

# Submission to the Review of the National Innovation System

Forum for European-Australian Science and Technology cooperation  
(FEAST)

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## Submission details

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## Declaration of Interests and Affiliations

The Forum for European-Australian Science and Technology cooperation (FEAST) is jointly funded by the European Commission and the Australian government. FEAST is hosted by The Australian National University on behalf of Australia's entire research and innovation community. The unit's mission is to facilitate research and innovation collaboration between Europe and Australia both in regard to the EU and bilateral cooperation with individual member states. In line with this role, FEAST's Executive Director is an Australian Government nominated National Contact Point (NCP) for the Seventh Framework Programme (FP7).

In fulfilling this intermediary role, FEAST works closely with the following:

- government officials in Australia;
- officials in the Delegation of the European Commission to Australia and European Commission officials based in Brussels;
- officials in Australian embassies in Europe (particularly in the Australian Mission to the European Union, Brussels);
- European Embassies and High Commissions in Canberra;
- the Australian research and innovation community;
- the Australian research management community (particularly staff in university research offices);
- companies with a commercial interest in strengthening research and innovation cooperation between Australia and Europe.

As such, and in line with the above affiliations, FEAST has an interest in commenting both on ways of improving the effectiveness of Australian-European research and innovation cooperation and more generally, *all* international engagement in research and innovation. *Please note that this submission does not repeat material from prior submissions, however it does draw upon material contained in some previously published opinion pieces.*

## Introduction

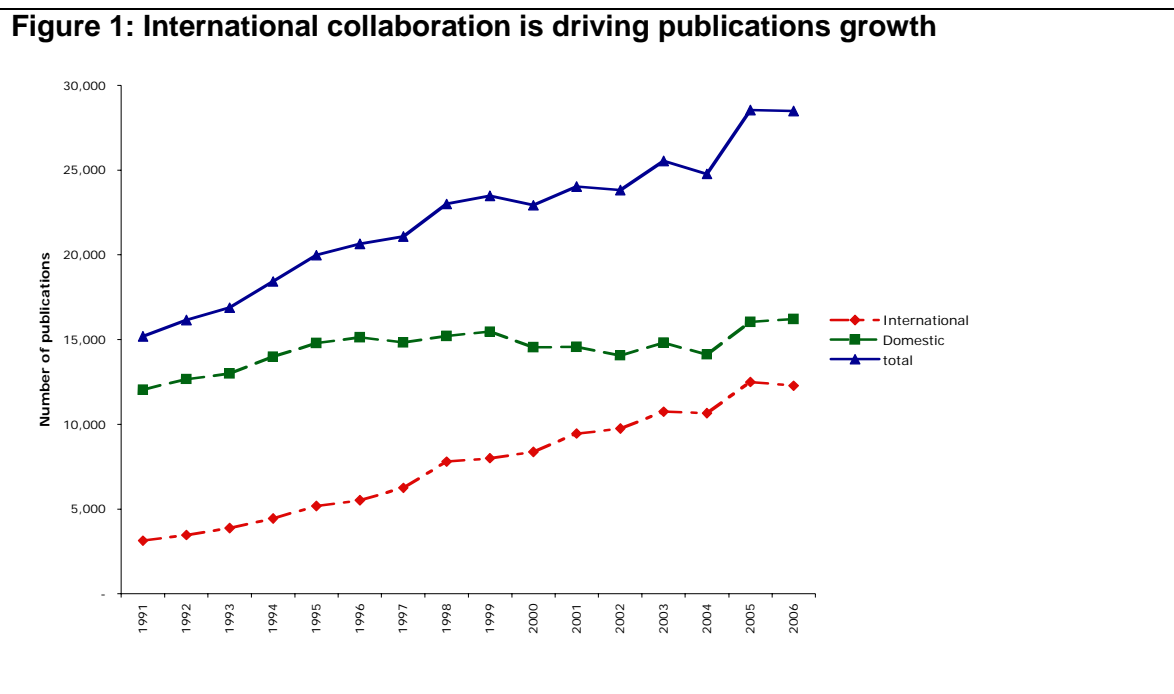
The purpose of this submission is to communicate findings obtained by FEAST from wide-ranging consultations and discussions with the stakeholder groups listed above. These consultations have been carried out over the last year as part of a programme of work focused on identifying and promulgating best practice strategies in research and innovation engagement between Europe and Australia. The submission also draws upon some preliminary findings from bibliometric analyses of patterns and trends in international research collaboration involving Australia-based researchers.

The submission comprises three sections:

- a consideration of the importance to Australia of international collaboration in academic research in general, and collaboration with Europe in particular;
- a discussion of ways of achieving stronger international engagement in research;
- a recommendation for improving the efficiency and effectiveness of both international academic research collaboration and international collaboration over business innovation.

### Key trends in Australia's international collaborative landscape

Bibliometric analysis suggests that most of the growth in Australia's research publications is associated with international collaboration rather than purely domestic efforts. FEAST has examined this issue with regard to those academic publications that are tracked adequately by Thomson publications data.<sup>1</sup> The output of purely domestic papers is growing by around 200 per year whereas papers with international authors are growing by roughly 600 per year, i.e. three-quarters of the growth in publications output is associated with international collaboration. This trend is illustrated in the following graph.

