Exploring the Government, Society, and Science Interfaces in Integrated Water Resource Management in South Africa

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Most modern approaches to water resource management acknowledge that the entire river basin or catchment should form the basic management unit if water resources are to be managed effectively and efficiently. In addition, since surface and ground water are inextricably linked via the hydrological cycle, it is also logical for water resource managers to seek to manage all forms of water as a single resource within the management unit. These two technical principles form the foundation for integrated water resource management (IWRM), and it is widely accepted that if they are implemented effectively, the outcome should be prudent water resource management within the river basin (Biswas et al. 2005).

Another important component of the IWRM philosophy is the need to engage all stakeholders in decision-making processes (Global Water Partnership 2000). Indeed, while effective and efficient water management institutions are usually regarded as "technocratic," they rely on good governance processes to ensure that all government and civil society stakeholders are engaged effectively[1]. In its ideal form, therefore, the IWRM approach to catchment or river basin management comprises a guiding philosophy, a practical and agreed framework for action, and a set of desired outcomes. These three characteristics are inclusive rather than exclusive, thereby reinforcing and extending the suite of advantages to be gained from the practical implementation of IWRM (Ashton in press).

Importantly, very few of the stakeholders or roleplayers that are engaged in technical, social or economic activities within a river basin acknowledge that IWRM decision-making is a political process (Allan 2005). In addition, much of the IWRM decision-making tends to ignore the social, cultural and political context, as well as the historical aspects within which these are embedded (Ashton in press). Taken together, these processes and contexts shape the dimensions of governance and determine the success or failure of IWRM initiatives. This paper reviews the evidence that new and more supportive government, society, and science interfaces and processes are helping to ensure the effective allocation and management of water resources in South Africa.

Drivers of Change

In 1994, the South African government started a comprehensive process of reform throughout the water sector; this process will still continue for several years. The focus for the South African water sector reform is driven by the need to redress the inequities of previous political dispensations, coupled with the urgent need to ensure that sufficient supplies of wholesome water continue to be made available to meet the rapidly growing needs of communities that are fueled by increased rates of urbanization and industrialization. The arid to semi-arid nature of much of South Africa and the growing scarcity of water resources make the resolution of these problems particularly acute (Basson et al. 1997).

Despite these challenges, South Africa's National Water Act (Republic of South Africa 1998) is widely regarded as one of the most progressive pieces of environmental legislation in the world

(Postel and Richter 2003). The new and enabling legislative framework presents stakeholders and authorities with a clear vision of equity, efficiency, and sustainability in the allocation and use of water, as well as the goods and services that are derived from or linked to such water use (Van Wyk et al. 2006). The focus on greater equity within South Africa's new water policy requires stakeholders to shift away from rights-based water allocations to a system where water allocation decisions are interest-based (Dent 2001). This move towards a negotiation-driven process of water allocation represents a dramatic change from previous procedures, requiring a fundamental shift in both mindset and practice, based on a mutual understanding of each group's resource needs and preferences, and acceptance that these needs are dynamic over space and time (Van Wilgen et al. 2003).

These objectives are ambitious and unprecedented and it should not come as a surprise that, at this early stage of the process, the objectives of

equity, efficiency, and sustainability in the allocation and use of the country's water resources remain elusive (Van Wyk et al. 2006). Part of the reason for this lies in the varied interpretations among different stakeholders as to what constitutes IWRM and how its goals and objectives can best be achieved. Another, perhaps even more important, reason is linked to the different levels of understanding of and familiarity with the governance processes that are needed in different situations, and how these can be best achieved. In South Africa, the shift in management approaches to embrace the principles of IWRM has been accompanied by processes of institutional decentralization and democratization designed to facilitate and strengthen local stakeholder participation in decision-making for water resources management (Pegram et al. 2005). These institutional changes are most easily visible in the emergence of Catchment Councils, Water User Associations and Catchment Management Agencies.

