Better DSS Design through Effective Engagement of External and Internal Stakeholders

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EXTENDED ABSTRACT

Within New South Wales, Australia, natural resource management is coordinated by 13 Catchment Management Authorities (CMAs) (Figure 1). The Catchment Action Plan that each CMA develops must be consistent with state-wide standards and targets which are established by the Natural Resources Commission, an independent adviser to the NSW government on natural resource management issues.

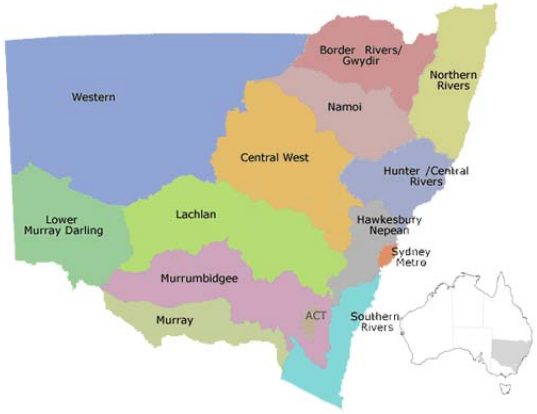

Figure 1. Map of New South Wales showing CMA regions

The main objective of the TOOLS2 project (the subject of this paper) is the development of modelling and decision support tools to assist CMAs with their catchment-level planning and site-level incentives funding decisions. This paper describes stakeholder (internal and external) experiences from this project, discusses their impact and influence on decision support system DSS design and project management, and makes recommendations for better practice in these areas.

The TOOLS2 project brings together a suite of environmental assessment models designed to address impacts of land use/cover/management change on terrestrial and aquatic habitat and biodiversity, salinity, land capability and soil condition and carbon storage. These serve as component models within a DSS that supports:

- catchment prioritisation
- catchment planning and scenario evaluation
- site-level incentives assessment.

As the primary measure of success for the DSS is adoption by CMAs, the process of stakeholder engagement is critical and a programme was developed to garner CMA input and support. A description and analysis of this strategy, and its adaptation over time, is the focus of this paper. The paper reviews this programme and concludes that it has been as successful as could be expected having regard to the level of resources devoted to it. Suggestions for improvement include developing the engagement strategy with the client, and funding individuals within the client organisations to act as project liaisons.

The paper also examines the internal engagement strategy. The formation of component model development groups did not well support the development of the DSS framework which, by its very nature, requires some degree of integration across the components. The main issues that emerged related to lack of a shared vision, and insufficient clarity as to roles and responsibilities, particularly to contribute to DSS design and implementation.

In the TOOLS2 project, the daily imperatives of CMA business prevent CMA staff from being intimately involved in the DSS development. Within the project team itself, the experience highlighted a need for much better communication at the outset of the project as to the vision for the project. A clear and common vision for the over-arching system is necessary so that team members understand their contribution to that system, and are then better positioned to tailor their contribution to fit the integrated whole.

1. INTRODUCTION

The *NSW Catchment Management Authorities Act 2003* established 13 Catchment Management Authorities (CMA) (Figure 1) to coordinate natural resource management (NRM) in NSW. Each CMA is responsible for involving regional communities in the management of its NRM issues, and for the delivery of government funding to help land managers maintain and improve natural resource condition throughout the State. While each CMA has been vested with the authority to plan and implement their investment strategies, their operations are constrained somewhat by state-level requirements that Catchment Action Plans (CAPs) are consistent with state-wide standards and targets for natural resource management. The Natural Resources Commission, which was established at the same time as the CMAs to act as an independent adviser to NSW government on NRM issues, is charged with reviewing and recommending the approval of the CAPs prepared by the 13 CMAs, as well as auditing the implementation of these plans and their effectiveness in achieving state-wide targets.

The main objective of the TOOLS2 project, which commenced in 2005 and runs until mid-2008, is the development of modelling and decision support tools that would assist CMAs with their catchment-level planning and site-level incentive funding decisions.

This paper describes experiences from the TOOLS2 project in which many of the challenges that arose in the process of decision support system and component model development stemmed not just from communications across the project team-client interface, but from within the project team itself, where it transpired that a common vision for the project was not universally shared. The paper focuses on the stakeholder (internal and external) aspect, discusses their impact and influence on decision support system DSS design and project management, and makes some recommendations for improving intra- and extra-project communications in the model development arena.

2. THE TOOLS2 PROJECT

The TOOLS2 (or more formally, Decision Support Tools for Natural Resource Management) project is a federally funded 3-year project, bringing together scientists and economists from state agencies with a role in natural resource management, and software developers from CSIRO, to develop environmental models for catchment planning and site-level assessments, and integrate these models into a decision support system, tailored to the specific needs of CMAs in NSW.

