Local water governance in South Africa: to which extent participatory approaches facilitate multi-stakeholder negotiations? The Kat River Valley experience

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Abstract

The aim of this paper is to describe and assess the impacts of the Companion Modelling (ComMod) approach on selected aspects of the negotiation process taking place among the members of a Water Users Association (WUA) board in the Kat River Valley of South Africa. After presenting the ComMod experience called KatAWARE, that was conducted in the Kat Valley, the results of on-going and ex-post evaluations of this exercise will be illustrated and discussed. Although there is still room for improvement, the KatAWARE process proved useful to the local WUA as an accompaniment supporting the preparation of a negotiated Catchment Management Plan.

Key words: Water Governance, Companion Modelling, Participatory Approach, Action-Research, Decision-Making, Negotiation Tool, Role-Playing Game, Multi-Agent Model.

1. Introduction

Post-Apartheid South Africa (SA) is facing the challenges of democratization in the use of natural resources. In the water sector, the National Water Act of 1998 introduced new principles such as decentralization of water management and subsidiarity between central and local institutions.

New institutions for water governance are being established: Catchment Management Agencies (CMAs) at the level of Water Management Areas (19 in SA) and Water Users Associations (WUAs) at the local level.

CMAs and WUAs will have to put in place processes of participatory decision-making and facilitate negotiation among water users having different socio-economic characteristics, unequal access to information and knowledge, different political influence and therefore a different capacity with regard to lobbying and negotiation. In this context, an action-research approach aiming at facilitating local negotiation and common decision-making seemed to be particularly appropriate.

A community of researchers called ComMod (Companion Modelling) recently developed a scientific posture regarding the adoption of simulation models and role-playing games for assisting participatory management of natural resources. There are two main features of this approach. The first is to take into consideration, from the beginning of the modelling process, the stakeholders' view of the studied problem. The second is to validate model hypotheses through the experience of the stakeholders. This results in an iterative process of comprehension, confrontation and analysis that involves local users, institutions and researchers. This iteration is also

aimed at validating or refuting the tools, such as models and role-playing games, which will be adopted by stakeholders for local negotiation.

The ComMod approach was applied as one of the approaches to facilitiate multi-stakeholder negotiations related to water allocation in a SA tertiary water catchment (the Kat River, in the Eastern Cape) where a WUA had recently been established. The aim of this paper is to describe and assess the impacts of the ComMod approach on selected aspects of the negotiation process taking place among local stakeholders in the Kat River Valley.

The text is organised as follows: section 2 describes the Kat River Valley socio-economic and institutional context; section 3 illustrates the steps of the ComMod approach in the Kat; section 4 discusses the impacts of the ComMod approach in the Kat River Valley identified through several evaluation exercises. Particular emphasis is given to an ex-post valuation conducted by a team that included external evaluators. Section 5 concludes and provides perspectives for future research in this field.

2. The Kat River Valley context

The Kat River has a catchment area of 1716 km^2 and an altitudinal range from 1800 to 300 m amsl that is mirrored by the mean annual precipitation and runoff. According to Midgely et al. (1994), the headwater catchments receive a mean annual precipitation of between 700 and 800 mm, which translates into a mean annual runoff of 70 to 90 mm. The lower catchment receives a mean annual precipitation of 482 mm, translating to a mean annual runoff of only 11 mm. The middle and lower catchment therefore rely heavily on river water for irrigated agriculture. Forty percent of the catchments population of close on 50 000 people (2001 figures) live in Fort Beaufort, located in the middle of the catchment. The remaining population lives on farms or within some 65 villages with populations ranging from 50 to 2500 persons (Birkholz 2007). An increasing number of villages are being supplied with tap water (as stand pipes), but many people still rely on the river as their main water source. The geography and history of the Kat Valley are detailed by Birkholz (2007). The following description borrows heavily from her report.