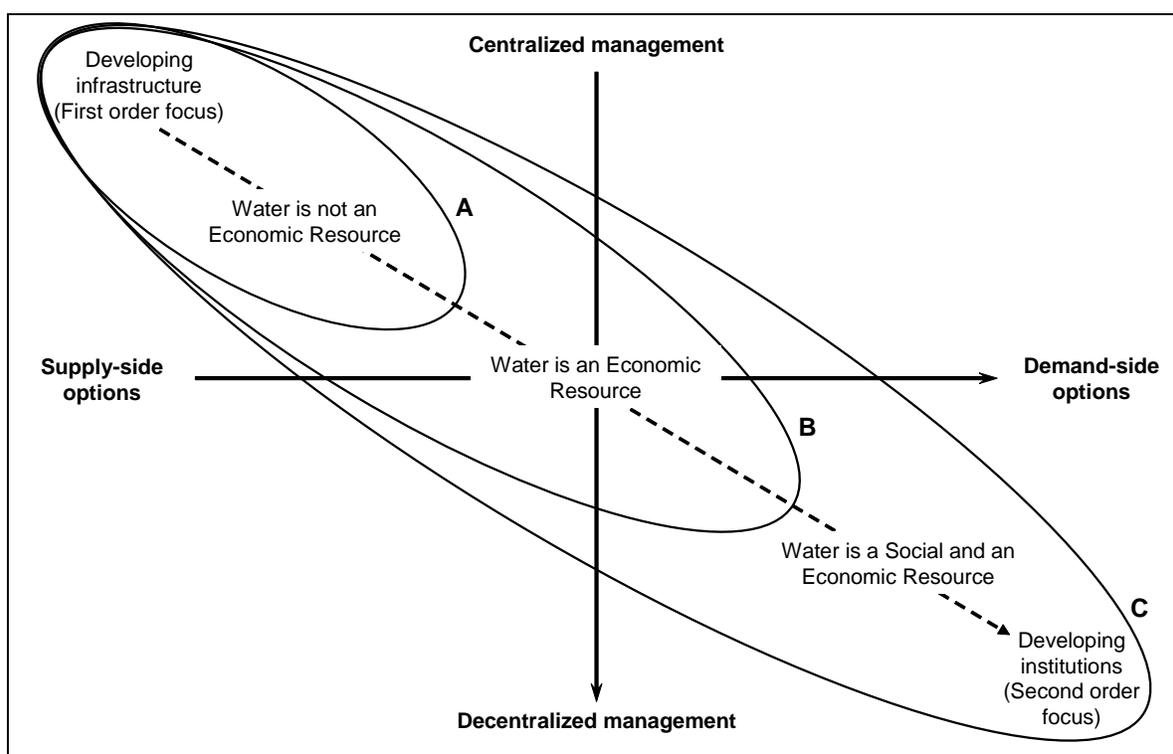Conceptually, the degree to which water

Figure 1. Conceptual model illustrating the general trend of change as the focus of water resource management broadens to include increasingly decentralized approaches (A), (B) and (C), while management options expand from purely supply-side options to include more demand-side options (redrawn from Turton et al., in press).

resource management is centralized and the degree to which management focus is directed towards supply-side or demand-side options are important drivers of change within the water sector. These drivers can be represented as axes on a matrix (Figure 1), where the general trend of change is shown as a progressive broadening of the scope of water resource management envelopes from (A) to (C) over time. The upper left-hand quadrant represents the early phases of development, where management is highly centralized, with a primary focus on supply-side options that can provide water with a high assurance of supply (envelope "A"). Since most emphasis is placed on the construction and operation of engineering structures to deliver water (the first order resource), the institutional needs reflect this importance and the management cadre consists predominantly of engineers and hydrologists.

As management becomes progressively more decentralized over time, the changes can be represented by envelopes "B" and "C" in Figure 1, with increasing emphasis being placed on the effectiveness of decentralized institutional structures and efficiencies of water utilization patterns, shown on the horizontal axis. More attention is also paid to new policy applications such as inter-sectoral water allocation and efficiency measures such as intra-sectoral allocative incentives, institution-building and the efficiency and effectiveness of operational procedures. This requires a much softer approach, seen as a second-order focus, where the principal resource being mobilized is social capital or social adaptive capacity (Ohlsson 1999). Now, effective water resource management requires a much wider range of skills, and includes policy specialists, social scientists, economists, lawyers, engineers, hydrologists, and ecologists, to name but a few specialist disciplines.

