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**[SUBMISSION TO THE REVIEW OF THE AUSTRALIAN RESEARCH COUNCIL ACT 2001]**

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 the Australian Research Council Act 2001.

As the 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 - including its Divisions ANZIAM (Australian and New Zealand Industrial and Applied Mathematics) and ANZAMP (Australian and New Zealand Association of Mathematical Physics).

Yours sincerely,

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AMSI Director

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# Review of the Australian Research Council Act 2001

Joint submission by AMSI, AustMS, and SSA  
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## 1. Scope and purpose of the ARC

### ***How could the purpose in the ARC Act be revised to reflect the current and future role of the ARC?***

For a foundational discipline like the mathematical sciences, which in large part performs research of a fundamental nature, it is hard to overstate the importance of the ARC's role in funding discovery research as a core part of its purpose.

Fundamental research generates truly transformative advances and discoveries through unanticipated new ideas. It has played an essential role in applications that we can no longer live without, such as the internet, online banking, Wi-Fi and GPS. Projects focussed on fundamental research that deliver transformational long-term benefits are common in the mathematical sciences. For example, RSA cryptography, essential to all electronic financial transactions, exists only because of fundamental mathematical research that predated electronic technology by centuries.

Keeping in step with the international research community and continuing to build an international reputation and capacity for excellent research are also reasons to support fundamental research. There are challenges in communicating the value of fundamental research to the general public, but its importance is widely recognised internationally. Government funded agencies with a similar purpose to the ARC, such as the NSF and European funding organisations deliberately provide substantial support for discovery research. International rankings (THE, QS and ARWU) of Australian universities are substantially based on top quality outputs, citations, and the international reputation of our researchers - all a consequence of fundamental research. This has flow on effects in attracting the world's best to research and teach at Australian universities, and in attracting international students to Australia in the face of an increasingly competitive international student market.

Another impact of a strong fundamental research culture in mathematical sciences is that it adds depth and understanding to the training of students at Australian universities. Our students receive the highest level of training, and bring this to future academic and industry careers. Further, strong researchers can, through outreach, raise the profile of the mathematical sciences as role models and ambassadors to Australian youth and the wider community. Strengthening engagement with the mathematical sciences across the whole pipeline, and public funding of excellent research to support a strong scientific workforce will be in Australia's national interest in the long term.

While we do not argue that the ARC should support only fundamental research, we point out that the ARC is the only significant source of funding for fundamental research in Australia. Fundamental research delivers long-term benefits via a multi-stage pipeline. The final stages of the research pipeline can often be appropriately supported through private investment and partnerships with industry. The initial stages, however, are a long-term investment with significant whole-of-society returns rather than a short-term profit. They are not attractive to profit-focussed private-sector investment, so must be realised via public investment.

Moreover, while university expenditure on research in the period 2012-2020 has increased substantially through growth in operational revenue, fundamental research has benefited little from the increased funding. University research expenditure increasingly favours applied research: the proportion of HERD funding to strategic and basic fundamental research declined from 50% in 2008 to 37% in 2020.

With regard to the balance between Discovery and Linkage, we note that the ARC Linkage program is not well suited to supporting research and research infrastructure in the mathematical sciences, and only incidental grants have been awarded to the mathematical sciences through this program. Indeed, only one LIEF grant has ever been awarded with a primary FOR code in mathematics. The type of research infrastructure needed for the mathematical sciences is not recognised or supported through government funding. Existing initiatives have not secured long-term funding from any source. It is time that this gap in the definition of research infrastructure, which excludes forms of research infrastructure needed in the mathematical sciences, such as dedicated facilities for intensive collaborative research, is addressed.

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Recommendations:

1. The inclusion of a provision in the ARC Act to specify discovery research as an explicit and substantial part of the ARC's scope.
2. The removal of the gap in the funding of mathematical research infrastructure – including by reviewing definitions of research infrastructure, which exclude forms of research infrastructure suited to and necessary for mathematical sciences research.

## 5. National Interest Test

***Please provide suggestions on how the ARC, researchers and universities can better preserve and strengthen the social licence for public funding of research?***

Given the public nature of ARC funding, alignment with the national interest as a “social licence” is desirable and appropriate for allocation of funds. Mathematical scientists, as part of the Australian scientific community, accept this and are generally engaged in research that they understand as meaningful to others, whether it be other academic disciplines or society and industry.

To ensure that the substantial national interest of projects with a fundamental, enabling or very broad scope is realised, is important to recognise that projects might have a long-term societal impact, predominantly contribute to knowledge creation, or only contribute to innovation in other academic disciplines, at least in the first instance. “Blue sky” projects lead to important new knowledge creation and innovation and have potential for a transformative impact on society and the economy in the longer term. The definition of national interest therefore requires a long-range view, both in time and scope.

Secondly, and this has also been pointed out above, a strong research culture is, of itself, in the national interest: it leads to a strong academic workforce, to the training of students who will eventually join industry, to universities and their ability to attract students and research talent, and ultimately to Australia's international reputation, and its sustained economic prosperity. All these elements influence and strengthen each other into broader outcomes outside of academia that are currently not always understood or recognised as part of the “social licence”.