The environmental assessment models under development will address impacts of land use/cover/management change on both terrestrial and aquatic habitat and biodiversity, salinity, land capability and soil condition and carbon storage. The suite of environmental assessment models was determined prior to project commencement, with their delivery to the DSS contracted from the state agencies.

The intent of the DSS is to provide a flexible framework to support the

- definition of change (land use and/or management) scenarios
- definition of funding program aims and assessment criteria
- exploration of multiple benefit surfaces
- generation of priority maps to assist with catchment planning
- interpretation and reporting of results.

In addition, the Natural Resources Commission (NRC), a body established to oversee and audit NRM in NSW, required that the DSS:

- includes models appropriate to scales at which CMAs work (temporal, spatial, organisational) and commensurate with data availability
- can act as a knowledge base and educational tool
- has industry-standard information management
- considers risk.

The main success criteria for the project defined by the NRC and the project's Steering Committee (and therefore the primary goal) is that a majority of the CMAs adopt the DSS and associated models for catchment planning, target setting, incentive funding determinations and program management, based on a belief that the DSS:

1. will help CMAs to conduct their business more efficiently
2. uses good science
3. caters for differences between CMAs and acknowledges CMA autonomy
4. ensures that investment decisions are based on rigorous, transparent and repeatable methods
5. will contribute to the goal of achieving better environmental outcomes

6. will be supported into the future in terms of software maintenance and upgrades, and connections to corporate databases.

Given the project brief, the work has many challenges. These relate to the models themselves (e.g. degree of complexity, intra-model synergy and compatibility); integration efforts (cohesion, multiple models, multiple purposes, multiple users); software development (adherence to agency protocols, scope for innovation) and project management (many teams, many stakeholders, many objectives).

At the highest level, the project has been structured around three components as shown in Figure 2:

- catchment prioritisation
- catchment planning and scenario evaluation
- site-level incentives assessment.

The project teams have been organised according to this structure.

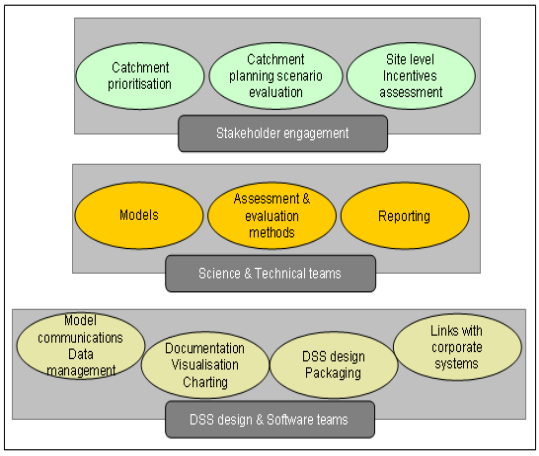

Figure 2. High level description of TOOLS2 project structure and team organisation

As the primary measure of success is adoption by CMAs (rather than the development of an innovative model and/or innovative software design), the process of engagement is critical and a two-way engagement strategy was developed to garner CMA input and support, build trust, communicate progress, and deliver prototypes and products.

2.1. External Engagement

It is well-established that the extent to which a software system or modelling framework is owned and adopted by the end-user is related not just to their awareness of model assumptions and limitations, but also to the extent that they have been involved in system development (Argent and Grayson, 2003). Issues related to how user-friendly the DSS interface is, the transparency of the methods and assumptions of component models, and credibility of results can be managed by involving the stakeholder/client in DSS development and seeking their input at appropriate decision-points along the way. However, this is difficult to achieve in the real world due to practical constraints and high transaction costs.

The TOOLS2 project has 12 client bodies (the Metropolitan CMA was not engaged in this project). Consequently, it was not feasible to maintain close ties with each CMA. However, the need for mechanisms that facilitated the exchange qof information and created opportunities for CMA input was identified. Engagement over the first 2 years of the project has occurred through

1. bi-annual Steering Committee meetings, attended by CMA Managers and Chairs, and the project management team
2. an initial 2-day workshop with representatives from CMAs, the NRC and project team members
3. day-long visits to 12 CMAs to learn about their incentive assessment methods, including types of models used (funding, biophysical, economic), whether social or other factors were included in their assessment frameworks, and how his occurred
4. nomination of CMA contact points for ongoing communications
5. workshops with one CMA to discuss catchment planning functions within specific DSS components
6. model-specific meetings with various CMAs to discuss methods and data
7. workshops to demonstrate prototype (October 2006) and version 1 (September 2007) of the DSS to communicate DSS design, progress on component models, and receive feedback
8. quarterly newsletters to report on project progress.

