REVIEW OF RESEARCH POLICY & FUNDING ARRANGEMENTS

Submission to the Working Group

September 2015

INTRODUCTION

The Australian Mathematical Sciences Institute (AMSI) welcomes this review and the opportunity to make a submission concerning the research policy and funding environment.

AMSI gives its strongest possible support to the Chief Scientist, Professor Ian Chubb, in his aspiration for a national STEM plan and to this government in its efforts to realise this vision. Research and research training are part of that plan and the STEM disciplines are critical to our economic future. It is our firm belief that any changes to research assessment and funding in Australia must be consistent with this national agenda. The success of a national STEM strategy hinges on the implementation of coordinated and strategic measures which are independent of the electoral cycle and so have bipartisan support. This review therefore has an unprecedented opportunity to recommend changes which will have a generational impact.

Before responding to the consultation questions we wish to identify some relevant features of our discipline and its research profile. AMSI produces an annual *Discipline Profile of the Mathematical Sciences* and an accompanying policy brief, this year entitled *Vision for a Maths Nation.* These documents provide detailed data and analysis and can be found at
2015 Discipline Profile – http://amsi.org.au/publications/discipline-profile-of-the-mathematical-sciences-2015/

2015 Policy Document - http://amsi.org.au/publications/a-vision-for-a-maths-nation/

The mathematical sciences are intrinsically international. Universities around the world are the engine of advances in both theoretical and applied mathematics and in statistics. These advances remain a fundamental part of the scientific and technological revolution and essential to productivity growth and innovation in the economy. For these reasons it is critical that Australia's university based mathematical sciences enterprise remains vibrant and we must continue to train academics to undertake teaching and research.

Australia has a poor record of employment of HDR graduates in the private sector and an even poorer one of research collaboration between universities and the private sector. Clearly our graduates must be trained for wide range of careers but at the same time Australian companies have to engage more fully through their own in-house graduate programs. Engagement with the private sector is key and we believe that our graduates, especially our research graduates, provide a vital channel for this engagement.

One of our four key policy priorities is to "Increase Business Engagement" and the commentary is directly related to this review.

REVIEW OF RESEARCH POLICY & FUNDING ARRANGEMENTS

Submission to the Working Group

September 2015

PRIORITY D: *INCREASE BUSINESS ENGAGEMENT*

The 2015 report by the Australian Academy of Science — *The importance of advanced physical and mathematical sciences to the Australian economy* — indicated that, of those business sectors based on a single core science discipline, mathematics and statistics accounted for five of the top seven by $18 billion value and were placed first, second and third, with a total annual value to the Australian economy of $25 billion, across the seven sectors (Table 4.2 of the 2015 Discipline Profile of the Mathematical Sciences). Of those sectors based on multiple science disciplines, the mathematical sciences ranked in all of the top eight with a total value of $57 billion per annum (Table 4.3 of the 2015 Discipline Profile of the Mathematical Sciences).

Unfortunately, this stellar performance hides an alarming trend. At a time when our governments are trying to drive up the number of research trained STEM professionals in the commercial world, domestic PhD numbers in the mathematical sciences have stagnated and overall PhD commencements in 2014 were the lowest for at least four years (Table 3.21 of the 2015 Discipline Profile of the Mathematical Sciences). They are still among the very lowest in the OECD and at half the OECD average. Australian companies are increasingly sourcing skilled staff offshore or outsourcing their research capacity to offshore providers.

UNIVERSITIES AND BUSINESSES MUST IMPROVE ENGAGEMENT TO MAXIMISE THE ECONOMIC BENEFITS OF MATHEMATICS AND STATISTICS.

We must increase the penetration of our graduates into the business sector and build a vibrant private mathematical sciences research sector in areas such as data science, optimisation and computational mathematics. Currently, the discipline's interest in the ARC's Linkage Grant scheme indicates little appetite to engage with business (Table 4.7 of the 2015 Discipline Profile of the Mathematical Sciences). Engagement will require a significant change to the work readiness of our graduates and the willingness of the commercial world to invest in home grown research and development in the mathematical sciences, the proven contributor to Australia's economy.

This review is timely and important. There is opportunity for considerable reform of research policy and funding in order to grow not only the commercial outcomes of publically funded research but to transform the research capacity of the private sector itself. It is well known that measures of impact drive change in our universities. However, it is of great importance that the vitality of theoretical disciplines is not diminished by the imposition of mandatory metrics for commercial impact. The mathematical sciences are a case in point: our commercial engagement will benefit significantly from broader measures of impact, whereas the health of the core discipline will suffer if we are not able to choose appropriate metrics for it.

