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Firming up the Conceptual Basis of Integrated Water Resources Management

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ABSTRACT *This paper focuses on defining the concept and process of Integrated Water Resources Management (IWRM), and in particular what is being 'integrated'. In the 'natural system' integration traditionally involves land and water; surface water and groundwater; water quantity and quality; and upstream and downstream water-related interests, including the upstream freshwater catchments and the downstream coastal zone. However, equally important, but less traditional, is the integration in the 'human system' involving a holistic institutional approach; mainstreaming water in the national economy; cross-sectoral integration in national policy development; linkages to national security and trade regimes; and involvement of all stakeholders across different management levels.*

Introduction

Worldwide, we are still far from securing water for basic human needs and development. At the same time, we are in many places approaching—or have surpassed—the limits for sustainable use of the water resources and the ecosystems that they support. Continued growth in population and economic activity leads to further increases in water demands and pollution, and thus to increased competition and conflict over limited water resources.

All life and all sectors of the economy depend on water. At the same time, most uses have some direct or indirect quantity or quality effects on the availability of water for other uses. That interdependence calls for integration.

The traditional sectoral and fragmented approach to water resources management has not recognized these basic features of water. Thus, it has often led to governing bodies representing conflicting interests, and to policy objectives that have been set without consideration of the implications for other water users and without consultation across sectoral and institutional boundaries. While the basic natural conditions and economic and social resources vary enormously from country to country, the lack of integrated policies and practices in water resources management has been almost universal. As a result, the available water and financial resources invested in the development of the resource have not been employed to maximize total social welfare.

There seems to be an increasing recognition that the water crises are mainly management and governance crises. There is a need to find appropriate ways to co-ordinate policy making, planning and implementation in an integrated man-

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ner across sectoral, institutional, professional and basin boundaries and to take into account the even more complex co-ordination issues arising over the management of international watercourse systems.

This is all well documented, and most recently the Second World Water Forum in The Hague confirmed the seriousness of the threatening water crises (Global Water Partnership (GWP), 2000; World Water Council, 2000). The Second World Water Forum set up a range of visions and a framework for action for how we can avoid the water crises and move towards long-term water security for people and the environment. Integrated water resources management (IWRM) is the proposed management approach to reach these goals.

What is IWRM: A Definition?

IWRM has been on the global agenda for a long time and has attracted significant attention since the international conferences on water and environmental issues in Dublin and Rio de Janeiro held in 1992. Yet, IWRM has never been unambiguously defined, nor has the question of how it can be implemented been fully addressed. To some extent IWRM has degenerated into one of these buzz-words that everybody uses but that means many different things to different people.

Such a high level of ambiguity is not fruitful. It obscures the debate and creates unnecessary misunderstandings. It is also counterproductive to one of the main thrusts of IWRM, namely to bring different water views and interests together.

This paper focuses on defining the concept and process of IWRM, in particular on what should be integrated. It summarizes and extracts from the work and thinking of the Technical Advisory Committee (TAC) of the GWP. The GWP TAC has embarked on a process to clarify, within the GWP and among the GWP partners, how to interpret the IWRM concept and process. To date this has resulted in five TAC background papers.

The main purpose of this effort is to firm up the conceptual basis of IWRM, as attempted specifically by GWP TAC (2000), thus assisting in creating a common platform for further discussion and consultation among professionals and decision makers. The intention is not to present an academically stringent theory, but rather to facilitate and promote an agreed language for talking across sectors, disciplines and other divides. The approach taken is intentionally pragmatic. It attempts to build bridges between the different academic disciplines, sectoral interests and broader political interests involved in water resources management. The results of such a process will inevitably differ, depending on the perspectives of the different disciplines and interests. All will have to compromise.

For the purposes of providing a common framework, the following definition of IWRM has been suggested by the GWP TAC (2000, p. 22):

> 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.

The definition recognizes that management should be understood in its broadest

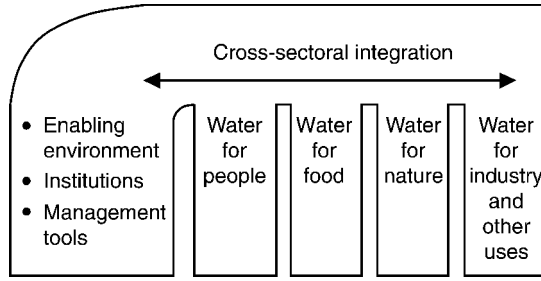

Figure 1. IWRM is the 'integrating handle' leading us from subsectoral to cross-sectoral water resources management. *Source:* GWP TAC (2000, p. 29).

sense, i.e. the 'M' in IWRM should be interpreted as 'development and management'.