In 1969 the Kat Dam was completed at the behest of farmers to irrigate tobacco and citrus crops, as well as to supply water to the town of Fort Beaufort, located in the middle of the catchment. The total area of land scheduled for irrigation below the dam was 1500 ha. Farmers with scheduling paid an annual license fee in return for which they were able to irrigate freely the amount of land granted to them, but could not expand beyond this area. The scheduled land was almost exclusively located between the dam and Fort Beaufort. Farmers below Fort Beaufort opted out of scheduling on the grounds that sufficient water would always be available for their needs. These unscheduled farmers did not pay a license fee, but could request a release from the dam at their own cost. Unscheduled farmers were not bound by licensing restrictions in the amount of land that they could irrigate. This difference between scheduled and unscheduled farmers has resulted in considerable tension between the two groups.

During the 1970s almost without exception commercial farmers in the Kat Valley were from the White race group. A major change occurred in 1980 when much of the upper Kat was taken into the independent state of Ciskei, forcing White farmers off

the land. Their farms became villages on which the former farm labourers dwelt. With the loss of management skills, access to capital and private land ownership (the land in Ciskei became state land), the irrigation systems in this area were abandoned and fell into disrepair. The farm occupants came to rely on livestock, limited local employment and remittances and state pensions for their livelihoods. Some of the citrus farms were taken over by a Ciskei parastatal, (ULIMACOR), managed by black farmers who were brought in from outside the catchment. These farms were marginally successful. Meanwhile lower down the valley, the farms that remained in the Republic of South Africa continued to support a thriving citrus industry based on irrigation using water from the Kat dam.

The next major political event was the institution of a democratic government in 1994 that included all race groups. The independent states were incorporated back into the RSA so that Ciskei no longer existed as a separate political entity. The new government set about to reform the water law to ensure equitable access to water for all present and potential water users. There is now a strong emphasis on redress of past inequities, with the aim of ensuring safe and reliable access to domestic water and bringing Black farmers into the commercial system. One mechanism for this has been the transformation of the old, exclusive, White irrigation boards into inclusive Water User Associations. Thus the Kat River Irrigation Board has been transformed into the Kat River Water User Association (KRWUA), which has a broad membership from among all race groups in the catchment and a range of water users including small- and large-scale irrigators, domestic users and the municipality. The steering committee of the KRWUA also has spatial representivity, with members coming from the area falling within the former Ciskei (the upper Kat), the scheduled areas that remained within the RSA (the Middle Kat) and the unscheduled irrigated areas (the Lower Kat).

From 1997 researchers from the Catchment Research Group (CRG) at Rhodes University have been active in developing capacity for water management among people of the Kat Valley. Recognising the marginalized nature of communities living in the former Ciskei, researchers focused on building the capacity of these communities to engage in decision making around water. In 2000 the CRG became actively involved in the process of transforming the irrigation board to a water user association, and more recently (2004-2007) have led a Water Research commission funded project through which the WUA has been developing its own catchment management plan for allocating water to the various water user groups. It is this project that provides the context within which ComMod was situated.

Although the KRWUA represents all main groups of stakeholders in the Kat, clearly some stakeholders enjoy better socio-economic conditions and higher educational levels, which provide them a great advantage in terms of skills required for participation and contribution to the collective learning process. This has had important implications for the way that the ComMod approach could be followed

3. Companion Modelling in the Kat River Valley

ComMod is a process where “modelling deals with the dialectic among the researcher, the model and the field. Simulation accompanies an iterative research process, which is specific to each situation. The endless following cycle ‘field work-modelling-

simulation-field work again, etc.' corresponds to this concept. This leads to the acceptance of a diversity of models and methods, each contributing to a new kind of relationship between the simulation, the research itinerary, and the decision-making process" (ComMod Group, 2003, 4.1).

Another important characteristic of ComMod is the joint use of Role-Playing Games (RPG) and models, particularly Multi-Agent Systems (MAS). "The association of an RPG with a MAS … seems to provide a good way to explain the content of a model in order to validate it and to communicate upon its basis" (Barreteau et al., 2001, 5.9).

Following the ComMod methodology, a MAS (KatAWARE) and a related RPG were developed in the Kat River Valley to contribute to the process of building the capacity of stakeholders to actively participate in designing a platform and context for their negotiation process and to select decision-making criteria for their catchment (Farolfi and Rowntree, 2005). The implementation of the ComMod approach was a component of a wider project titled "A stakeholder driven process to develop a catchment management plan for the Kat River Valley", referred as "the Kat Project" from now on. From here on, we will use the term "KatAWARE project" to indicate the ComMod component of the larger "Kat Project".