It is important to note that South Africa's original focus on water supply infrastructure has not been abandoned since this infrastructure still forms the backbone of all water supply measures (Basson et al. 1997). As additional measures are adopted over time, this is reflected as a widening management envelope, whose shape at any given time depends on several external factors. Particularly important among these factors are the physical nature and availability of water resources, and the level of

political "maturity" of South African society.

Some Views on Governance

A key part of the current global and national debates around governance relates to the lack of agreement as to what governance comprises (European Union 2001). Even a cursory review of the recent literature will reveal that the term 'governance' has been used to describe a wide array of situations or conditions that include the roles and responsibilities of government, lay society and the business sector, decision-making processes, management actions at all levels, the behavior of individuals and communities, institutional structures and settings, legal and statutory instruments, and idealized processes of participation or collaboration (Ashton in press). In some cases, the word "governance" simply appears to have been appended to a particular descriptor of a system or situation as if it's presence in the now-expanded term could provide greater "legitimacy" or "public acceptability." This unfortunate feature is one that is also shared by inappropriate use of the word "sustainable"—again appended as if it could confer some form of authenticity or validity to a particular situation or activity.

Many descriptions of governance have also been linked to specific considerations, where governance is considered to be a process, a structure, a system of values or a specific outcome. While each of these applications are no doubt entirely appropriate and legitimate within their specific contexts, the sheer variety of these uses has created considerable confusion about the underlying concept and meaning of governance and, in particular, the concept of "good governance" (Ashton in press). In the context of IWRM, it is therefore important to understand and properly contextualize the use of the term governance so that it helps to clarify and guide decisions and actions, rather than adding to the existing confusion.

The South African emphasis on broadening the participation of stakeholders in IWRM seeks to ensure that prudent water resource management can enhance the quality of life of all citizens while simultaneously ensuring the long-term viability of the water resources upon which all development depends (Department of Water Affairs and Forestry 1997). Clearly, this approach mirrors the concept

of sustainable development and reflects the fundamental inter-dependence between economic development, the natural environment, and people (World Commission on Environment and Development 1987). Importantly, this approach requires all segments of society to co-operate within a governance system that reflects their values, principles, aspirations, imperatives, and objectives (Folke et al. 2002). Significantly, this recognition also means that government, civil society—or the lay public—and scientists or technology providers must co-operate closely and share a common vision of the future. This view provides strong support for the so-called "Trialogue" model of governance that links government, civil society, and science in a set of partnerships, and that promotes close collaboration and interactions between each of these sectors (Figure 2). In this view, particular emphasis is placed on the interfaces between the three sectors and their contribution to good governance.

Here, it is important to recognize that while the "government" and "science" clusters in the Trialogue represent components of the broader "society" cluster, they also represent discrete groupings of individuals and institutions that must perform specific actions on behalf of society. In this conceptual system, the "science" cluster represents technology providers that direct their efforts to improve the quality of life in society and assist government to deliver on its mandates. In turn, the "government" cluster represents those individuals and institutions that have been selected by society to provide leadership and direction on its behalf. In an ideal situation, the three clusters are inter-dependent and mutually supportive and their interactions are guided and underpinned by agreed sets of principles and values that combine to deliver good governance as a desirable outcome (Figure 2) (Ashton in press).

In practice, the contextual components of governance systems are often misunderstood, or it is assumed that everyone shares a common set of values, goals, and ideals. This is seldom true in reality, where people living within the same community may differ widely in their abilities, views, and aspirations. Similarly, the effectiveness of governance systems can be hampered by the
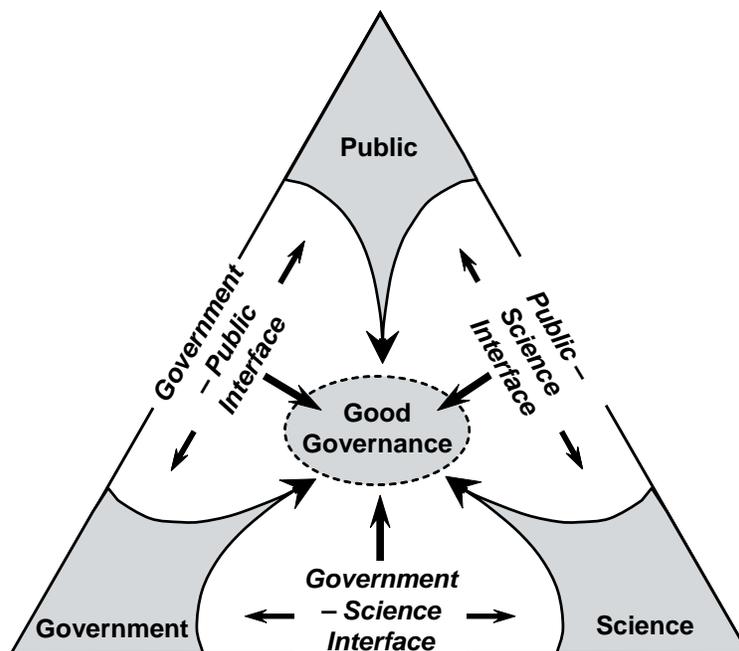

