



Research, part of a Special Feature on [Mental Models](#)

The Potential Role of Mental Model Methodologies in Multistakeholder Negotiations: Integrated Water Resources Management in South Africa

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ABSTRACT. Equitable redistribution of resources is an emergent phenomenon in democratizing countries, and attempts are often characterized by decentralized decision making within a framework of multistakeholder negotiations. South Africa offers a unique opportunity to explore the manifestations of these relationships, particularly through Integrated Water Resources Management and its National Water Act of 1998. The Integrated Water Resources Management framework provides for collaborative strategic planning, shared visioning, consideration to water resource protection, attention to the regulation of use, operational planning, and implementation of management plans. Water users, with different stakes and views of how the resource should be managed, are expected to arrive at a single strategic plan for a specific hydrological region. Clearly this complex planning situation creates a need for tools that assist in producing a measure of convergence in thinking and enough of a shared rationale to allow stakeholder participation to produce an integrated management outcome. Several such tools are available in the overall catchment management strategy, but these would benefit from clearer understanding of the positions from which different stakeholders are operating and a way of knowing whether these positions are aligning. In this paper challenges posed by differences in meaning and understanding amongst stakeholders are examined against the need to engage stakeholders in water resources management. We deliberate on the prospects of employing mental model methodologies within the context of the strategic management framework for water management described.

Key Words: *mental models; participatory water management; stakeholder negotiation*

INTRODUCTION

Decentralization and democratization are topics of important concern for most countries emerging from colonial rule, and many developing and transitional countries have launched decentralization reforms over the past decade (Ribot 2004). Although colonial regimes emphasized national cohesion, effective rule, and efficient management of rural subjects (Ribot 2004), postcolonial reform focused on democratization, pluralism, and rights. Agrawal and Ribot (1999) claim that decentralization of natural resource management is characteristic of these reforms. After 1994, South Africa embarked on a national water policy and created legislation in the form of the National Water Act (NWA; Republic of South Africa 1998) that embraces a number of these postcolonial reforms. This paper is a practitioner's assessment of the applicability of a mental models approach in the context of

decentralized democratic resource management and Integrated Water Resource Management (IWRM) in general.

Whether decentralization and democratization of natural resource management is successful or not, complete or incomplete, it is transforming the institutional environment on which natural resources management depends (Ribot 2004). Decentralization changes the kinds of authorities that make decisions over natural resources as well as the kinds of decisions that are made. In the case of natural resources, democratic mechanisms are expected to allow local actors to articulate needs and collectively derive appropriate responses based on options and preferences. Decentralization is built on the belief that local actors are better able to assess the situation, have better access to information, understand appropriate responses, and are more easily held accountable. However, Ribot (2003)

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warns that decentralization that democratizes and transfers powers threatens many actors. This leads to weak implementation and little literature exists that examines the concrete outcomes and practice of decentralization in the water sector. Arguments against decentralization claim that it will eventually lead to the destruction of the resource or to conflict among parties interested in, and using the resources (Ribot 2004). Ribot further reports that decentralization is not being established in the law or is not implemented in practice. We challenge this with a clearly demonstrable legal and management apparatus in the South African water sector that, in principle, supports decentralization.

The general trend in decentralized, democratized approaches is to involve various stakeholder groups in platforms for participation and decision making. These are commonly called multiple stakeholder platforms (Steins and Edwards 1998, Warner and Verhallen 2005, Warner 2007), defined as a “decision-making body (voluntary or statutory) comprising different stakeholders who perceive the same resource management problem, realize their interdependence for solving it, and come together to agree on action strategies for solving the problem” (Steins and Edwards 1998:1). Inherent in this definition is the assumption that the diverse stakeholder groups perceive the same management problem. Although stakeholder platforms offer the opportunity for a more holistic and integrated coordination of resource management, they can also mean polarization, tension, and conflict, as they bring together divergent values, attitudes, cultures, and norms.

