

SEARCH CRITERIA

Model	Model D: Information Access
Industry	Natural resource management
Focus/Level	Industry
Approach to information needs	Software package
Special Interest Groups	Other

1. PROJECT TITLE:

Development of an integrated catchment management software (ICMS) package

2. FUNDERS:

Land and Water Australia. CSIRO Land and Water, and the Integrated catchment assessment and management (ICAM) centre at the Australian National University

3. PROVIDERS:

CSIRO Land and Water

4. Key Contacts:

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5.INDUSTRY/ISSUE/GEOGRAPHY:

The project's primary target group are catchment managers. ICMS is a PC based software product developed to facilitate the rapid development and delivery of catchment science.

6. PROJECT CONTEXT:

The project to develop and facilitate the adoption of an improved software package for use in integrated catchment management has been active for 4.5 years (early 1997 to end August 2001). Adoption activities continued to December 2001.

The final project reports notes that:

Experience with the development and distribution of decision support systems for delivering research outcomes to catchment managers has identified major impediments to their adoption in the decision making process. These include protracted development time, focus on single impacts, difficulty in combining results with other decision support tools, and scant attention to non-biophysical factors. Based on the belief that these impediments can be addressed in the software design phase, we have developed a framework, called the Integrated Catchment Management System (ICMS), tailored to catchment management issues. By separating data, models and interfaces from one another, and by providing extensive catchment representation, data management, model linking and visualisation functionality, ICMS is an effective vehicle for rapid building and delivery of catchment applications. This

separation allows for models to be updated, with very little impact on the overall application. It allows for models to be reduced to encapsulations of process or empirical relationships, and thus provides non-programmers with the ability to develop applications. The use of model libraries to interchange models and their data definitions provides a ready method to distribute updated and/or new models to ICMS users. Of course, this ease of use comes at a cost and ICMS is most appropriate for non-intensive modelling applications. ICMS is currently being trialled by several catchment modelling and management groups. Applications include the development and delivery of a complex water allocation model and a model of nutrient transport and delivery processes within a large Queensland catchment. In addition, libraries of catchment hydrology models have been developed for distribution.

The ICMS is a PC-based software product, developed to facilitate the rapid development and delivery of catchment science to catchment managers. It implements a 'layered' approach to development and delivery, through the use of four components. These are:

- ICMS Builder – the central engine
- Models embedded in the ICMS MDL (model libraries)– proprietary free-ware and newly-developed models
- ICMS Projects – suites of linked models and their data.
- ICMS Views – DLLs which provide tailored views of Projects.

7.PROJECT NICHE (SPECIFIC OBJECTIVES):

According to the final report, the objectives for the project centred on research and development to underpin development of a high quality software product designed for catchment management issues and catchment managers. Thus they address the need to understand the issues, to build on already successful software engineering endeavours of the project team, and to identify ways to transfer the product to the target audience. The objectives were:

- to promote the continued use of software in catchment management by the commercialising of CMSS
- to identify the modelling needs of catchment committees in Australia, and cater for these in the development of an integrated catchment management software (ICMS)package
- to further develop the CSIRO--developed "Open Modelling " shell for the ICMS package
- to facilitate the adoption of the new ICMS through interactive training workshops with catchment groups, and through appropriate commercialisation

8.PHILOSOPHY/APPROACH:

The information access model is the basis for this project's approach. It focuses on the growing role of the internet, information CDs and distance learning.

9. RESOURCES, MANAGEMENT AND STAFFING STRUCTURES:

Land &Water Australia supported the project including it in its Integration and Adoption Program. The Integrated Catchment Assessment and Management (ICAM)Centre, Australian National University has contributed to building the models that populate ICMS and provided sound business and project management support has been critical to the development of the product. The CRC for Catchment Hydrology (CRCCH) is promoting and distributing the product as part of that CRC 's major commitment to support and foster good catchment modelling practice in Australia.

10. PROCESS/METHODS USED:

The project synthesises activities around meeting yearly milestones as given in the project schedule. These provided a valuable scheduling tool for managing the breadth of activities underpinning good software design, complemented with a practical marketing and adoption strategy.

Once the software was developed, there were two phases to the strategies used to promote the use of ICMS. Phase 1 (1998-2000) was where adoption activity during the development phase was based on initiating discussions for joint projects with modelling groups, presentation of conference papers and workshops. The final report also said that extensive discussions were held with the National Land and Water Audit, ICAM, CSIRO Heartlands, and the CRC for Catchment Hydrology to ensure that ICMS was considered when making decisions about development platforms.

Phase 2 (2001) began in 2000 with a proposal to negotiate a non-exclusive licence with the CRCCH to market and support ICMS was approved. Under this agreement the CRCCH will ship ICMS free of charge on receipt of a request accompanied by a signed standard non-commercial software licence agreement. This is to be managed through a dedicated web site. <http://www.clw.csiro.au/products/icms/>

11. IMPACTS TO DATE (AND EVALUATION APPROACHES USED):

Evaluation to date has been objective driven. Impacts under the objectives are as follows:

- **to promote the continued use of software in catchment management by the commercialising of CMSS**

CSIRO Land and Water business staff handled the search for a commercial partner, and negotiating the legal agreement. A commercial partner Australian Water Technologies (AWT) was granted an exclusive licence after a rigorous tendering and selection process. The lengthy process however commencing in 1997 and concluding in February 1999 was frustrating particularly as it compromised the ability of CSIRO to adequately support potential and existing CMSS clients.

Throughout the project period, CSIRO continued to field CMSS enquiries, related to access to the software, and the nutrient loading data that underpins the model. CMSS has also been featured in National Pollutant Inventory and Environment Australia projects, and is firmly entrenched as a first-cut approach in catchment management projects throughout Queensland, Western Australia and New South Wales.

