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Review of ERA and EI
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**[SUBMISSION TO THE ARC REVIEW OF EXCELLENCE IN RESEARCH FOR AUSTRALIA (ERA) AND THE ENGAGEMENT AND IMPACT ASSESSMENT (EI)]**

The Australian Mathematical Sciences Institute (AMSI), the Australian Mathematical Society (AustMS) and the Statistical Society of Australia (SSA) welcome the opportunity to make a submission to this review of ERA and EI.

As lead organisations representing the disciplines of mathematics and statistics in Australia we are well placed to make comment and provide advice pertaining to mathematical sciences research and its applications. The following observations and recommendations are the result of consultation with academic research staff in the mathematical sciences, aligned with SSA, AMSI and AustMS.

Yours sincerely,

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# ARC Review or ERA and EI

Joint submission by AMSI, AustMS, and SSA

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## *ERA*

### *Value of ERA*

*To what extent is ERA meeting its objectives? Are the ERA objectives appropriate for meeting the future needs of its stakeholders?*

While academic research staff in the mathematical sciences who were part of this consultation consider evaluation of research quality to be important, they are not convinced that the benefits of ERA exceed the considerable resources involved – academic as well as institutional - in a three-yearly ERA assessment cycle. While it is accepted that periodical assessment of research through ERA is now part and parcel of the university sector, the members note that certain objectives of the ERA have not been met.

In particular, the ERA has not been successful in the 4th objective, *identifying emerging research areas and opportunities for further development* in the mathematical sciences. Since research output is classified within research codes at the 2 and 4-digit level, new and emerging research tends to remain hidden among other research output. The ERA does not seem to include a specific mechanism to identify and support this objective.

*What impacts has ERA had on the mathematical sciences discipline, both on departments and schools as a whole and individual researchers?*

Many emphasise that the ERA has prompted a positive shift towards research quality and a renewed focus on mathematical sciences research at their university. Insofar as the ERA has pushed research in the direction of excellence over volume, and has increased research capacity at mathematical sciences departments, it is to be applauded as having had very important positive impacts.

Unfortunately, the positive impact has not been universal. At smaller universities, mathematical research, partly due to the minimum threshold, as well as the publication culture in the mathematical sciences which favours concentration of research results in fewer publications, is often not included in the ERA assessment. This means that potentially high-quality research can remain invisible both in the ERA review and, as a consequence, within those universities themselves.

Mathematical scientists also identified potential adverse consequences as a result of the desire of universities to optimise ERA outcomes. For instance, even though journal rankings were abolished after the first ERA Review, the practice of ranking journals (often based on Scimago rankings) has continued at certain universities. While encouraging researchers to publish in quality journals is one thing, at some universities publishing research is discouraged unless it is in certain journals with a high ranking. Publishing in newly established unranked journals in emerging or interdisciplinary areas can therefore become problematic.

In addition, at certain universities department funding, recognition of research output towards academic workload, or any other incentives have been made dependent on publication in certain journals. These practices can stifle good research or research in emerging areas and can be detrimental to PhD and early career researchers who are still working their way up to publishing in the top journals. Ideally, the ERA should discourage universities from using journal rankings to constrain diverse research output.

*How do you use ERA outcomes? Are they beneficial to you/your organization?*

Individual researchers in mathematical sciences might use strong ERA outcomes in applications for ARC funding, even though these outcomes are unlikely to play a role in decisions to fund grants. ERA outcomes might also play a role in institutional funding discussions or organisational restructuring. As reported above, the ERA has fostered an increased focus on research excellence.

However, the widely shared opinion is that these benefits come at a considerable cost. The amount of resources required for the ERA process are seen as excessive especially given the fact that there are a number of internationally utilized measures of excellence already available that involve external rankings, citation counts and so forth at a fraction of the effort.

*How often should ERA occur? Every 3/5 years or another timeframe?*

Given the relatively long timeframe for publication of mathematical research, as well as for mathematical publications to generate citations and create impact, the three-year timeframe for ERA reviews has always been too short to adequately assess research quality in the mathematical sciences. A review cycle of 5 years or longer, and a longer reference period of research output to be included in the assessment, would be more appropriate. Given the lower publication volumes in the mathematical sciences it might also mean that more units would be able to meet the minimum threshold to be assessed in the ERA. This could lead to more robust evidence of long-term trends and more informative data.

The current challenges faced by the university sector strengthen the argument for a limited assessment and an extended period until the next ERA review to allow the sector to recover. It would enable the sector to direct much-needed resources where they are of most benefit, prioritising actual research activity over the assessment of it in a resource intensive ERA process.

### *Assessment methodology: Peer review and citation analysis*

- *Is the peer review methodology for evaluating the quality of research appropriate? What are strengths and weaknesses?*
- *Is the citation analysis methodology for evaluating the quality of research appropriate? What are strengths and weaknesses?*
- *Does the discipline-specific approach for evaluating research quality (citation analysis or peer review for specific disciplines) continue to enable robust and comparable evaluation across all disciplines?*

The current approach to only assess research in 0101 (pure mathematics) through peer analysis, and in the other four-digit codes in the mathematical sciences exclusively through citation analysis is widely seen as very problematic.