Mental model studies have been conducted across many fields and are of interest to natural resource management because of the need to understand stakeholders’ constructions of how the system functions and what values might be brought to bear on actual practices. In the context of this work, mental models are taken to be frameworks of concepts and relationships that underpin how people understand, filter, and process information and contribute to understanding, reasoning, prediction, and action (Craik 1943, Gentner 1983, Biggs et al. 2008, Jones et al. 2011). It has been suggested that mental model approaches may be used to increase the ability to recognize alternative perspectives, assist in building shared understanding among resource users and managers, and thereby support negotiated change (Biggs et al. 2008, Etienne et al. 2011, Jones et al. 2011; T. Lynam, R. Mathevet, M. Etienne, S. Stone-Jovicich, A. Leitch, N. Jones, H.

Ross, D. Du Toit, S. Pollard, H. Biggs, P. Perez, *unpublished manuscript*).

Proponents of two methods for eliciting and analyzing mental models (Etienne 2006, Etienne et al. 2011, Stone-Jovicich et al. 2011) argue that such tools are important in articulating the different conceptions of the state of the world and values of different stakeholder groups. If such techniques are found to be useful then their application across several sectors of resource management might prove useful in the cooperative governance of natural resources. In this paper we do not present the results of a research process but rather present practitioners’ perspectives on the application of mental model approaches to the challenges facing strategic adaptive planning for Integrated Water Resources Management (IWRM) in South Africa. We aim to reflect on the utility of the mental models approach from policy and practice perspectives in the context of IWRM in South Africa. Our intent is to identify how the application of mental models approaches might improve IWRM and also where they may not be useful. The paper is structured so as to first introduce the specific context of IWRM in South Africa, then examine the potential application of a mental models approach to IWRM.

BACKGROUND TO IWRM IN SOUTH AFRICA

The South African National Water Act (NWA) makes provision for the establishment of statutory bodies, called Catchment Management Agencies (CMAs) as the institutional base from which to manage water resources. The NWA incorporates international principles of IWRM and embraces the national values of democracy and equity, both of which call for a high level of participation from water users. These developments in South Africa are in strong contrast to pre-1998 South African water legislation, and users are adjusting to the realities of operating in this participative mode. South Africa is only starting to implement a comprehensive and functional approach to public engagement at the level of Water Management Areas. Further background to, and efforts in, this regard have been reported in several publications (Gorgens et al. 1998, Motteux 2003, Du Toit 2005, Du Toit et al. 2005)

Under the Act, South Africa is divided into 19 Water Management Areas that correspond to hydrological boundaries. Each of these has a CMA expected to

execute its duties in collaboration with local stakeholders. There are a number of stakeholder platforms, i.e., Catchment Management Forums and Catchment Management Committees, in which IWRM can be negotiated at more local scales. These platforms are more than places where stakeholders defend vested interests in limited water resources. They are opportunities for priority setting, strategic planning, and collaborative adaptive management, thus signifying a significant role for civil society. From a practical point of view, CMAs, along with stakeholders, will be responsible for preparing, implementing, and revising catchment management strategies, on a five-year cycle, that are in line with three specific policy objectives of the National Water Resources Strategy (DWAf 2004a): equitable access to water, sustainable use thereof, in an effective and efficient way. The national government has prepared guidelines to assist CMAs and stakeholders in preparing their strategies. Although they do not specify context nor do they provide 'blue-print' strategies, they outline the basic areas that need to be covered for IWRM to be operationalized. It is therefore incumbent on the CMA to facilitate the process of drafting and implementing these strategies with inputs of stakeholders. Broadly, the guide for preparing the regional Catchment Management Strategy (CMS) is provided in the form of framework comprising four main parts (color coded in Fig. 1). Essentially these parts are: (1) a foundation for the preparation of management strategies, management scenarios, and a shared vision; (2) the development of strategies for the protection of the resource, including provision for environmental water requirements, and water use regulation, i.e., licensing and compliance enforcement; (3) strategies for facilitating IWRM processes, i.e., public participation and funding; and (4) strategies for enhancing cooperative relationships and governance.