The definition emphasizes that IWRM is a *process.* Thus, IWRM is not a goal in itself. It is a means to an end, or rather it is the process of balancing and making trade-offs between different goals in an informed way.

The most basic social, economic and environmental goals are implicit in the definition:

- *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 the maximum possible economic efficiency in order to ensure social welfare and contribute to the elimination of poverty;
- *social 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 sustains the vital life-support systems, thereby not compromising use by future generations of the same resource.

The specific details of these goals will have to be balanced through political negotiations in the IWRM process.

Finally, the definition emphasizes that IWRM is about *co-ordination.* It is the 'integrating handle' that can lead us from fragmented subsectoral to holistic cross-sectoral water management (Figure 1).

What is Being Integrated with What?

IWRM is often confused with other 'new' approaches to water resources management and development, such as river basin management, water demand management and the ecosystems approach. IWRM is definitely closely related to these approaches, but the centre of concern is different.

River basin management concerns using the basin/catchment/aquifer as the basic water management unit. As water flows according to the natural boundaries of the basin, allocating certain water resources management functions to river basin entities will often be a very useful way to ensure that IWRM issues are considered. However, IWRM is much broader than that. A fundamental IWRM issue faced by many water-stressed countries is to what extent the

country should attempt to be self-sufficient in food, or move towards importing part of its food requirement (and thus water requirements as 'virtual water'). Another important IWRM issue that some countries will have to address is the link between subsidized energy prices and overexploitation of the groundwater resources for irrigation purposes. These are examples of issues that, although they may be approached at the river basin level, ultimately need to be addressed at the national level in the form of national policies and international relations.

Similarly, water demand management and the ecosystems approach are critically important approaches to meet water resources management challenges. Each has much to offer to IWRM, but they address only part of the complex issues of IWRM.

There are two basic categories of integration. The first is the *natural system*, which is a critical determinant of the availability and quality of water resources. The second is the *human system*, which shapes resource use, waste production and pollution of the resource, and which sets development priorities. Integration has to occur both within and between these categories, taking into account variability in both time and space. This is different from the traditional approach, which fragments water management by sector. IWRM also views the role of water managers more holistically, including not only the traditional 'water professionals', but also a wider range of stakeholders from other, water-related sectors. Using IWRM approaches helps water managers recognize how people's behaviour affects demand for water and, thus, how to change from traditional supply management to more demand-responsive approaches.

Integration in the Natural System

Integration in the natural system involves the following.

Integration of land and water (including 'green water' and 'blue water') management. The starting point for water resources management must be the hydrological cycle. In the hydrological cycle, water is transported between the compartments of air, soil, vegetation and surface water and groundwater sources. Different types of land use and vegetation cover have, through their differences in consumption use and ability to store water ('green water'), a significant influence on the availability (i.e. amount and quality) of water for other water uses. Most water management, including the literature on IWRM, tends to focus on the 'blue water' extractable from surface water and groundwater bodies, thus neglecting rain and soil water management. Management of 'green water' and 'blue water' in an integrated way holds significant potential for water savings (crop per evaporated drop in rain-fed and irrigated agriculture), increasing water use efficiency and the protection of vital ecosystems.

Likewise, water is a key determinant of the character and health of all ecosystems (terrestrial as well as aquatic). Their water quantity and quality requirements therefore have to be taken into account in the overall allocation of available water resources. These basic relationships are often neglected by water managers.

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, between 'blue water' and 'green water' and between upstream and downstream water interests.

Integration of surface water and groundwater management. The hydrological cycle also calls for integration between surface water and groundwater management. The drop of water retained at the surface of a catchment may appear alternately as surface water and groundwater on its way downstream through the catchment. The widespread use of agrochemicals and pollution from other non-point sources already pose significant threats to groundwater quality and force managers to consider the linkages between surface water and groundwater. Groundwater pollution is frequently, for all practical purposes, irreversible over a human time-scale, given present technologies and the remediation costs involved. Similarly, there are a multitude of feedback effects of groundwater withdrawal and use on the surface.

Integration of quantity and quality (including water and waste water) in water resources 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. 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. 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.

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.

Integration of upstream and downstream water-related interests. An integrated approach to water resources management entails the 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.

Integration of freshwater management and coastal zone management. Freshwater management and coastal zone management should be, if not integrated, then at least co-ordinated, reflecting the 'continuum' of fresh water and coastal waters. Freshwater systems, including upstream land-based sources of pollution, 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.