The first 6 of these activities contributed directly to DSS and component model design. The seventh assisted in DSS refinement and demonstrated achievement against key milestones, while the eighth served primarily as a reporting and marketing communication device. Furthermore, the newsletters enabled the capture of model and DSS design documentation which satisfied an internal, as well as external, communication need.

In general, the CMAs were supportive of the objectives of the project and, in face-to-face meetings, always expressed interest in progress on the models and supporting software, and showed a willingness to convey their needs and provide input.

The 2-day workshop at the outset of the project was extremely valuable and many important issues, common to all CMAs, were identified at this time. Recurring themes were the need for models that:

- were consistent with state-wide standards and targets
- would link into corporate systems
- would be supported beyond the project's life.

The need for CMA engagement and regular communication about project progress was also identified. Over the two days, small group discussions were held to identify major areas of CMA responsibility, systems currently in use for supporting investment decisions and their adequacy, their level of integration with other parts of their business processes and how the new DSS and its component models should be made available to CMAs.

The day-long visits with individual CMAs to discuss their processes for assessing environmental impacts of management scenarios and making funding determinations were also invaluable. Typically, these workshops involved fewer than 10 people, with time allocated for presentations and ample discussion time. The information elicited from these workshops, regarding the funding processes used, the role of social and other factors in influencing determinations and the need for flexibility within the DSS framework, was vital to the eventual DSS design. Most importantly, these workshops highlighted the fact that most CMAs already had effective methods for conducting their business, to which they were quite attached, and that the TOOLS2 project team would have to not only produce something better than existing systems, but also convince the CMAs that they had done so.

The prototype workshops provided a further opportunity to discuss the CMAs existing methods, to present some preliminary software mock-ups of how the DSS might cater to their needs and facilitate further discussions about corporate links, relationships between this project and other government NRM initiatives and the need for ongoing corporate support of the DSS after the life of the TOOLS2 project. The participants at these workshops were not necessarily the same as those at earlier workshops, which required covering a lot of 'old ground'. While time-consuming, the benefit was it broadened the body of CMA staff exposed to TOOLS2.

Less successful was the team's capacity to maintain open and regular communication with CMAs outside of these direct contact meetings. The nominated contact officers were not effectively engaged by the project team, and did not voluntarily engage themselves.

A quarterly newsletter was instigated mid-way through the project as a means of informing CMAs of project progress. (This replaced a project website). In addition to regular updates about model development, the newsletter contained articles about DSS functionality, links to corporate systems, meeting summaries and alerts for upcoming workshops. These proved to be a very powerful and well-supported communication medium and the project's Steering Committee encouraged the team to 'keep them coming'.

2.2. Internal Engagement

While the project team identified the need for a coherent and targeted engagement strategy with our external stakeholders, less thought was given to communication with the internal stakeholders – i.e. the project team. While communication did occur, it became clear that the internal facet of the people-model interface also required formal, prior planning.

Much of the project team management adhered to a standard model, with project governance arrangements established early on and some delineation of roles and responsibilities, including the appointment of leaders to manage engagement, catchment-scale issues and site-scale issues.

Model development groups formed along environmental and economic lines and, not surprisingly, along agency lines, as would be expected from the contract arrangements for the project. These groups represented a natural and pragmatic breakdown for the development of the environmental modelling components. However, the grouping did not support the development of the DSS framework well. By its very nature, this requires some degree of integration (at least conformance) across the components. To address the need for integration it was proposed that working groups be established to operate across the model and DSS software development themes. Of the proposed groups, the following proved successful:

- an *integrating engine* group – responsible for the over-arching DSS design;
- a *catchment-scale assessment* group – responsible for catchment-specific functions and integration of catchment-scale models into the framework;
- an *incentives assessment* group – responsible for design of assessment processes and integration of environmental model outputs into the decision-support framework
- an *engagement strategy* group – responsible for developing and coordinating the implementation of a strategy for communicating with and engaging the CMAs, as well as other stakeholders and the steering committee.

Some of the other proposed working groups were less successful in generating communication flows across the model development groups and ultimately floundered. These included groups to identify data needs and commonalities, design incentives assessment process, and design and prepare documentation.

Flows of information between project team members were achieved via six-monthly project workshops, phone conferences, emails and the use of online collaborative software for managing documents, events and tasks. The workshops (internal, and prototype and version workshops with CMAs) proved to be excellent opportunities for building a sense of community within the project team. As the project progressed, the agency divides and physical distances, that might have hampered communication at the beginning of the project, became less significant.. The issue of lack of understanding between different science disciplines, often cited as a problem in large multi-disciplinary projects, did not emerge as a problem. In fact, there was generally a high level of respect shown between, and to, individual researchers and software developers.