The drafting of the CMS is the nexus for negotiation and consensus-reaching as well as a collaborative ground plan for rolling out water reform, conservation, and management. CMSs are, from a practical point of view, the strategic vehicle used by CMAs and their stakeholders to enable action in catchments (see Fig. 1). Both values and appropriate technical issues are discussed by stakeholders as the CMS is developed, but there is no precedent, and often little enabling culture, for this kind of initiative.

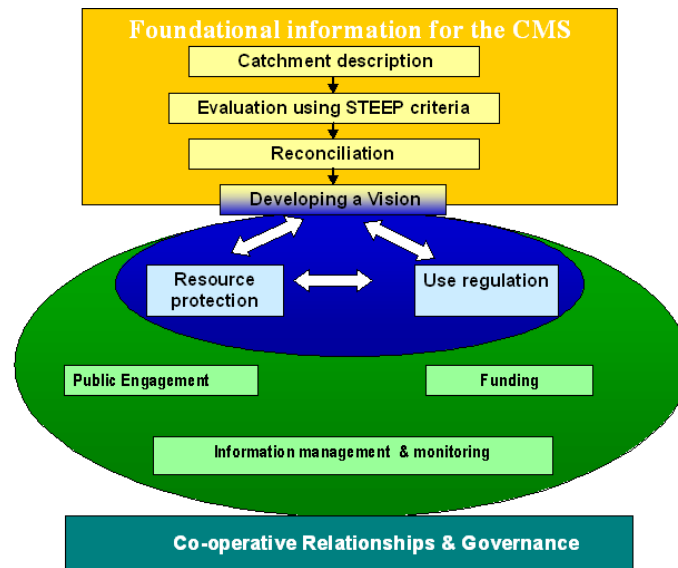
Decentralized democratic decisions are designed and expected to resolve conflict and set river basins on paths toward equitable and sustainable management. Whether this happens or not will depend on the application of sound and considered interventions that support and enhance self-organization and collaborative strategic planning. Networking, negotiation, and collaborative strategic planning are elements well catered for by the National Water Act. Building of networks is provided for by the support for forums, committees, and water user associations and a number of opportunities exist for negotiation in relation to visioning, water allocation, and resource classification (DWAf 2001, DWAf 2003, DWAf 2004a,b,c, DWAf 2007). Furthermore, the processes of strategic adaptive management, i.e., learning-by-doing, are supported by the obligation to review and revise catchment management strategies every five years.

How these design features are experienced on the ground is however still unclear but initial research (Biggs et al. 2008) shows that various stakeholder groups have their own mental models of what water resources management entails. Even if participatory processes are planned and executed smoothly, there is nothing to suggest that polarization, tension, and protection of vested interests will not occur. Pollard and Du Toit (2004) report that different sectors have developed their own understanding and therefore their own practice around water resources management, especially evident between the water supply sector on the one hand, and the water resources planning and protection on the other. However, why might mental models research aid in such a situation? Despite proposals that mental model approaches aid in better understanding of complex, dynamic systems and how peoples' perceptions of the world impact on how they function (Moray 2004), there are a number of contextual challenges that need to be addressed.