To conduct the ComMod process in the Kat, a task force composed of two Cirad researchers (Modelling team) and two Rhodes researchers (Social team) was formed. A South African MSc student was involved full-time in the process, a French MSc student worked on the modelling component during six months, whereas several South African and international students contributed to the facilitation and data-collection tasks during their internships at Rhodes University. A South African facilitator-translator was also part of the team.

Table 1 summarizes the sequence of workshops held during the Companion Modelling component of the Kat Project.

Table 1 Sequence of ComMod Workshops in the KatAWARE Project

Date	October 2004	May 2005	June 2005	September 2005	November 2005	March 2006	October 2006	February 2007	March 2007
Event	Introductory workshop	Preparatory workshops with different WUA groups	KatAWARE Prototype Model Workshop	KatAWARE Version 1 Model Workshop	RPG Session 1	RPG Session 2	Scenarios Workshop 1	Vision Workshops	Scenarios Workshop 2
Participants	ST, WUA, MT	ST, WUA	ST, WUA, MT	ST, WUA, MT	ST, WUA, MT	ST, WUA, MT	ST, WUA, MT	ST, WUA,	ST, WUA, MT

ST = Social Team; WUA=Water Users Association; MT=Modelling Team

In *October 2004* the first workshop with the Kat River Water Users Association (KRWUA) was held in Fort Beaufort with the aim of presenting the ComMod approach to the local stakeholders, establishing their buy-in for the process, and gaining their opinions on it. Several surveys (Farolfi and Jacobs, 2005; Farolfi and Abrams, 2005) were then conducted from November 2004 in the Kat Valley in order to collect information and data to construct a first prototype Multi-Agent model called KatAWARE.

The KatAWARE prototype (Farolfi and Bonté, 2005) was developed on the basis of secondary and primary data, individual surveys and interviews with local

stakeholders, discussions with, and inputs from, the Social team at Rhodes University. The prototype was presented and discussed during a workshop held in Fort Beaufort in *June 2005* (Burt et al, 2005a) during which the stakeholders appeared to reach a consensus on the validity of the representation of water flows, water uses and current allocations in their catchment. During the workshop, local stakeholders raised several doubts and criticisms on specific issues of the model and its outcomes. From these comments and criticisms a new version (V1) of the KatAWARE model was developed (Farolfi-Bonté, 2006) and later presented to the stakeholders at another workshop held in *September 2005* (Burt et al., 2005b).

This new version of the model was much more realistic in terms of hydrology, spatial distribution of water users and their characteristics, management of the Kat River Dam and private water stock facilities. During the September 2005 workshop, KRWUA members began by constructing water allocation scenarios using the KatAWARE model, and then later discussed these scenarios in groups.

Concurrent with the development of the model, was the development of a Role-Playing Game (RPG) (Farolfi, 2006). The RPG was based on the same conceptual model backing KatAWARE V1, but in order to make it playable, the reality was "reduced" to three sub catchments, roughly corresponding to the three areas of voting for WUA board members of the Kat River Valley (i.e. upper, middle and lower Kat). The number of players corresponded to the number of KRWUA members that usually attend the WUA meetings (an average of 8). This resulted in a RPG playfield composed of: three sub-catchments, each one with different rainfall, two smallholding irrigation schemes (in the upper Kat), three large-scale citrus farms (two in the middle Kat and one in the lower Kat), three villages (one in each sub-catchment) and a dam in the upper Kat.

The game was played for the first time in *November 2005*, and based on players suggestions was revised and re-played in *March 2006* (Fox et al., 2005 and 2006). The main objectives of the game were: a) to facilitate the understanding of the KatAWARE model from which the RPG was derived; and b) to provide researchers with further information on stakeholders' individual and collective strategies regarding water use and water management in the catchment. Information gathered from the observation of players' behaviour and the strategies they adopted during the two RPG sessions further enabled researchers to improve KatAWARE V1, particularly in terms of agents' behaviour.

The new version of the model, KatAWARE (V2), included two new improvements, based on the gathered information and stakeholder responses:

- Specification of the agents' individual strategies;
- A simplified spatial representation, similar to the RPG.