Professor Geoff Prince
AMSI Director

REVIEW OF RESEARCH POLICY & FUNDING ARRANGEMENTS

Submission to the Working Group

September 2015

CONSULTATION QUESTIONS (5 sections)

Section 1: OVERVIEW OF CURRENT POLICY AND FUNDING FRAMEWORK FOR UNIVERSITY RESEARCH

1.4.1 What are the main factors impeding the commercialisation of the research output Australia's universities?

The concentration of the university research system, especially the Go8, on the ERA system and international research rankings. This drives academics to pursue publication alone as the means for career advancement. The mathematical sciences are a case in point with high levels of performance in ARC Discovery Projects and low performance in, for example, Linkage Grants.

1.4.2 What are the barriers to improving research-industry collaboration?

The absence of a significant program of funding for INDIVIDUALS to undertake industry collaboration and the corresponding absence of recognition of such collaboration in university career progression.

The low numbers of research trained individuals in the private sector and the correspondingly low numbers of such individuals in senior management. In the Australian finance sector there are significant numbers of mathematical sciences professionals in technical positions but they are rare in senior management.

The lack of opportunity for postgraduate students to spend time on industry-based research.

The increasing absence of private sector graduate entry programs.

1.4.3 What are the best strategies to address these problems? What confidence should we have that they will make a difference?

Look overseas at those OECD countries who were once in a similar position to us and who have radically improved their situation. Concentrate on programs which are scalable, eg the Mitacs Accelerate Program in Canada http://www.mitacs.ca has placed more than 10,000 postgraduates into industry research internships. AMSI's intern program is based on this model http://amsiintern.org.au/

1.4.4 Is the dual funding system for competitive grants the most effective way of providing support for the indirect costs of these grants? Why is it? Would any other approach be more effective?

No comment.

Section 2: RESEARCH BLOCK GRANTS (RBG)

2.3.1 Does block grant funding still have a role to play in funding research?
No comment.

2.3.2 Is block grant funding distributed by performance-based formula still the most appropriate way to allocate funding? If not, what alternatives might be suitable?
No comment.

2.3.3 Are the current allocation formulae still fit for purpose? If not, how might they be changed to improve alignment with policy objectives?
The current RTS allocations, along with inflexible candidature regulations, mitigate against research students being able to undertake industry-based research during their candidature. Domestic PhD enrolments in the mathematical sciences are dropping because students are being head-hunted in their honours/masters years. PhD programmes need a broader vocational base to attract both students and employers. The JVA-Engineering cadetships needs to be overhauled (more flexibility is required) and refunded (more awards are required) to have any impact.

2.3.4 Would there be an advantage in reducing the number of programmes from the existing six? If so, how might this be achieved?
No comment.

2.3.5 Do the current metrics provide appropriate and clear incentives for researchers and institutions for engagement with industry and commercialising research? If not, what other metrics would be suitable and how might the metrics be collected? Are there any metrics whose collection or use should be discontinued?
Clearly a broader set of metrics are required. So far as the mathematical sciences are concerned, where there is a broad range across applied and theoretical research, we would strongly favour being able to customise the basket of metrics according to the sub-discipline, for example, biostatistics through cryptography to low dimensional topology.

2.3.6 Are the funding rules still fit for purpose, especially in relation to delivering more effective and innovative HDR training? What changes could be made to improve funding rules?
See our response to 2.3.3 above and our response to the ACOLA review.

2.3.7 For any changes canvassed in response to the above questions, will there be a need for any transitional arrangements? If so, what sort of arrangements and for how long?
Yes, transition to say, 1000 industry-based research internships annually, will take time and this should be seriously scoped and flexible measures applied.

Section 3: COMPETITIVE GRANTS PROGRAMMES

3.3.1 What changes would support increased recognition of industry experience alongside research excellence in competitive grant processes?

Make such recognition explicit and drop the regressive "research environment" scoring category.

3.3.2 What changes would address any barriers to industry participation as partners in research funded through competitive grant programmes?

No comment.

3.3.3 What role/value would entrepreneurs and business representatives add in the competitive grant process, either as staff or as representatives on advisory and assessment bodies?