TRANSFORMATION IN WATER MANAGEMENT: SOME CHALLENGES FOR THE APPLICATION OF MENTAL MODEL METHODS

First, for most people in South Africa, no matter what their status, democracy is a new system of governance and South Africans are still developing an understanding of what such a system might hold. A personal and group responsibility for water

Fig. 1. The framework for Integrated Water Resources Management and hence the Catchment Management Strategy (CMS) in South Africa (DWAF 2007, adapted from DWAF 1999). Clusters of contextual information and substrategies for the CMS fall into four parts (color coded).



management that will lead to a future-focused approach rather than polarized protection of vested interests is essentially an experiment in progress. A critical review of participatory practice in IWRM in South Africa (Lotz-Sisitka and Burt 2005) reviewed experience of democratic, participatory practice at catchment level and produced an important collection of insights. The review indicates that policy making and implementation should be understood in the context of South African history, where a strong reliance on centralized governance still exists. In this case, stakeholders still perceive central government to be the body that must provide solutions. This conclusion presents an obstacle for decentralized approaches in which engagement assumes that stakeholders see the benefits to participating in decision making and that they have the opportunity to influence the outcomes of a participatory process. The question is whether or not mental model methodologies can make any contribution in aiding the democratization and decentralization processes given these perceptions of dependency.

Second, the technical approach to IWRM has resulted in the introduction of a new management discourse. This shift has placed massive demands

on water practitioners, and civil society alike. At almost every level of the water sector and civil society there appears to be conceptual conflation and a basic lack of clarity as to what the policy and legislation imply for actual practice (Du Toit et al. 2005, Biggs et al. 2008). If participants in a decentralized resource management setting do not understand what integrated water resource management is and what it means for them, it may be difficult for them to effectively contribute. Furthermore, some of the new concepts conflict with and/or contradict practices that have been part of previous legislation, thus creating problems for implementation. This rings true with what mental models theorists Collins and Gentner (1987) claim, that a person may explain a domain with which they are unfamiliar by drawing on a familiar domain that they perceive to be similar. In this case it appears that the managers are drawing on previous legislative frameworks to understand and develop current practices. The question is can mental model methods help resolve such conflations?

Third, Pollard and Du Toit (2004) report that different sectors have developed their own understanding and therefore their own practices around water resources management. The authors

report that these sector specific differences are carried over into the language and practice reflected in the different ways that the concept of management is applied in the sectors. Also, the authors noted that different sectors take the opportunity of public engagement to drive different agendas. In the forums launched in the Sand River Catchment (Burt et al. 2005, Du Toit et al. 2005), stakeholders use the forums to voice particular concerns. Interactions are not solution-centered but rather focused on vocalizing grievances or creating a particular identity. In such cases there is little motivation for engagement in collaborative strategic planning. A number of interactions have taken the form of one group accusing another group of being responsible for a problem such as the pollution of water or inequity in allocations. Unlawfulness and malpractice are usually identified as the source of the problem. In all these cases participation is a dynamic social process that is contingent on who is present at any given meeting. The question in this instance is: can mental model methods take these dynamics into account or are they too static in their assessments of stakeholder perception?

These are real challenges facing decentralized planning processes. In the next section, we consider the application of mental models methods to the particular IWRM framework in South Africa.

MENTAL MODELS METHODOLOGIES AND DECENTRALIZED, STRATEGIC PLANNING IN IWRM

The framework for CMS development in South Africa provides a ground plan (Fig. 2) for facilitated stakeholder engagement (DWAF 2007). The core of the CMS focuses on a shared vision for the resources of a particular catchment, mechanisms for the protection of the resources, and the regulation of use with conditions drawn from both the vision and the protection strategy. The three aspects are interlinked and interdependent, one cannot be developed in the absence of the other. Also all three require varying degrees of stakeholder engagement, which means that there is the potential for different stakeholders to have different vested interests in each. In such a case there is the potential for conflict rather than collaboration or vice versa.