V2 of the model was supposed to be implemented in a new multi-agent platform called "Mimosa" (Müller 2004, Müller & al. 2005), which was being developed by a researcher of the Modelling team concurrently to the development of KatAWARE V1. However, "Mimosa" was only operational in 2007, too late to cope with the deadlines of the Kat Project, which required V2 to be ready by the end 2006. In addition, no modeller from the Modelling team was available or able to implement V2 in another multi-agent platform. Consequently, V2 remained a conceptual model, and

the last 2 workshops with the KRWUA were conducted using a slightly modified version of V1.

Following the RPG sessions, the first workshop to discuss scenarios produced by the KatAWARE model took place in *October 2006*. It was attended by several WUA members, a representative of the Department of Water Affairs anf Forestry (DWAF), a representative of the Nkonkobe Municipality, the Research Team from Rhodes University and the Cirad modellers (Farolfi, 2007a). The relatively good participation and enthusiasm shown by local stakeholders during the two RPG sessions created a sense of optimism in the researchers with regards to the capacity of KRWUA members to interpret scenarios and figures produced by the KatAWARE model, and thus discuss them as a basis for the development of the CMP. Consequently, the model was used "live" within the workshop: simulations were run and scenarios were produced directly out of the computer during the session attended by the local stakeholders. However, the model still proved to be too complex and the figures and charts produced during the workshop too abstract to allow real participation and negotiation on alternative strategies of water allocation by all participants (Brown, 2007).

The Social team conducted some separate workshops in *February 2007* ('Vision Workshops' in table 1) with different groups of water users in order to reach a limited number of alternative scenarios agreed by them. Four scenarios (including the status quo) emerged from these workshops and were then elaborated by the Modelling team using the KatAWARE model in terms of socio-economic and environmental outcomes. The figures produced by the model were then re-elaborated by the Rhodes researchers and presented in a more user-friendly way to the KRWUA during a 2-day workshop held in Fort Beaufort in *March 2007* (Burt et al, 2007).

During this workshop, the KRWUA members worked in two groups and reached a general consensus on a scenario that increased moderately the irrigated hectares in all three sub-catchments (up to 800 Ha in the upper Kat -50% citrus and 50% annual crops-; up to 650 Ha in the middle and lower Kat respectively -90% citrus and 10% annual crops-).

Those users previously scheduled under the old water act (Act 56, 1954), raised the issue of whether or not lower Kat farmers, who were not previously scheduled and therefore did not contribute to the maintenance of the dam, should now be given the same assurance of supply as those who did pay and were restricted by their scheduling commitments. Another proposal set forth the suggestion of getting a hydrological model developed, in order to provide citrus producers of the middle and lower Kat with information on dam operation scenarios, relative to water availability and varying levels of assurance, to investigate the implications to both previously scheduled and previously non-scheduled users.

These proposals from the KRWUA have been included in the first draft of the CMP produced by the Rhodes team and will be discussed further in a final project workshop with the KRWUA.

4. Evaluation

4.1. Methods of evaluation

This paper presents the results of several on-going evaluations on the KatAWARE project and an ex-post evaluation case-study structured around the Project "ComMod : a research approach to support sustainable development" funded for the 2006-8 period by the French National Research Agency (ANR).

The on-going evaluations were based on individual questionnaires submitted to the participants during or after the workshops and during group de-briefings run at the end of each workshop.

The ex-post evaluation was carried out by an external evaluator using the Protocol of Canberra (PoC) (see Appendix 1), which is based on two separate questionnaires: the Designers Questionnaire (DQ) and the Participant Evaluation Guide (PEG). The DQ was filled out by the Modelling team and the Social team independently, without the presence of the evaluator. The participating stakeholders' experiences of KatAWARE were captured through an informal interview with participants conducted by the social team. Eleven participating stakeholders took part in the evaluation. These interviews allowed stakeholders to tell their story in their own words. The social team analysed and coded the data according to the kind of information sought in the Participant Evaluation Guide (PEG).