Australian researchers' recent experience of the ARC's assessment of benefit through the NIT is an adversarial one. Researchers are, by and large, trained and appointed for research and education skills. They require the support of experts in media and PR to articulate technical research to non-technical audiences. Funding applications include detailed descriptions of the benefits of the proposed research, and benefit is a significant assessment criterion. This nuanced, technical discussion of benefit should form the basis of the ARC's assessment of the national interest of funding projects. The ARC's role in the NIT can then become a cooperative one: assess benefit based on nuanced, information; then aid funded researchers in articulating this benefit in lay terms post award.

Recommendation:

1. Strengthening the social licence requires better expression of the societal benefits of research in general and the encouragement of a culture that appreciates this. The ARC, in collaboration with universities and academia, should play a role in communicating the value of research, post-award, from fundamental to more applied activities.

## 6. Administrative burden

***What elements of ARC processes or practices create administrative burdens and/or duplication of effort for researchers, research offices and research partners?***

Within the mathematical sciences discipline there is broad agreement that the amount of time and effort required from Australian researchers to submit funding applications is excessive and detracts from valuable research time. It is out of step with comparable schemes in other countries.

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The issue is not the writing of the actual research proposals, but rather the disproportionate amount of time and effort necessary to complete the supporting elements. This becomes particularly acute, even embarrassing, where the administrative burden placed on international collaborators is completely misaligned with their actual involvement in Australian research projects.

Other elements are either redundant or unnecessarily long or repetitive. Institutional supporting statements, while important in major funding schemes (Laureates, Centres of Excellence, ITRH and ITTC), are repetitive and largely redundant in smaller-grant schemes. Elements of track-record sections are unnecessarily long and are unnecessarily repeated in the project-description section. A complete review of the structure of applications is long overdue.

However, it is important to retain the excellent aspects of ARC practice. The ARC's incorporation of clear measures for assessing relative to opportunity and encouraging equity of funding are ahead of many international schemes, and should be retained.

Recommendations:

1. We recommend that the ARC benchmarks its funding proposal requirements with international practices and scales them back significantly, in particular the supporting elements of funding applications.
2. We recommend that the administrative burden be significantly reduced by introducing a two-step process where first-round expressions of interest are assessed by the College of Experts and the top 40% are invited to submit a full proposal and submitted to expert review.

## 7. Process improvements

***What improvements could be made to ARC processes to promote excellence, improve agility, and better facilitate globally collaborative research and partnerships while maintaining rigour, excellence and peer review at an international standard?***

Fostering the international engagement with international experts in the peer review processes has proven to be difficult due to the way the ARC currently operates. Given the sheer volume and length of funding applications, involving experts as peer reviewers imposes a considerable administrative burden on discipline experts. This makes engaging international experts particularly challenging.

The ARC makes genuine efforts to assess relative to opportunity and to promote gender equity in funding. However, more could be done to promote greater equity of opportunity across different academic levels, to ensure that the excellent research ideas of early- and mid-career academics are supported. International funding agencies such as the NSF in the USA have developed good mechanisms to achieve this and the ARC could use successful models such as this as a basis for improvements.

Recommendation:

1. Reducing the length of grant proposals to what is really essential, in line with international benchmarks, will help address this.
2. Benchmarking against peer organisations to improve equity of funding across career stages can help to promote both excellence and agility.

## 8. ERA and EI

***With respect to ERA and EI, do you believe there is a need for a highly rigorous, retrospective excellence and impact assessment exercise, particularly in the absence of a link to funding?***

While academic research staff in the mathematical sciences consider evaluation of research quality to be important, they do not believe that the benefits of ERA exceed the considerable resources involved.

As AMSI, AustMS and SSA pointed out in their submission to the ERA and EI review in October 2020, while the ERA has encouraged an increased emphasis on research quality, any positive impacts have

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not been universal and the desire among universities to optimise ERA outcomes also carried significant risk of adverse outcomes.

Moreover, in the period that ERA has existed the importance and scope of international rankings of universities and university subject areas have also grown significantly. For example, new rankings relating to the UN's sustainable development goals have now been introduced and are widely supported. While university rankings are not perfect, they serve as reasonable measures of research quality without putting any demand on ARC resources or on university resources within Faculties, Departments and Schools that could be more productively deployed. Moreover the international rankings are updated annually, while ERA/EI are only national in scope and only undertaken every few years.

With regard to EI, a very significant shortcoming of measuring research engagement and impact is that it was framed as the impact of academic research to end users outside of academia. As such, the engagement and impact assessment has been of limited value to demonstrate the impact and engagement of mathematical sciences. Nor does it measure impact through outreach and public engagement. The current definition of end-user, which does not include other universities or other research disciplines, has not been appropriate to capture the types of engagement common in the mathematical sciences. It does not recognise the scale and complexity of research pipelines, nor their critical importance to truly transformational discoveries.

Recommendation:

1. It is our view that, in recognition of the fact that both initiatives have served their purpose, there is no longer a need for the ERA and EI exercises.

## 9. Evaluation capability

***With respect to the ARC's capability to evaluate research excellence and impact, how can the ARC best use its expertise and capability in evaluating the outcomes and benefits of research to demonstrate the ongoing value and excellence of Australian research in different disciplines and/or in response to perceived problems?***

We agree that demonstrating the value of research and preserving the social licence for doing research should be an ongoing joint effort by the research community and the ARC. The ARC's resources are best deployed to ensure funding of excellent research, and to communicate the benefits of that research.

Recommendation:

1. We do not view the collection of research data as a core mission of the ARC. There are other entities that do this well.