Figure 2. Conceptual diagram illustrating the linkages and interfaces between government, science, and the lay public, and their collective partnerships and contributions to "good governance" (modified from Ashton, in press).

assumption that all stakeholders can be engaged and informed in a uniform way regardless of their cultural and historical background, social structures and preferences, educational levels, and literacy and linguistic abilities. The situation is aggravated in those communities that are plagued by historical disadvantages and pervasive poverty. External interventions are needed to "level the playing field" before these individuals and communities can participate effectively and equitably with their peers in decision-making processes (Ashton in press). Where no provision is made to enable disadvantaged stakeholders to participate effectively in decision-making processes, this situation is often referred to as "the illusion of inclusion" (Ashton and Chonguiça 2003).

In the end, an ideal governance system has to ensure that stakeholder engagement at all levels is carefully balanced and integrated to enable the best and most sustainable outcomes to be agreed upon and achieved (Ashton in press). However, despite clear evidence of the benefits to be gained by ensuring that the broader public are correctly engaged in decision-making processes, there is still surprisingly little guidance available on how best to achieve this ideal.

Given the complex and multi-dimensional nature of governance, it is important to ensure that all participants clearly understand their roles and responsibilities, and adhere to a set of common principles that define "good governance" (European Union 2001). To achieve this, stakeholders must first agree on the roles and responsibilities of every group and individual participant, the rules and procedures that will guide and govern the interactions between them, what form the anticipated outcomes of the decision-making process will take and how these will be implemented. The prior adoption of such an agreed set of procedural and behavioral guidelines provides a strongly cohesive force that helps all participants to accept ownership of both the participatory process and the final outcomes of that process (Ashton in press).

Adherence to the guiding ethics and values that characterize "good governance" will help to ensure that a governance system within a particular context is effective, efficient, and socially relevant (Ashton in press). Clearly, therefore, good governance has to be based on, and incorporate, the attitudes,

values, and practices of society while also giving meaning to society's aspirations and objectives. The European Union (EU) has presented a useful set of five principles of good governance as the basis for attempts to improve its performance (European Union 2001). These principles are:

- **Openness** – where governance institutions are transparent and inclusive, communicating freely about what they do and the decisions that are taken, using language that is accessible and understandable to all stakeholders;

- **Participation** – where the quality, relevance, and effectiveness of policies, legislation, regulation, and practice depend on public participation from conception to implementation, to create greater confidence in the institutions of governance and the outcomes of policy;

- **Accountability** – where every role in the legislative, administrative, and executive processes is made clear, and where there is appropriate clarity and responsibility from everyone who is involved in developing and implementing policy at every level;

- **Effectiveness** – where policies are timely and appropriate, delivering what is needed, based on decisions made during participative decision-making processes; and

- **Coherence** – where policies and implementation actions are consistent with other initiatives, and are clearly aligned and well understood by all participants.

In an African context, the first three of these principles require special prominence to ensure that all stakeholders are able to participate equitably. This necessity is driven by the need to deal with problems related to low levels of literacy and a lack of familiarity with technical terminology, widespread poverty that is often sustained by continuing inequalities in terms of access to resources and finance, and a lack of familiarity with democratic processes—often accompanied by mistrust of unfamiliar representatives and "self-appointed leaders." Resolution of such inequalities inevitably takes time to achieve and, unfortunately, can also lead to some dissatisfaction among certain

stakeholder groups. However, this is unavoidable if the final outcome is to be sustainable in the long-term.