4.2. Results of the evaluation

The ComMod experience in the Kat River Valley was an attempt to support the local WUA to develop those negotiation and decision-making skills that are needed to produce a CMP. The main objectives of the ComMod process are (ComMod Group, 2003 and 2006): **a)** producing knowledge (for the researcher and for the local stakeholders) in terms of an improved comprehension of system interactions; and **b)** supporting the negotiation process that aims at modifying the interactions with the resource (water here) as well as among socio-economic entities. The process uses modelling and simulation tools to build-up a common representation of the studied system, understand its dynamics, and provide support for the analysis of scenarios It seems useful at this stage to discuss how these objectives were matched (or not) through the adoption of the ComMod approach in the Kat. ComMod supposes finally a positioning of the researcher in the process, which is also important to discuss in the Kat case.

4.2.1. Producing knowledge about a complex system

A river basin is certainly a complex system made, among others, of hydrological, social, ecological, cultural, and economic components, all interrelated. The system is dynamic and, therefore, subject to changes overtime. Every group of water users in the basin has a different perception of this complexity and interacts with water in a different way. Furthermore, every user holds different knowledge regarding the hydrological and ecological functioning of the catchment due to his/her experiences and educational level.

The described phases of construction of the KatAWARE model (prototype and V1) and its discussion with the KRWUA offered stakeholders, working as a group, an opportunity to confront the complexity of their system through a simulated representation. This opportunity provided a common platform to learn and adjust the model based on their local knowledge of the system. The passage from the prototype of KatAWARE to V1 and then the sessions of the derived RPG were a sort of co-construction of knowledge, as it happened through the (uneven) contribution of all participants. Some stakeholders appeared to grasp well certain components of the system whilst others struggled with the complexity and the "realism" of the KatAWARE model.

Surveys and partial evaluations conducted so far (Burt et al., 2005 a and b; Fox et al., 2005 and 2006; Brown, 2007; Jones, 2007) indicate that common learning did take place, but for the mentioned reasons and socio-cultural dynamics of the post-apartheid South Africa, this common learning was uneven and took place at a different speeds among the various groups of stakeholders.

4.2.2. Accompanying a common decision-making process

The objective of ComMod in the Kat River Valley went beyond the sole purpose of producing common knowledge: it more explicitly sought to support the local WUA board members in their negotiation and decision-making process for the generation of a CMP. This objective could be considered as a continuation of the previous phase of collective learning. The companion process is positioned upstream of the technical decision (preparation of the CMP) and provides the stakeholders with some possible (alternative) roads to engage a social process of matching the identified problems (water allocation among multiple users to foster socio-economic development and preserve the environment) to system variables (ComMod Group, 2006).

In the Kat, this companion phase passed through three sub-phases: communication, interpretation and analysis of scenarios, and selection of scenarios.

4.2.2.1. Communication among stakeholders

During the first workshops dedicated to the construction and discussion of the KatAWARE model, only a few members of the WUA, and always the same, felt free to speak. Most participants kept silent either because they did not grasp the complex and sometimes abstract nature of the model or because they did not "dare" to contradict or even comment on the opinions of other participants. Also when split into smaller groups, some "leaders" conducted the discussions and left no or little space for the others. There was, therefore, little communication during the construction phase of the model.

Conversely, the two sessions of the RPG allowed discussions and exchange of viewpoints among all players, even if the classical social pattern characterized by some stakeholders having a "dominant" position and, therefore, trying to monopolize the discussions, emerged clearly during the RPG sessions. During the simulated WUA meetings to allocate the water from the dam, every player was allowed to express his/her needs and propose a strategy that had to be considered for the annual water allocation by the WUA. There was, therefore, a turning point in terms of

communication among stakeholders between the construction of the model and playing of the RPG.

The RPG sessions offered a platform for confrontation of strategies and needs, stimulated discussions about the individual/collective interests and, likely, facilitated the comprehension of several aspects of the system to those participants who only marginally understood it during the construction phase of the model.

This observation forced researchers to reconsider the actual success of the learning process in the construction of the model. If only few participants really understood the model before the RPG, then it is likely that the final version of the model is based only on the consensus and input of the more dominant members of the WUA. Additionally, the functioning and complexity of the model was only really understood within the context of the RPG. If this observation is correct, then the additional learning which occurs within the RPG, and the more global vocalisation of opinion within its context, expands the range of consensus related to the model's accuracy; but this consensus is still based only on those members that actively participated not only in the RPG but also the workshops leading up to it.

