A framework to describe the ‘readiness’ of indicators to evaluate outcomes of environmental watering

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1. Environmental watering is a term used to describe the planned release of river water to achieve one or more ecological objectives, e.g. extending a natural flow event to support waterbird breeding. Evaluation of the outcome of the watering often relies on biophysical and/or numeric indicators (e.g. change in habitat condition; number of waterbird nests). We have devised a framework to describe an indicator’s ‘readiness’ as an evaluation indicator. The utility of the framework to assist evaluators select appropriate indicators is under trial with promising results which will be presented.
2. Maturity frameworks, environmental flows

# Introduction

In the Australian government’s [Flow-MER program](https://csiroau-my.sharepoint.com/personal/cud004_csiro_au/Documents/flow-mer.org.au) (Cuddy et al. 2024), different approaches and indicators are used to infer annual and cumulative (over time) ecological outcomes for six ecosystem themes (fish, vegetation, species diversity, ecosystem diversity, hydrological regime, food webs and water quality) from watering actions, designed to meet an ecological objective/s (e.g. enhance fish habitat). Outcomes are reported annually for the most recent water year (July–June) and cumulatively since the start of the program. How objectives are set differ between themes. This makes it difficult to provide a Basin-scale synthesis of outcomes, and can also lead to comparison of evaluation methods that downplay the realities of what can be achieved based on the available data. This has led us to devise a framework to assess the ‘readiness’ of an indicator to serve as an evaluation indicator. We have chosen the term ‘readiness’ to avoid implying any judgement on the appropriateness of the indicator. The framework is based on the concept of maturity models. However it is not intended to judge the maturity of an indicator – rather it is to provide modellers and evaluators with a rational and logical approach to selecting indicators that are appropriate for addressing the issue at hand. We are trialling the framework on the Flow-MER program and preliminary results (not yet peer-reviewed) will be presented and critiqued.

# Methodology and Results

The framework is an adaptation of the maturity model concept, with 5 levels of ‘readiness’. Unlike industry-standard maturity models (e.g. the Capability Maturity Model, CMU 1994) which are designed to drive organisational process and/or capability improvement, our ‘readiness’ framework does not assume an orderly progression ‘up’ the maturity ladder or imply that one level is better than another.

In constructing the framework, we have identified a number of common phases (levels) through which an indicator matures: A Trial, B Repeatable, C Performing, D Adaptive and E Integrated. The 5 readiness principles that we have identifed are 1 Science integrity; 2 Fit for purpose; 3 Quantitative and evidence-based; 4 Collaborative arrangements; 5 Improved through research. Table 1 provides an example of mapping a principle across the 5 evaluation maturity phases. The framework can then be used to characterise evaluation indicators. Results for 3 hypothetical evaluation indicators are provided in Table 2.

Table 1 Mapping the 3 key criteria of principle 1 Science integrity across the 5 readiness phases

| Key criteria | A Trial | B Repeatable | C Performing | D Adaptive | E Integrated |
| --- | --- | --- | --- | --- | --- |
| Defensible, robust methods | Test indicator | Repeatable method | Quantitative methods | Modelled scenarios | High predictive power |
| Methods quantitative | Qualitative methods | Semi-quantitative | Quantitative methods | Modelled data | Scenarios / prediction |
| Confidence estimates | Low confidence | Known confidence | Known confidence | High confidence | High confidence and trusted |

Colour key: yellow – new science, low confidence, qualified reporting; pale green – sound science, known confidence, reliable reporting; darker green – strong science base, high confidence, reporting informs adaptive management.

Table 2 Results from using the framework to assess the readiness of 3 hypothetical evaluation indicators

| Principle | Evaluation indicator maturity | | |
| --- | --- | --- | --- |
|  | Indicator 1 | Indicator 2 | Indicator 3 |
| 1 | E Integrated | A Trial | B Repeatable |
| 2 | D Adaptive | B Repeatable | C Performing |
| 3 | D Adaptive | A Trial | C Performing |
| 4 | C Performing | C Performing | C Performing |
| 5 | C Performing | B Repeatable | B Repeatable |
| Average overall rating | 3.8 | 1.8 | 2.6 |

# Conclusions

We have devised an indicator ‘readiness’ framework that we believe addresses a gap in the environmental assessment literature. Rather than focus on critiquing evaluation models and methods (and the indicators they use), we provide a framework for describing (and selecting) evaluation indicators that is non-judgemental and seeks to make a positive contribution to the science of evaluation.

Our trial using the (draft) framework to describe the readiness of the indicators used in the Flow-MER program has shown that the framework not only provides a logical approach to selecting indicators, it can help in communicating why a particular indicator has been selected, in eliciting indicator characteristics that are of importance to the issue at hand, in gathering user (client) requirements and to manage expectations. It can assist users in selecting a level of indicator that is sufficiently ‘ready’ for the job at hand.

We are keen to continue developing the framework. It brings a level of pragmatism to the modelling of environmental outcomes and advances the science of addressing environmental challenges through intelligent modelling.

Acknowledgements

The Flow-MER Program is funded by the Australian Government through the Science Program of its Commonwealth Environmental Water Holder with co-investment from CSIRO, the Australian government’s science agency. We acknowledge the Traditional Owners of the lands and waters of the Murray–Darling Basin, express our respect for past and present Elders amongst the many Nations of the Basin, and thank them for their enduring Caring for Country.

References

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