It is also important to note that good governance requires a systems approach that is based on the inclusion and inter-dependence of all its components and every segment of society (Figure 2). Each of the principles listed above needs to be included and integrated into a coherent system; none of them should be ignored, avoided, or diminished. The effectiveness of a given governance system does not depend on the extent to which one or more of these principles are included, but rather on the degree to which each principle can be customized to suit local circumstances and then integrated into a coherent whole.

Discussion

It is significant that the IWRM approaches in countries with more mature democracies tend to include a wider range of positions located towards the lower right-hand quadrant of Figure 1; countries with less mature or emerging democracies tend to occupy narrower positions, located closer to the upper left-hand quadrant. This distinction also emphasizes the differences between the needs of developing countries, or those with fledgling democracies—where the level of infrastructural development may be inadequate for sustainable development to take place—and those of more developed countries with more mature democracies, where the transition from an agricultural or resource-based economy to an industrialized economy has already taken place.

The key role of the science cluster within the proposed Trialogue model (Figure 2) is to gather, interrogate, and integrate knowledge and information into forms that provide useful and practical guidance to society and government. Importantly, the science cluster is seen to include the natural sciences, life sciences, and social sciences, together with their underpinning disciplines and philosophies. Taken together, the effective structuring and functioning of the science cluster provides the technical core of human ingenuity that underpins the abilities of society and government to adapt to whatever circumstances prevail in their environment (Homer-Dixon 1995, Ohlsson 1999). This is perhaps most clearly seen as the technology base

of a country's economy, allowing it to become locally relevant and globally competitive.

Conclusions

Those societies that are characterized by effective and harmonious interactions between the science, society, and government clusters appear to be more likely to achieve the ideals of IWRM in socially acceptable ways that promote political stability. Clearly too, the success of the interactions between each of these clusters depends on effective and trustworthy inter-personal relationships between individuals within each of the clusters, where individuals and institutions share their knowledge and experiences in a unified learning system (Roux et al. 2006). This will allow all participants to move beyond their traditional roles of knowledge provider and knowledge consumer, to a true partnership where inter-dependencies are recognized, and all parties can negotiate feasible, desirable and acceptable outcomes (Roux et al. 2006).

The proposed 'Trialogue' model of governance (Figure 2) provides a useful conceptual model that highlights the need for lasting partnerships between government, civil society, and science to promote shared understanding, responsible decision-making, and collective responsibility for prudent water resource management—the hallmark of IWRM. These partnerships also require each group to accept the need for formal governance structures, processes and instruments that complement and strengthen an underpinning philosophy of co-operation. In turn, for these to be truly effective, all stakeholders must understand the multidimensional nature of governance and their individual roles and responsibilities. Taken together, the five principles of good governance promoted by the European Union (2001) provide a useful 'blueprint' for building and guiding effective and responsible interactions between stakeholders. This blueprint forms the core of South Africa's approach to IWRM.

The water sector reforms in South Africa provided the catalyst for the government to adopt new and more inclusive approaches to IWRM, based on a long-term vision of the equitable and sustainable use of the country's water resources.

Effective implementation of IWRM now requires all sectors of South African society to work together to achieve the shared vision of peaceful economic development.

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Endnotes

1. This paper draws considerably from ideas presented in Ashton et al. (in press) and Turton et al. (in press).

References

Allan, J. A. 2005. IWRM: A new sanctioned discourse? SACIWater Paper, Online at www.soas.ac.uk/water issues as Occasional Paper #50. Accessed July 2006.

Ashton, P. J. In press. The role of good governance in sustainable development: Implications for integrated water resource management. In *Governance as a Trialogue: Government – Society – Science in Transition,* edited by Turton A. R., J. Hattingh, G. A. Maree, D. J. Roux, M. Claassen and W. F. Strydom, 354. Water Resources Development and Management Series, Springer-Verlag, Berlin.

Ashton, P. J. and E. Chonguiça. 2003. Issues and trends in the regional harmonization of E.I.A. processes in southern Africa, with special reference to transboundary and cumulative impacts. In *Assessing the Need for a Regional Approach to Environmental Impact Assessment in Southern Africa, edited by* Chonguiça E. and R. Brett. IUCN Regional Office for Southern Africa, Harare, Zimbabwe.