4.2.2.2. Interpretation of, and discussion about, scenarios

The phase of discussion and interpretation of scenarios produced by the KatAWARE model was supposed to start after the two sessions of the RPG had been played. V2 of the model was supposed to have been completed within time to facilitate this discussion on scenarios. This version would have had a more simplified interface, similar to the three sub-catchments played in the RPG. V2 should include also some behavioural components observed during the two RPG sessions. However, due to the above-mentioned technical delays, V2 was not ready at the time scheduled for the scenarios workshops (end 2006), and, therefore, a slightly modified version of V1 was adopted to represent the selected water allocation scenarios and discuss them with the WUA.

The October 2006 workshop was not well attended and, therefore, from a participatory point of view inconclusive in regards to discussions around water allocation. The model was still perceived too complex by some participants, while most of them considered it as a tool to "prescribe what to do" in the Kat, instead of a platform to reflect together on the possible consequences of their future actions.

The "realism" of KatAWARE V1 was certainly a misleading aspect as it lead to the perception that the model was a decision support tool in the classical meaning, and not a tool to facilitate preparatory discussions for the future decision making process. In other terms, the model was perceived as a "tool to tell" rather than a "tool to test" (Jones, 2007).

Following the lesson of the October 2006 workshop, the research group decided not to run anymore the model "in vivo" with the stakeholders, but rather to use it in the laboratory to produce scenarios previously discussed with the stakeholders and then present these scenarios in a more user-friendly way during the following meeting.

In the last ComMod workshop held in the Kat (March 2007), four scenarios previously discussed and agreed on by all stakeholders in a preparatory meeting were elaborated through KatAWARE V1, and the results of the simulations in terms of socio-economic consequences and water preservation were presented to the participants through a slide show based on maps and simple graphic symbols. Participants appreciated this approach and agreed to discuss in 2 groups (upper Kat on one side and middle + lower Kat on the other side) the proposed scenarios.

4.2.2.3. Selection (preliminary) of scenarios

At the end of the March 2007 workshop, the two work groups of stakeholders selected 2 different scenarios of water allocation to be further detailed in the CMP draft and discussed. Those scenarios increased moderately the irrigated surfaces in all three sub catchments. What emerged clearly from this session was the conflict between large-scale farmers of the middle and lower Kat over rights to the water in the dam. The relatively precise quantification of the amounts of water required for different development scenarios stimulated a confrontation among the largest water users in the catchment (i.e. citrus farmers) about an old and still unresolved problem: the transition from the old system of water rights linked to land ownership (scheduled land) to a new system of water licenses independent of land ownership. Large scale and emerging farmers in the middle-lower Kat, who farm scheduled land, wanted to preserve their priority to water as scheduled users through a higher insurance of supply of the water from the dam. Large scale unscheduled farmers from the lower Kat asked for a licensing system that would provide them with water at the same level of insurance of supply as other farmers.

Small-scale farmers, mainly situated in the upper Kat, and domestic users were not part of this conflict, as both chosen scenarios would satisfy their requests in terms of water quantity. Small-scale farmers and rural domestic users were more concerned about the infrastructure and investments that would allow them to have a better access to the resource: namely the rural domestic users looked for more communal taps in those villages where they are obliged to fetch water from the river, and indwelling taps where communal taps are available. Small-scale farmers stated from the beginning of the ComMod process that they “see the water flowing in the river, but they cannot use it when they need it”. They therefore asked for irrigation infrastructures and water storage facilities. It must be underlined that this choice of scenarios is only preliminary to the technical phase of decision making; this will take place on the basis of the first draft of the CMP and that should lead to an agreed document to be submitted by the KRWUA to DWAF.

4.2.3. Positioning of the researcher within the ComMod process

Some members of the research team (the modellers) joined the Kat project only in 2004, whereas the social team had already a long tradition and experience of collaboration with the WUA members. The legitimacy itself of the proposed ComMod process for the WUA was largely provided by the fact that the social team approved it before it was presented to the KRWUA.

This heterogeneity in the composition of the research group is particularly important to consider when it comes to the analysis of the researcher implication in the

ComMod process in the Kat: the modellers maintained a certain "neutrality" during the whole process, acting purely as knowledge providers at the same level as the other stakeholders; this neutrality probably did not apply to the social team.