A note of caution: it is critical that in opening up the competitive schemes to encourage industry engagement that the error of ERA is not repeated. That is, the ERA left industry-engagement out in the cold and we must make sure that purely academic research is not similarly isolated. For this reason it is critical that research is measured by applicable metrics and not a fixed set. Hence the involvement of business representatives should be restricted to the development and assessment of "industry-based metrics". So, for example, mathematical sciences projects would utilise more or less of such metrics depending upon whether the project was optimising hospital emergency wards or developing results in category theory.

3.3.4 How could industry expertise play a more central role in the peer review process for competitive grant programmes to ensure research with the best potential for commercial outcomes is given greater priority in relevant programmes?

See 3.3.3 above.

3.3.5 Could assessment criteria in relevant grant schemes include greater weightings for likely predictors of commercial benefit such as 'record of commercial achievements' and 'commercial potential of research'?

Laudable so long as they are only used where applicable and not universally.

3.3.6 Is there a need for a greater focus on competitive research programmes which specifically support early stage commercial research endeavours, such as proof of concept funding and require tangible progress toward a commercial outcome within a five-year timeframe?

Yes, mathematical sciences start-ups are very exciting and having a significant impact in Australia.

AMSI
AUSTRALIAN MATHEMATICAL SCIENCES INSTITUTE

REVIEW OF RESEARCH POLICY & FUNDING ARRANGEMENTS

Submission to the Working Group

September 2015

Section 4: PERFORMANCE OF THE RESEARCH SYSTEM

4.3.1 Is there a better balance between competitive grants and Research Block Grants which would improve the commercial returns from research?

No comment.

4.3.2 Are there useful international models for increasing research-industry collaboration which could be implemented domestically?

Yes, the Canadian Mitacs programs for industry-based research internships and industry postdocs have achieved remarkable success. Mitacs began as a network of centres of excellence in the mathematical sciences and now runs programs across all university disciplines and industry sectors. Mitacs founder Prof. Arvind Gupta can be seen at https://www.youtube.com/watch?v=1uQJVoqF1Ac speaking about their programs.

4.3.3 What more can universities and industry do to enhance collaboration between them?

Universities can remove PhD candidature rules which impede industry engagement.

Industry and universities can work together to build shared postdoctoral programs. The success of the Cambridge Science Park is a compelling example.

4.3.4 How could measurement of university/industry engagement be improved?

No comment.

4.3.5 How could measurement of knowledge transfer of research outcomes to industry and other end users be improved?

No comment.

4.3.6 How could research impact be measured?

No specific comment but please engage the services a statistician as part of the team developing the metrics.

4.3.7 Is it appropriate to require the application of consistent IP management principles and processes across the sector? If so, how?

Yes, but they need to be sensitive to project scale. For example, AMSI Intern project intellectual property is owned by the industry partner and that is vital for industry buy-in. The IP is licenced back to the other parties for teaching and research purposes.

4.3.8 How are SMEs affected by IP issues? How do SMEs navigate the innovation system?

AMSI Intern has a lot of experience placing PhDs with SMEs for research internships and we would welcome a detailed discussion with the Review Panel.

4.3.9 Would greater uniformity in IP arrangements be useful to end-users? How would standard approaches constrain institutional policy choices?

See 4.3.7 above.

4.3.10 What role is there, if any, in international rankings in assessing the performance of the Australian research system? What options are there for developing an international rankings approach for engagement, collaboration and commercialisation that are suitable for time series analysis?

No comment except to say we have a poor record in collecting and reporting data consistently on almost any time scale for projects such as this.

4.3.11 What lessons can be drawn from the US example of the Bayh-Dole Act?

No comment.

Section 5: RESEARCH TRAINING AND EMPLOYMENT

5.3.1 How could research programme structures and rules be improved to remove blockages to more flexible and innovative HDR delivery?

In our submission to the ACOLA review we suggested the following:

Candidature flexibility.

- Candidature duration should be extended to allow the equivalent of 6-12 months approved coursework, both discipline-based and generic skills-based.
- Candidature rules should allow students to remain enrolled during approved activities such as internships.
- Candidature rules should allow students to remain enrolled until their theses are successfully examined and defended.

5.3.2 What changes to research funding structures reduce structural funding barriers affecting the movement from undergraduate to HDR studies?

No comment

5.3.3 Would a move away from institutional funding towards student based funding improve HDR delivery?

No comment.

5.3.4 Do university employment practices include drivers of promotion and IP ownership which work against researchers engaging in commercialisation opportunities?

Absolutely!