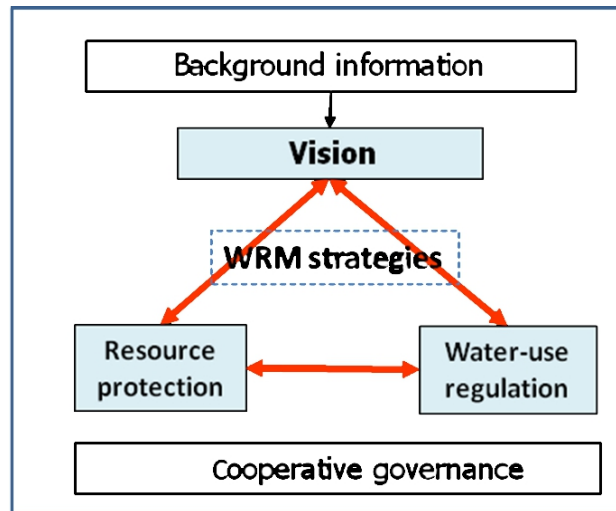
Experience from six catchments in South Africa tells us that providing structures, systems, and

platforms for strategic planning is not enough (Du Toit and Pollard 2008). Making sure that a body is representative of all water users does not guarantee meaningful participation. It is however, the first step toward creating the environment for democratic governance and participation in water resource management. On the other hand, a situation in which stakeholders expect different outcomes from participation is not likely to support collaboration and collective decision making. Current engagement with stakeholder forums indicates that many stakeholders do not see public platforms as opportunities for democratic decision making. This situation points to a poor conceptualization of what decentralization was designed to bring to collective resource management processes.

Although multiple stakeholder platforms have the potential to be troubled by conflict and tension, learning to understand what motivates different groups is likely to be an important and constructive point of departure in deriving collaborative strategic plans for both protecting resources and regulating use (Du Toit 2005). We suggest that, through engagement with the CMS framework, there is the potential to detect sectoral priorities, tensions, or conflict associated with particular water management approaches and practices. Mental model methods can be used as a screening technique for addressing particular challenges associated with multiple stakeholder environments. However, trust in the process is likely to be a prerequisite as a basis for discussion and the generation of common meaning and action. The appointment of an agent capable of this kind of facilitation is of critical importance. Whatever the management case, we maintain that the meanings that stakeholders harbor are critical.

Some mental model theorists, such as those involved in organizational research, take a particular interest in the development of “collective or shared” mental models as a way of enhancing team performance (Langan-Fox et al. 2000, 2001). This requirement holds true for effective team involvement and decision making when team members are from the same or like-minded organizations. The situation is different in multiple stakeholder environments assigned with planning and management tasks. Although mental models approaches may not get conflicted groups to work together, they may identify where differences and similarities in their conceptualizations lie and then these can be used to bring about better collaboration and enhance collective decision making.

Fig. 2. Three key areas requiring stakeholder consensus and collaboration. The areas highlighted in blue require stakeholders to collaboratively define strategic plans for the management of water resources. WRM = water resources management (Du Toit and Pollard 2008).



In the context of South Africa, mental models approaches may be specifically applied to particular aspects of the CMS or other aspects of IWRM in general. We summarize the potential applications in Table 1 and refer the reader to the paper by Jones et al (2011).

It is highly likely that the various methods will require testing and modification to fit specifically with each of the steps in the strategy development process. Also various approaches will need to be matched with the various key stages of the strategic planning (listed in Table 1). The testing of the Consensus Analysis approach in one catchment in South Africa (Biggs et al. 2008), for example, indicated that it is suited to identifying the existence or absence of consensus across different sectors whereas the ARDI method (Actors, Resources, Dynamics, and Interactions; Etienne 2006, Etienne et al. 2011) is more suited to building consensus where it does not exist. The latter method, in particular, may be valuable for developing a collaborative vision, deriving scenarios, modeling various water balances for each of the scenarios, and prioritizing resource allocations through developing schematic representations of how stakeholders perceive the system to function. The ARDI systems diagrams illuminate drivers of the system that form the basis for participatory approaches involving

modeling, termed Companion Modeling, (Dray et al. 2006, Etienne 2006, Etienne et al. 2011). The use of ARDI provides an opportunity to interrogate decisions, strategies, and management plans for water resources management. Etienne et al. (2011) believe that the systems diagrams of how stakeholders perceive their context to function is an important basis for modeling the scenarios and hence helping select management related decisions. They further believe the ARDI method to be of potential value in multiple stakeholder environments for seeking consensus and moving toward capturing management decisions in strategies.