The most significant issues to emerge related to:

- the lack of a shared vision by project members for the TOOLS2 project
- insufficient clarity at the outset of the project about responsibilities, if any, of team members to contribute to DSS design and implementation. Some model developers was seen as being over and beyond their project brief.

3. CONTRIBUTIONS BY THE CMAs TO DSS DESIGN

The discussions with the CMAs provided a very good picture of how they conduct their business, the models (not necessarily software) they use to assess the environmental benefits from changing management, and how they align their daily operation with their catchment targets and state-wide imperatives. While the project team includes 'experts' in various environmental science disciplines, none are experts in the operations of CMAs, and this was an area where it was felt that CMAs could contribute the most to the DSS development.

Some environmental issues, such as salinity, were well understood by CMAs. Furthermore, methods for assessing the impacts of management change on salinity in many CMAs were found to be adequate for informing decision-making, given the level of salinity data and knowledge. Other environmental issues, in particular assessing and valuing aquatic habitat and biodiversity, were less well understood and this was reflected in the lack of models or methods to prioritise and assess these values. The CMA consultations had provided a clear picture of where the expertise of the project team was most valuable, where CMA expertise should be captured in the DSS and also which of their existing methods should be incorporated into the DSS because they are already appropriate for the intended purpose.

With 12 CMAs, some synthesis of the information was needed to identify commonalities and differences between them and resolve how the DSS could best meet the needs of all CMAs. For example, with respect to evaluating landholder proposals for incentive funding, it was found that funding models could be classified into ranked or non-ranked approaches. Differences were apparent in the use of environmental thresholds, inclusion of social factors (e.g. cultural heritage), sharing of costs between CMA and landholder and bonus payments between CMAs. All these were included in the funding model framework that presents the CMA with a range of options for evaluating incentive proposals. The framework allows the CMA to modify the process and selection criteria to make it appropriate for the funding program and is sufficiently flexible to accommodate their own assessment criteria.

Figure 3 shows the funding model screen in the DSS where the user selects from ranked or threshold-based options, and whether to include social factors, cost-sharing arrangements and bonus payments.

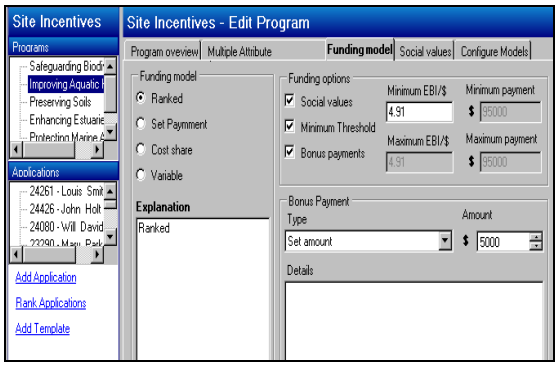

Figure 3. The funding model screen showing the range of funding methods incorporated in the DSS.

For catchment-scale planning and prioritisation, CMAs identified the ability to explore multiple environmental benefits and assess resource condition as their greatest needs. To support this, four component 'tools' are under construction:

- a scenario builder tool to describe land use/management change
- a configuration tool to 'map' land use/management classifications between the component models and the scenario builder and reporting tools
- a reporting tool for charting and mapping results from scenario evaluation
- a multi-criteria analysis tool for building priority maps.

While the CMAs did not play a direct role in the choice of the component models, they were the key drivers for the design of the DSS framework. The incorporation of suggestions and modifications for the DSS elicited from the CMAs, demonstrates the commitment of the project team to addressing their key needs. While not guaranteeing adoption, demonstration of commitment to this ideal is anecdotally an important element supporting acceptance. In the next section, some of the less successful areas of stakeholder engagement are discussed, and suggestions given for improvement.

4. ROOM FOR IMPROVEMENT

4.1. External Engagement

The face-to-face interactions with CMAs were extremely valuable in eliciting information to inform the DSS design. Unfortunately, there were extended periods between these meetings where almost no information exchanges occurred, apart from the newsletter (which only commenced halfway through the project). The nominated contact officers in each CMA were not utilised in any meaningful way, nor did they volunteer their input (reflecting the pressures under which CMA staff operate). Participation in the project by CMA staff members is in addition to their normal work and to date they have been very generous with their time. Likewise, many project team members work on multiple projects making it difficult deliver on their core components, let alone actively engage CMAs in the DSS and model development process. If a higher level of engagement is identified as highly desirable, it may only be achieved, by writing one/some of the external clients into the project for this purpose with appropriate funding support.