Integration in the Human System

Integration in the human system involves the following.

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). The development of an institutional framework capable of integrating human systems—economic, social and political—represents a considerable challenge.

Mainstreaming water in the national economy. Water must be integrated into the general economic development planning processes by striving for government policies, financial priorities and planning that take account of the implications for water resources development, water-related risks and water use. Likewise, investments in large-scale water developments may have macro-economic effects and pose financial risks that cannot be understood in isolation from the general macro-economic planning process.

It is also essential that government makes policies that encourage *all* economic sector decision makers (public and private) to take the real value and full costs of water into account when making production and consumption choices.

Integrating water resources planning with poverty alleviation. Poverty alleviation is possibly the most pressing development issue in many developing countries. Poverty is closely linked to water resources management. It is the basic need of the poor for household water that is not met, and it is the rural and urban poor, who depend on agriculture, fisheries and other natural resources for their livelihoods, who suffer the most from water scarcity and pollution. It is essential that the specific linkages between poverty and water in a given context are analysed, understood and taken into account in the overall water resources management and development policies, as well as in the application of various management tools and instruments. Water allocation and regulatory instruments (for example, through pricing and charges) that are central to IWRM in more affluent areas may have very negative effects on poverty alleviation and equity concerns if these instruments are not adapted to the specific local socio-economic context (van Koppen & Schreiner, 2000).

Cross-sectoral integration in national policy development. The decisions of economic sector actors will in most countries have a significant impact on water demand, water-related risks and the availability and quality of the resource. The decisions will not be water-sensitive unless clear and consistent information is available on the full costs of actions and their implications; importantly, incentives to take account of the external costs of their decisions have to be given. Water-related developments within all economic and social sectors should be taken into account in the overall management of the water resources. National food, energy and industrial policies may have a profound impact on water resources, and vice versa. Hence, developments in these sectors must be evaluated for their implications for water resources management and possible impacts

on the natural system. This is not as simple as it might seem. IWRM must include procedures for cross-sectoral information exchange and co-ordination, as well as techniques for evaluating the implications of individual projects for water resources in particular and for society in general.

Linking water resources planning to national security and trade policies. On a broader international scale, water resources management is intimately linked to international trade regimes and national security issues. 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.

Another national security aspect of water resources management is the link to international trade in food and other products that require significant amounts of water to produce. For some of the world's most water-stressed countries the critical water resources issue is to what extent they can rely on importing 'virtual water' through food grains without compromising national security interests.

Integration across different management levels. 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 in implementing IWRM. The agencies involved in water resources management have to be considered in their various geographical 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.

Involvement of all stakeholders in the planning and decision process. The need to involve 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, 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 at the lowest appropriate level of implementation; at each implementation level the relevant stakeholders need to be identified and mobilized.

Implementing IWRM

Integration is a necessary but not sufficient condition for sustainable water resources management. IWRM is the process of balancing and making trade-offs between the ecological, social and economic goals and interests in a practical, scientifically sound way. The goals, interest and challenges will vary from place to place.

A simple framework is proposed as the starting point for moving towards IWRM, as illustrated by Figure 2. Concurrent development and strengthening of

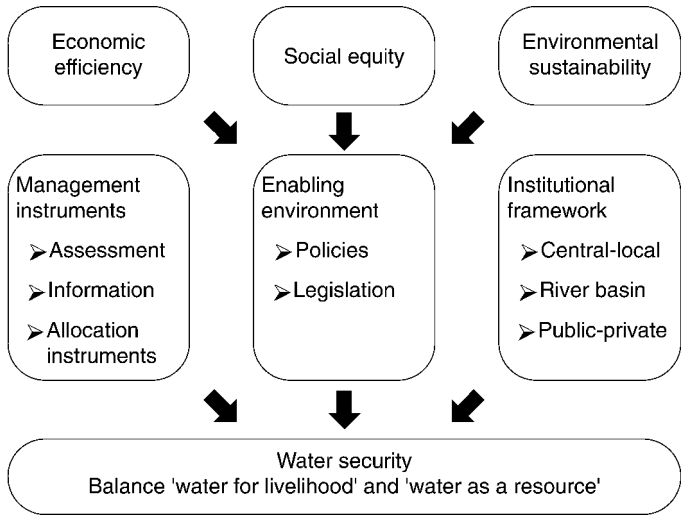

Figure 2. The enabling environment sets the rules; the institutional roles and functions define the players who make use of the management instruments.

three elements is needed: an enabling environment, appropriate institutional roles, and practical management instruments.