There also exists potential for linking mental models studies with adaptive management processes. The use of simulation models in collective decision making for the management of natural resources is one of the characteristics of adaptive management (Holling 1978, Walters 1986). The companion modeling approach, through accommodating stakeholders in the definition of management plans, enables the imagining of a more open, dynamic management, capable of adaptation and anticipation, by gathering the various actors in a partnership, based on scientific information and cultural creativity (Etienne et al. 2011). Consensus Analysis (described in Stone-Jovicich et al. 2011) provides the possibility for tracking changes in understanding

Table 1. Potential match between the Catchment Management Strategy (CMS) planning process and mental model methodologies.

Part of CMS	Substrategy of the CMS	Mental model method/approach/ orientation	Reference
PART A	Situation description, analysis Reconciliation	Consensus analysis Companion modeling Conceptual Content Cognitive Mapping	Stone-Jovicich et al. 2011 Dray et al. 2006, Austen 1994
	Scenarios development	Companion Modeling	Costanza and Ruth 1998 Dray et al. 2006 Biggs et al. 2008
	Visioning	Causal dynamics Companion Modeling	Özesmi and Özesmi 2004 Dray et al. 2006 Abel et al. 1998 Moray 2004 Etienne 2006
PART B	Water resources protection	Causal dynamics Companion Modeling	Abel et al. 1998 Moray 2004 Etienne 2006
	Water use regulation	Causal dynamics	Abel et al. 1998 Moray 2004
PART C	Monitoring, compliance, and enforcement	Risk communication	Morgan et al. 1992, 2002
	Public engagement and capacity development	Consensus analysis Companion modeling Causal dynamics	Stone-Jovicich 2011 Abel et al. 1998
PART D	Institutional arrangements and cooperative governance	Organizational research Risk communication	Langan-Fox et al. 2001 Serman 2000 Morgan et al. 1992

within institutions provided that it is consistently applied over a reasonable period of time and that the results of the analysis are routinely analyzed and fed back into the management institution. Espoused in this way, consensus analysis may provide a means to measure responsiveness of mental models in a context where there is a need for adaptive management.

CONCLUDING COMMENTS

For people to appropriately engage with the sustainable management of complex phenomena such as water, they presumably need to have a grasp

on the variety of interrelationships and conceptualizations that operate within a system. Implicit in this is the notion that understandings are usually at variance. Work by Abel et al. (1998) was directed by the view that differences in understanding of a system hinders communication and cooperation between stakeholders and therefore impedes management initiatives, creating the impression that consensus is an imperative for collaborative planning. Although a number of mental model methods focus on consensus, we recognize that consensus is not a precondition for proceeding with decentralized governance of natural resources. Sustainability may well be achieved without consensus, and in trying to find

solutions to tricky problems, the lack of consensus may be a good thing because different perspectives provide material for the identification of solutions. We do not necessarily expect consensus to be developed, for example, around the values held by different water users. What would however contribute to achieving sustainability might be recognition among different stakeholder groups of multiple value systems and then the acceptance and use of the opportunities provided by the legal framework to integrate these different values systems into a politically acceptable bundle. Some mental methodologies (Etienne et al. 2006, Etienne et al. 2011) or similar approaches might be valuable for diffusing potentially conflict ridden situations and supporting planning through developing a shared conceptualization of the catchment, for example, its resources and problems. Achieving functional participatory water resources management is a challenge that South Africa has tackled through its IWRM policy. How tools such as mental model methods are incorporated into that now depends on practitioners for clear and appropriate guidelines for their application.

Responses to this article can be read online at:
<http://www.ecologyandsociety.org/vol16/iss3/art21/responses/>

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