In the Great Lakes Council Coastal Catchments Initiative project (see Merritt *et al*., this issue), a full-time project co-ordinator was appointed by the client to not only manage the project, but to promote and raise awareness of the project, develop partnerships and undertake community consultation and education activities. This has proved most successful and could serve as a model for NRM DSS development. The key message is that successful stakeholder engagement needs significant investment from both the client and the project team, with a commensurate budget.

Another area where we could certainly improve is in the development of our engagement strategy, a process which would have benefited from more input from CMAs. More thoughtful up-front design of engagement methods considering who, what, when and how would have informed all aspects of the project workplan and delivery.

4.2. Internal Engagement

In retrospect, the failure of some of the working groups to function could be attributed to a narrow definition of responsibility, and lack of clarity as to what delivery of a DSS entails. Except for the software team, contracts were focussed on development of an environmental assessment model to plug into the DSS. The design and development of the DSS itself was not part of their frame of reference. One consequence of this separation of tasks is insular model development that does not consider the other models, or indeed the overall DSS framework. In addition, the availability (and interest) of team members to contribute to integration tasks (e.g. data and documentation protocols) is not clear. While not catastrophic, such dysfunction could have been avoided if the expectations, roles and responsibilities of each team member had been aired, well-defined, and agreed to, at the outset of the project.

Strong leadership is required to ensure internal cohesion. When project participants are engaged from different organisations, then any delegation of decision-making responsibility within the project team to individuals or sub-committees needs to be agreed collectively, and then respected.

5. THE NEXT STEP

At the time of writing, the demonstration of version 1 of the DSS via a series of one-day workshops is about to commence. These workshops need to make best use of CMA participants' time and that of the project team. They are key promotional and delivery-on-expectations events, and need to demonstrate to the CMAs that we have heard their requests, have understood their business arrangements and acknowledged the need for integration with other NSW natural resource management systems and processes as exemplified by the DSS.

It is a time when CMA feedback is crucial; and when CMAs can start to play an active role as testers of the DSS. For this to occur, the DSS needs to be sufficiently operational to allow CMA staff to trial it in parallel with existing processes. Perhaps, we will see that the lull in regular and active stakeholder interaction in the intervening months has not been a failure of the TOOLS2 project at all, and the best use of the CMAs' time is in the consultation stage (where we achieved well), and the testing stage (soon to commence) and in providing feedback on its strengths and weaknesses towards the end of the project's life.

6. CONCLUSIONS

Effective communication across the people-model interface requires the active engagement of model developers and end-users. Understanding and awareness of the decisions that have been made in the process of DSS and model development are critical to adoption. Unfortunately, and despite the best intentions, close collaborative arrangements are often not achieved because the end-user is not an integral part of the project team.

In the TOOLS2 project the daily imperatives of CMA business prevented CMA staff from being more intimately involved in the development of the DSS. While it would not have been possible to fund a CMA representative from every CMA out of the project, a closer alliance between the ultimate end-user and the project team could have been achieved through funding a number of CMA officers a percentage of their time to be directly involved in the project. The advantages of such an approach include: a greater sense of collaboration, more satisfaction with the end product, more direct input into project decision-making; and ensuring more permanent communication conduits back to the CMAs.

Within the TOOLS2 project team itself, the experience highlighted a need for much better communication at the outset of a project about the project vision – including objectives, risks, scope (in and out), success criteria, expectations of team behaviour, and mechanisms for resolving disagreements. A clear and common vision for the over-arching system is necessary, so that project members understand their contribution to that system, and are then better positioned to tailor their contribution to fit the integrated whole.

Having mechanisms in place for encouraging communication and the exchange of ideas is not always sufficient. Our experience in the TOOLS2 project was that forum-style meetings (via phone hook-ups) were not as effective or efficient as more formal progress reports.

Finally, it needs to be acknowledged that there is no one and perfect way for interacting with people in the development of decision-support software, or any other system or framework. We cannot predict or manage for all eventualities. Finding the method or methods that work best will be situation and team dependent and thus require adaptive management. There are certainly recommended practices, which have been shown to be more effective than others in fostering DSS adoption and ownership by the stakeholder, but there are also a host of practical realities that demand a flexible and adaptive approach to bridging the people-model interface – e.g.

- individual idiosyncrasies
- cultural and institutional environments – e.g. differences between workplaces in terms of the freedoms and flexibility to operate
- demands on stakeholders' time.

7. REFERENCES

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