Basson, M. S., P. H. Van Niekerk, and J. A. Van Rooyen. 1997. *Overview of Water Resources Availability and Utilization in South Africa.* DWAF Report No. P RSA/00/0197. Department of Water Affairs and Forestry and BKS (Pty) Ltd., Pretoria, South Africa.

Biswas, A., O. Varis, and C. Tortjada (Eds.) 2005. *Integrated Water Resources Management in South and South-East Asia.* Water Resources Management Series. Oxford University Press, Delhi, India.

Dent, C. M. 2001. Installed water resource modelling systems for catchment management agencies. *Water SA* 27(3): 333-340.

Department of Water Affairs and Forestry. 1997. *White Paper on a National Water Policy for South Africa.* Department of Water Affairs and Forestry, Pretoria, South Africa.

European Union. 2001. *European Governance: A White Paper.* Commission of the European Communities, Brussels. Online at : http://www.europa.eu.int/comm/governance/white_paper/index_en.htm. Accessed June 2006.

Folke C., S. R. Carpenter, T. Elmqvist, L. H. Gunderson, C. S. Holling, B. H. Walker, J. Bengtsson, F. Berkes,

J. Colding, K. Danell, M. Falkenmark, L. Gordon, R. E. Kasperson, N. Kautsky, A. P. Kinzig, S. Levin, K. G. Mäler, F. Moberg, L. Ohlsson, P. Olsson, E. Ostrom, W. V. Reid, J. Rockstrom, H. H. G. Savenije, and U. Svedin. 2002. *Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformation.* Scientific Background Paper for the World Summit on Sustainable Development. Environmental Advisory Council, Stockholm, Sweden.

Global Water Partnership. 2000. *Towards Water Security: A Framework for Action.* Global Water Partnership, The Hague.

Homer-Dixon, T. F. 1995. The Ingenuity Gap: Can poor countries adapt to resource scarcity? *Population and Development* 21(3): 587-612.

Ohlsson, L. 1999. *Environment, Scarcity and Conflict: A Study of Malthusuian Concerns.* Department of Peace and Development Research, University of Göteborg, Sweden.

Pegram, G., G. Mazibuko, C. Von Der Heyden, A. Anderson and B. H. Hollingworth. 2005. *Strategic Review of Current and Emerging Governance Systems Related to Water in the Environment in South Africa.* WRC Report No. K5/1514. Water Research Commission, Pretoria, South Africa.

Postel, S. and B. Richter. 2003. *Rivers for Life: Managing Water for People and Nature.* Island Press, Washington D.C.

Republic of South Africa. 1998. *National Water Act (Act No. 36 of 1998).* Pretoria, South Africa.

Roux, D. J., K. H. Rogers, H. C. Biggs, P. J. Ashton and A. Sergeant. 2006. Bridging the science-management divide: Moving from unidirectional knowledge transfer to knowledge interfacing and sharing. *Ecology and Society* 11(1): 14. Online at http://www.ecologyandsociety.org/vol11/iss1/art4.

Turton, A. R., J. Hattingh, M. Claassen, D. J. Roux, and P. J. Ashton. In press. Towards a model for ecosystem governance: An integrated water resource management example. In *Governance as a Trialogue: Government – Society – Science in Transition,* edited by Turton A. R., J. Hattingh, G. A. Maree, D. J. Roux, M. Claassen and W. F. Strydom. Water Resources Development and Management Series, Springer-Verlag, Berlin.

Van Wilgen, B. W., C. M. Breen, J. J. Jaganyi, K. H. Rogers, D. J. Roux, T. Sherwill, and E. van Wyk. 2003. *Principles and Processes for Supporting Stakeholder Participation in Integrated River Management: Lessons from the Sabie-Sand Catchment.* WRC Report No. 1062/1/03. Water Research Commission, Pretoria, South Africa.

Van Wyk, E., C. M. Breen, D. J. Roux, K. H. Rogers, T. Sherwill and B. W. van Wilgen. 2006. The ecological reserve: Towards a common understanding for river management in South Africa. *Water SA* 32(3): 403-409.

World Commission on Environment and Development. 1987. *Our Common Future.* Oxford University Press, New York.