- **to identify the modelling needs of catchment committees in Australia, and cater for these in the development of an integrated catchment management software (ICMS) package**

The final project report says that modelling of processes that predict sediment, nutrient and salt export from different types of catchments, different land uses and/or management practices, continues to dominate catchment modelling. This is augmented by water allocation issues in the larger agricultural basins and the impact of riparian management on in-stream water quality.

The ICMS case studies address many of these issues and have demonstrated the capability of scientists to develop and deliver simple representations of these processes using ICMS.

- **to further develop the CSIRO--developed "Open Modelling " shell for the ICMS package**

According to the final project report, the capabilities of ICMSBuilder are far more extensive than envisaged. The development life cycle for ICMSBuilder, entailing design, coding, testing, debugging, and application building, has dominated the project work schedule. ICMSBuilder has also received very positive response from the catchment modelling community at conferences since 1997 (MODSIM 97,MODSS 99,Hydro 2000),and has been selected as a candidate for the modelling toolkit of the CRC for Catchment Hydrology. Recent show-casing of the system in the United States also attracted significant interest and praise.

- **to facilitate the adoption of the new ICMS through interactive training workshops with catchment groups, and through appropriate commercialisation**

There have been two phases to the strategies used to promote the use of ICMS. These reflect the state of maturity of the software and the development of an appropriate marketing arrangement. The following is from the final project report.

Phase 1 -1998-2000

Adoption activity during the development phase was based on initiating discussions for joint projects with modelling groups, presentation of conference papers and workshops. Extensive discussions were held with the National Land and Water Audit, ICAM, CSIRO Heartlands, and the CRC for Catchment Hydrology to ensure that ICMS was considered when making decisions about development platforms. While the Audit discussions were not successful, ICAM has been a major collaborator, as has the CRC for Catchment Hydrology. ICAM has used ICMS for the development of the Namoi water allocation prototype, and also uses ICMS for teaching modelling concepts within its 3 rd year Water Resources Management course. As well as considering ICMS for its modelling toolkit framework, the CRCCH is using ICMS as the development tool for a major project and has provided a vehicle for informing the industry about ICMS developments through its monthly CATCHWORD newsletter.

Papers on ICMS applications have been presented at MODSS 99 (Barnes &Cuddy 1999) and Hydro 2000 (Croke et al.2000,Gilmour et al.2000,Letcher et al.2000,Newham et al.2000). Internal workshops have been held since 1998,supported by a range of interactive tutorials. The first 'external ' workshop during this phase was in November 2000,,in conjunction with the Hydro 2000 conference, for staff from WA Water and Rivers Commission and Department of Agriculture.

Phase 2 -2001

In 2000,a proposal to negotiate a non-exclusive licence with the CRCCH to market and support ICMS was approved. Under this agreement, the CRCCH will ship ICMS, free of charge, on receipt of a request accompanied by a signed standard non-commercial software licence agreement. This will be managed through a dedicated web site. While ICMS is free of charge, applications built using ICMS are not bound by this condition. This approach was adopted to eliminate financial barriers to uptake. Uptake is then dependent on the modelling community wanting to use ICMSBuilder to develop models, and wanting to use ICMS View to distribute those models within a tailored application. The business plan underpinning the marketing and adoption strategy is attached (Attachment 6).

The website is now active (<http://www.cbr.clw.csiro.au/icms>)and will be ported to the CRCCH site in late 2001.A schedule of workshops (Appendix B -Workshop Schedule for ICMS training)is prepared for the period September-December 2001 to promote

ICMS and train potential users. ICMS is also being used to write the models within an AEAM workshop in September 2001.

These workshops will be supported by extensive exercise and reference material, based on the current NoteSet series (Cuddy et al.2000).

12. EFFECTIVENESS:

ICMS has been effective in providing catchment managers with a tool to develop and investigate a range of 'what if' scenarios for a range of complex issues important in their catchment. ICMS has been used to develop Projects that link:

- simple rainfall/runoff models with instream flow routing models to predict changes in flows in the Upper Murrumbidgee under different climate scenarios
- simple rainfall/runoff models with instream flow routing and regression models to predict changes in flows in the Namoi under different farm dam storage scenarios
- socio-economic models of crop selection with water allocation constraints, to predict effects on flows in the Namoi under different water allocation scenarios
- rainfall, ground and surface water models, with salinity and nutrient transport models to predict potential socio-economic impacts of expansion of dryland salinity in a south-west catchment in Western Australia.

ICMS has been designed for processing of simple representations of catchment behaviour and is not suitable for processing of spatially dense, or computationally intensive applications.

13. PROJECT DOCUMENTATION AVAILABLE:

<http://www.clw.csiro.au/products/icms/AboutICMS/abouticms.html>

Cuddy S, 2001, Final Report to Land & Water Australia – Project CWA20 Development of an Integrated Catchment Management Software (ICMS) Package, CSIRO Land and Water, August 2001

Cuddy, S. M., Letcher, R. A. and Reed, M. B. (2002). Lean interfaces for integrated catchment management models: rapid development using ICMS. In:Rizzoli, A. E. and Jakeman, A. J. (International Environmental Modelling and Software Society (iEMSS), Biennial Conference. Lugano, Switzerland, Vol 3 pp 300-305. iEMSS, Lugano, Switzerland.

14. ISSUES:

The tendering process seeking a commercial product partner was lengthy and frustrating commencing in 1997 and concluding in February 1999. This compromised the ability of CSIRO to adequately support potential and existing CMSS clients.

15. COMMENTS/CONCLUSIONS:

Overall the final report noted that the project team had delivered an innovative, robust and practical catchment management tool of which they are justifiably proud.

16.REVIEW METHODS:

Desktop Review, contact with Author