The enabling environment comprises national, provincial and local policies and legislation. These constitute the 'rules of the game', which enable all stakeholders to play their respective roles. The 'rules' should promote both top-down and bottom-up participation of all stakeholders, from the national level down to the village or municipality, or from the level of a catchment or watershed up to the river basin level.

Government's role in the enabling environment should be that of activator and facilitator, rather than top-down manager. The formulation of national water policies, the enactment and enforcement of water resources legislation, the separation of regulation from service provision functions and encouragement and scrutiny of the private sector are all important aspects of the government's role.

In addition to governments, private companies and community-based organizations that promote the full participation of women and disadvantaged groups should be involved. All these actors have a role to play in enhancing access to water, bringing about a balance between conservation and development, and managing water as an economic and social good.

Regarding governance and institutional roles, this is an area where stage of development, financial and human resources, traditional norms and other circumstances will play a large part in determining what is most appropriate. Nevertheless, institutional development is critical everywhere to the formulation and implementation of IWRM policies. Clear demarcation of responsibilities between actors, adequate co-ordination mechanisms, the filling of jurisdictional gaps and the elimination of overlaps, and the matching of responsibilities to authority and to capacities for action, are all parts of institutional development.

Finally, a management 'toolbox' with practical instruments should be developed to help water managers get their jobs done. The art of IWRM lies in

selecting, adjusting and applying the right mix of these tools for a given situation. Five categories deserve special attention:

- water resources assessment, comprising data collection networks, environmental impact assessment techniques and risk management tools, for example for floods and droughts;
- communication and information: raising awareness is often a potent instrument for improving management, particularly when accompanied by opportunities for informed stakeholder participation;
- tools for water allocation and conflict resolution: allocation could be done through a mix of regulatory and market instruments based on a valuation of the costs and benefits; and conflict resolution tools could provide guidance in issues of upstream versus downstream, sector versus sector and humans versus nature;
- regulatory instruments, including direct controls such as land use plans and utility regulation, as well as economic instruments (prices, tariffs, subsidies and others) and the encouragement of self-regulation, for example by transparent benchmarking and product labelling;
- technology: both new and traditional technologies might provide scope for progress, both within the water sector and in other productive sectors that affect water supply and demand.

Conclusion

It is important to emphasize that IWRM must not be interpreted as a universal blueprint for water resources management worldwide. Certain basic principles underlying IWRM may be commonly applicable, but they must be seen in the specific context and stage of economic or social development. The nature, character and severity of water problems, human resources, institutional capacities, the characteristics of the public and private sectors, the cultural setting, natural conditions and many other factors differ greatly between countries and regions. Practical implementation must reflect such variations in local conditions and should, consequently, take a variety of forms. Likewise, the best mix of IWRM elements will change over time for a specific country and region due to internal or external developments.

It is also important to stress that the complexity should not overwhelm one. In practical terms, the central challenges faced by a specific region, country, subregion or community are often relatively obvious and simple to identify for those who have agreed to take an integrated approach. However, getting the different actors to agree to this approach and to do something in a co-ordinated way may be much more difficult.

Implementing IWRM is a political process that involves allocating resources between competing uses and users. Sometimes it is possible to come up with win–win solutions. However, more often compromises and trade-offs will have to be negotiated. Agreeing to social, economic and ecosystem sustainability goals, and finding the right balance between them, is at the heart of this process. IWRM will not in itself lead to their achievement, but it is unlikely that they can be achieved without it.

Public awareness is needed in order to mobilize effective support for sustainable water management and induce the required changes in behaviour and

actions. Additionally, public awareness and subsequent pressure for action may be vital in fostering the 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.

Finally, the process of agreeing on a common 'platform and language' for discussing IWRM should be seen as work in progress. Principles, concepts, ideas and recommendations will have to be tested, refined and developed further through practical application in water resources development and management around the world.

References

Chéret, I. (2000) *Letter to my Minister* (Stockholm, GWP).

Global Water Partnership (GWP) (2000) *Towards Water Security: A Framework for Action* (Stockholm, GWP).

Global Water Partnership Technical Advisory Committee (GWP TAC) (2000) *Integrated Water Resources Management,* TAC Background Paper No. 4 (Stockholm, GWP).

Koppen, B. van & Schreiner, B. (2000) From bucket to basin: poverty, gender, and integrated water resources management in South Africa, contribution to the 'Integrated water management in water-stressed river basins in developing countries: strategies for poverty alleviation and agricultural growth' workshop, 16–21 October.

World Water Council (2000) *World Water Vision: Making Water Everybody's Business* (London, Earthscan).