A final mention is worthwhile regarding the position of the researchers with respect to the dialogue and communication among local stakeholders during the ComMod process. According to the "system thinking" literature, two opposite postures exist: the "interpretative system approach" (Checkland, 1981; Roling, 1996), that gives priority to whatever communication among stakeholders is necessary to reach a consensus made of various and multiple points of view, and the "critical learning system" (Ulrich, 1987) that underlines the need to consider the power relations, to prepare less empowered groups to the discussions and negotiation sessions through preparatory workshops, and that accepts the non-neutrality of the facilitator. In the ComMod process in the Kat, the modellers followed from the beginning the first posture, while the social team clearly adopted the second approach. Adopting the critical learning approach proved to be essential, given the socio-economic and educational differences found in the catchment, a situation representative of most South African catchments.

5. Conclusions and perspectives

Some aspects of the KatAWARE process make this experience a peculiar case for the ComMod literature. The following characteristics can be underlined.

1. The Kat River Valley is a relatively large and populated area, if compared to most applications of the ComMod approach so far;
2. Several groups of water users were involved in the process of developing a CMP, they have very different characteristics and perceptions of the water issue in the catchment;
3. ComMod was adopted within a larger project (the Kat Project), with wider research and development objectives;
4. The Kat River Valley has been the field for several participatory research projects for water management since 1994;
5. The research group was multidisciplinary and the tasks of modelling and facilitation were under the responsibility of two separate teams (the modelling team and the social team).

In the light of the particular context of the Kat AWARE process, some final considerations are drawn and a series of potential constraints for the adoption of ComMod in South Africa are discussed below.

The ComMod approach is based on an iterative process of understanding, confrontation and analysis. A significant factor in the KatAWARE case was the participants' limited capacity to 'refute' and effectively 'confront' the assumptions underlying the model.. The main reason for this lack of confrontation in the KatAWARE case was that the majority of participants found the computer model too difficult to understand and thus effectively engage with. As a consequence, many participants did not perceive it as something that they could challenge. Instead they saw it as a 'tool to tell' rather than a 'tool to test'. This therefore undermined a key feature of the ComMod approach: the validation of model hypotheses through the

experiences of the stakeholders. The RPG proved much more accessible to all participants compared with the computer model.

The research group felt from the beginning the absence of some crucial stakeholders, namely DWAF and the Municipality of Nkonkobe. Both stakeholders were repeatedly invited to all workshops, but attended only very few of them. This lack of participation by these important partners raises a question mark over the representation issue within the ComMod process in the Kat. On the other side, this example illustrates how difficult is to involve public decision makers and institutions in long and time-consuming participatory exercises. The difficulty of involving public actors such as DWAF or the Municipality represents a potential constraint when an adoption of ComMod is envisaged at a higher territorial and institutional scale (e.g. Catchment Management Agency or even central DWAF).

ComMod in the Kat proved to be a long (2.5 years) and articulated process (9 workshops in Fort Beaufort plus several preparatory meetings). This heaviness determined a certain fatigue in the local stakeholders and made it difficult to have the same level of participation over the project's duration. Such a process is also expensive, particularly in terms of hours of expert work, and time consuming for the involved researchers. These aspects must be considered when choosing between ComMod and other participatory approaches to facilitate learning and decision making around water management in South Africa. In addition, some skills required to implement the ComMod process (particularly modelling and facilitation) are rare, and difficult to combine into the same research group, as it happened in the Kat River, particularly in developing countries. Variants of ComMod could be envisaged in order to "slim" the process, such as using only RPGs, or only extremely simplified models.

Finally, the difficulty of involving public actors such as DWAF or the Municipality represents a potential constraint whether an upscaling of ComMod is envisaged at a higher territorial and institutional level (e.g. Catchment Management Agency or even central DWAF).

Collective learning, communication among stakeholders, and common decision making undoubtedly took place during the ComMod process in the Kat, but it is difficult to separate the effects of ComMod from the effects of the many other projects and initiatives that took place in the Kat since 1994. While some significant insights were gained by participants, it is important to consider whether or not this would have been possible without the "field preparation" provided by the previous projects.

