non-governmental organisations, and the private sector. GWP was created to foster Integrated Water Resources Management (IWRM), which aims to ensure the co-ordinated development and management of water, land, and related resources by maximising economic and social welfare without compromising the sustainability of vital environmental systems.

GWP promotes IWRM by creating fora at global, regional, and national levels, designed to support stakeholders in the practical implementation of IWRM. The Partnership's governance includes the Technical Advisory Committee (TAC), a group of 12 internationally recognised professionals and scientists skilled in the different aspects of water management. This committee, whose members come from different regions of the world, provides technical support and advice to the other governance arms and to the Partnership as a whole. The TAC has been charged with developing an analytical framework of the water sector and proposing actions that will promote sustainable water resources management. The TAC maintains an open channel with its mirror bodies, the GWP Regional Technical Advisory Committees (RTACs) around the world to facilitate application of IWRM regionally and nationally. The Chairs of the RTACs participate in the work of TAC.

Worldwide adoption and application of IWRM requires changing the way business is conducted by the international water resources community, particularly the way investments are made. To effect changes of this nature and scope, new ways to address the global, regional, and conceptual aspects and agendas of implementing actions are required.

This series, published by the GWP Secretariat in Stockholm has been created to disseminate the papers written and commissioned by the TAC to address the conceptual agenda. Issues and sub-issues with them, such as the understanding and definition of IWRM, water for food security, public-private partnerships, and water as an economic good have been addressed in these papers.

Global Water Partnership

GWP Secretariat, Sida, SE-105 25 Stockholm, Sweden. Office: Sveavägen 24-26, Stockholm
Telephone +46 (0)8 698 50 00 Telefax +46 (0)8 698 56 27
E-mail gwp@sida.se www.gwpforum.org

ISBN: 91-630-9229-8