Within the mathematical sciences, vastly different publication and citation cultures exist alongside each other. The subdisciplines 0102 (applied mathematics), 0103 (numerical and computational mathematics), statistics (0104) and mathematical physics (0105) encompass divergent citation cultures but are measured against the same benchmarks. This might lead to detrimental ERA outcomes for more theoretically oriented research areas within those subdisciplines, as they typically generate fewer citations compared to publications in more applied areas within those same subdisciplines.

We emphasise that, in the vein of the San Francisco Declaration on Research Assessment, the quality of the scientific content should always be deemed more important than publication metrics, even if metrics analysis is relatively easy and can be useful to identify trends. We also note that in the UK, the Research Excellence Framework has abandoned all citation analysis for the assessment of mathematical sciences in favour of peer review.

With this in mind, there is wide support to extend the use of peer review methodology for the assessment of mathematical sciences research, either as the only assessment method or in a hybrid system alongside metrics analysis (where peer review contributes to a percentage of the evaluation). At the very least, peer review should be used to assess research in areas such as such as theoretical statistics, the more theoretical areas of applied or numerical mathematics (such as optimisation theory) and mathematical physics. Citation analysis should never be the only method of assessment in FOR codes that have divergent citation cultures.

### *ERA rating scale*

*Is the five-band ERA rating scale suitable for assessing research excellence? Since 90% of units of evaluation assessed in ERA 2018 are now at or above world standard, does the rating scale need to be modified to identify excellence?*

The main objective of the periodical ERA assessment was to foster excellence in Australian research. The continuous improvement of Australian research as benchmarked against national and international research activity is cause for celebration. The mathematical scientists who are part of the consultation see no reason to change the rating scale.

### *ERA interdisciplinary research and new topics*

*Does ERA adequately capture and evaluate interdisciplinary research?*

Similar to new and emerging research areas, interdisciplinary research tends to remain hidden and unrecognized among other research output. The ERA does not seem to include a specific mechanism to identify and support research that combines multiple research areas. The standard categorisation by FOR code would seem to preclude this being done effectively.

### *Collection of ERA data*

*Should ERA move to an annual collection of data from universities? What would be the advantages and/or disadvantages of an annual data collection?*

This is a question that is better answered by universities as it directly involves their capacity to organise annual collection. Given the publication rates in the mathematical sciences there is no compelling logistical reason to collect data annually.

### *Publication of ERA data*

*In future ERA rounds, should the volume of outputs submitted for each unit of evaluation be included in the National Report? Should research outputs be published with their assignment to specific disciplines following completion of the round?*

While the mathematicians consulted are generally in favour of increased transparency of the ERA process, it is unclear if publishing volume data and lists of research outputs in itself would deliver real benefits in rendering assignment and assessment decisions more transparent. In addition, to discourage excessive volumes of poor quality publications, limiting the assessable output per research staff member to their best five publications, as has been done in the UK could be considered.

## *Engagement and Impact Assessment*

*Considering that EI is a new assessment, to what extent is it meeting its objectives? What impact has EI had on individual researchers and your department or school? Are the current definitions of Engagement, Impact and end-user appropriate?*

The engagement and impact assessment in its current form is of limited value to demonstrate the impact and engagement of mathematical sciences. The current definition of end-user, which does not include other universities, is not appropriate to capture the types of engagement common in the mathematical sciences where research often translates to other research disciplines. In the current definition of impact, the research must also translate to a practical uptake or use in the community.

Given that the impact of mathematical research into the development of new analytical tools, methodologies and adaptation in the community is typically measured in a long timeframe – in some cases decades – the typical 5-year timeframe is much too short to do justice to the contribution of mathematical sciences. An impact timeframe of 10 years, as suggested by the mathematical sciences community when the Engagement and Impact Assessment was introduced, would be more appropriate.

### *Unit of assessment*

*Are the two-digit Field of Research codes the most appropriate method to define units of assessment for Engagement and Impact?*

Yes, this is appropriate.

### *Engagement and impact narratives*

*Is the narrative approach suitable for describing and assessing research engagement with end-users, impact and approaches to impact?*

- *In your opinion, are there quantitative indicators that could be used to measure the impact of research outside of academia?*
- *How often should the EI assessment occur? Every 3/5 years or another timeframe?*

The time lag and often indirect mechanisms through which mathematical research filters through to commercial and community outcomes (such as algorithmic development that forms the basis of commercial computer packages and interfaces) may make the narrative method challenging. With regard to the timeframe, we refer back to the first question: A longer period of 10 years would be more appropriate.

## *Streamlining and simplifying ERA and EI*

*Should ERA and EI be combined into the one assessment? Are there other ways to streamline the processes to reduce the cost to universities of participating in ERA and EI?.*

ERA and EI should not be combined into one assessment. Using technological advances such as ORCID could make the process more streamlined.

## *Utilising technological advances and pre-existing data sources*

*Should ORCID iDs and DOIs be mandatory for ERA?*

Yes, both ORCID iDs and DOIs should be made mandatory after an appropriate transition period.