Among the numerous lessons provided by this experience, one seems to be particularly relevant for future applications of participatory approaches in similar contexts. In South Africa during the last years, very many projects have been implemented with the main goal of helping local stakeholders to express their "visions" or to elicit "mental models" about water uses, related problems and perspectives. Most of, if not all, these projects have produced interesting reports and literature that did not actually concretize into a real negotiation support for the involved stakeholders. In other words, the "technical phase" of negotiation and decision making process has always been neglected so far, with the emphasis being on the preparatory phase of "visioning".

In the Kat project, which had as its explicit objective the development of a CMP with the KRWUA, the ambition to go beyond "visioning" and move towards the real negotiation process leading to the "technical decision making" phase was clear. The contribution of ComMod in this direction was instrumental, as the model first allowed quantifying and representing spatially the problems, and the RPG then facilitated the discussions and the debates around these problems. During the Kat Project, the preparatory phases leading to "visions" determined few if no conflicts among local stakeholders. The real conflicts emerged when alternative water allocation strategies expressed as m^3 of water to different groups of stakeholders were proposed and discussed. The quantified scenarios allowed by the model KatAWARE were the bottom line for these discussions.

Even if the ComMod process and the consequent discussion and provisional choice of scenarios is only preliminary to the technical phase of common decision making, which should lead the KRWUA to the definition of the CMP, the crucial step towards local negotiation and decision-making around water management was reached in the Kat. Through the co-construction and discussion of quantitative scenarios, the KatAWARE process proved a useful, though improvable, accompaniment to the local WUA as they progressed from the qualitative step of "visioning" and definition of priorities to the preparation of a negotiated CMP.

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Appendix 1 – Graphical Outline of the Protocol of Canberra

Designers Questionnaire

CONTEXT

Socio-Political Setting :

- Stakeholders: who, why & how selected
- Political, legal and institutional setting
- Level of conflict surrounding the issue

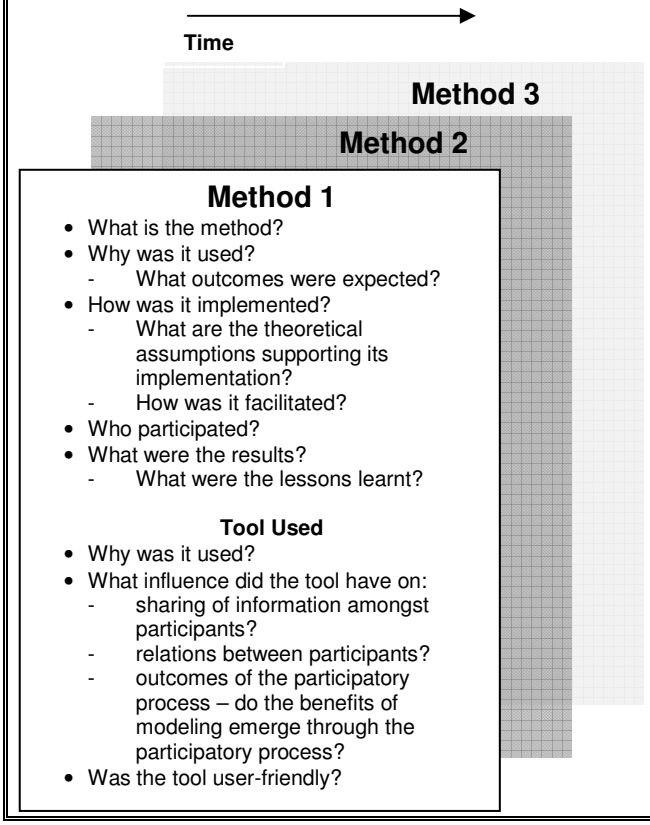
Physical Setting:

- Nature of issue
- Scale of issue

Objectives:

- What are the project objectives?
- Who and/or what influenced the design of the project?
- Why was participatory modeling used?

PROCESS



Participant Evaluation Guide

CONTEXT

Socio-Political Setting:

- Why is the stakeholder participating in the project?
- Who else can he/she recall participating?
- Who else should've been involved? Why?
- Who is responsible for managing the resource/issue at stake?

Physical Setting:

- What does the participant consider to be the issue(s) or resource(s) at stake?

Objectives:

- What does the participant consider the project to be about (generally speaking)?

PROCESS