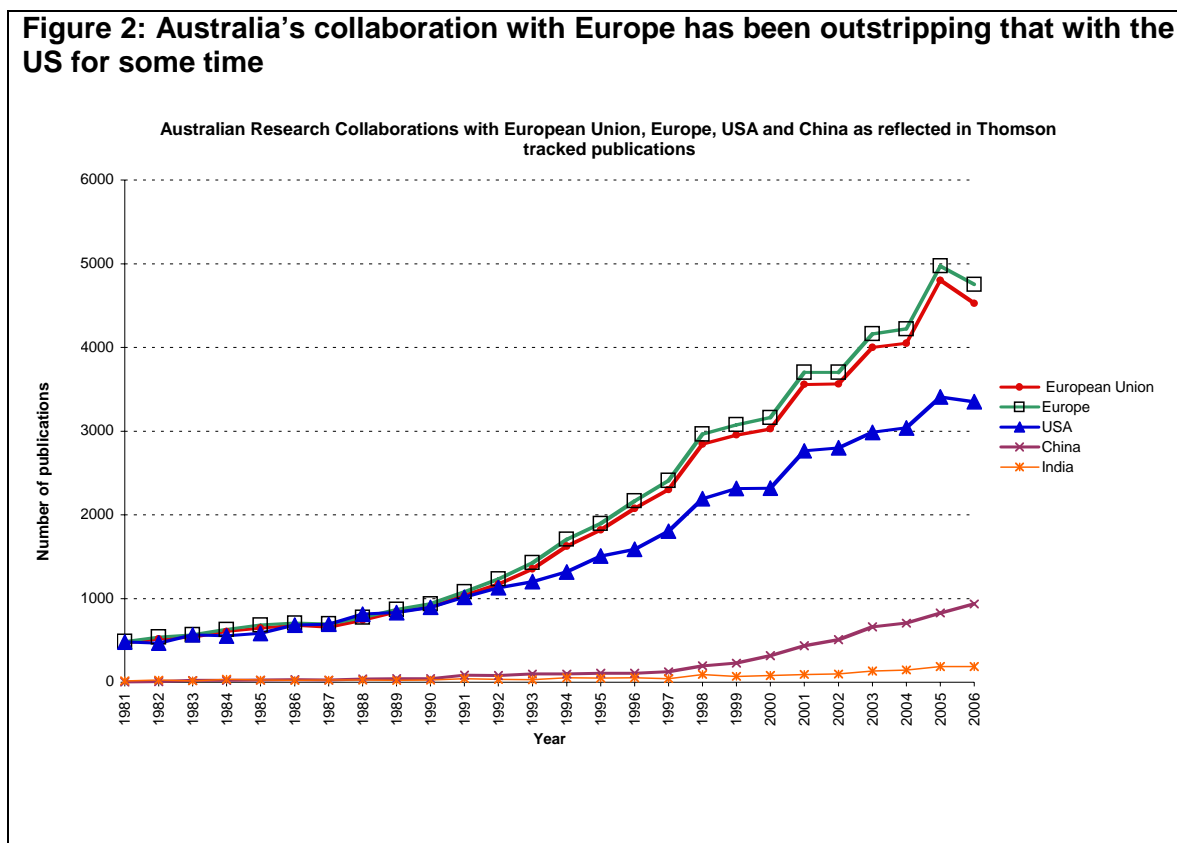


Source: Thomson data provided to FEAST by the ANU's Research Evaluation and Policy Project.

<sup>1</sup> Thomson is a key data source used to assess research performance, however it suffers from the important limitation that the humanities and social sciences are not covered effectively.

Europe is Australia's major research partner, a trend that the following graph illustrates. According to this dataset, the early 1990s marked a point of divergence between Australia's research collaboration with Europe and the United States. The number of collaborative publications with European researchers has grown faster than the number with US collaborators. Not surprisingly, the number of collaborative publications with China has been increasing since 1997, far more than that with India.

**Figure 2: Australia's collaboration with Europe has been outstripping that with the US for some time**



Source: Thomson data provided to FEAST by the ANU's Research Evaluation and Policy Project. Note that the dip in 2006 is simply due to lags in capturing publications.

There are several factors responsible for these trends. International research collaborating is *broadening* geographically (we are collaborating with more countries) as well as *deepening* (we are intensifying our collaboration with particular countries in specific fields of research). FEAST will be carrying out more detailed analyses of these trends over the next two months, including an examination of the impact on citation rates.<sup>2</sup> What is clear at this (preliminary) stage is that research engagement with Europe is of major, and growing, significance to Australia.

### Achieving stronger international engagement

FEAST has been examining researchers' experiences in collaborating with Europe, starting with those teams who have participated in Sixth Framework Programme (FP6) projects. In our discussions, we have been asking questions about the best approaches to take (what works well and what doesn't) as well as the benefits obtained and any challenges encountered. Our consultations to date have covered 47 FP6 projects, which amounts to nearly half of the formal Australian participation in FP6. Significantly, Australian researchers have, in the main, welcomed this initiative

<sup>2</sup> These findings will be made available to the Review on request.

because they fully appreciate the importance of providing the European and Australian science and innovation policy communities with better information on how best to intensify research collaboration.

### *The traditional paradigm*

The established wisdom for many researchers and policy-makers has been to view international research collaboration as a complementary but auxiliary activity to core research. That approach lent itself to searching for dedicated funding to support international research collaboration. Efforts to meet this demand have been reflected in targeted funding to support international collaborative projects.

In this approach it is extremely difficult for the supply for funding for international engagement to match the demand for it, and as a result the size of the “deal flow” in international research cooperation tends to be limited by the availability of targeted funding. There is also a tendency for some researchers to view international cooperation as a means of supporting research projects that they have been unable to fund via domestic sources. This leads them to seek to engage internationally from a position of weakness rather than strength. Proposal submission synchronisation can be an additional problem faced when targeted funding for international engagement is relied upon.

In this established perspective the risks faced when attempting to make international collaboration happen can be rather high. Considerable time, and resources, can be consumed attempting to secure special funding for international collaboration yet the probability of success is low compared with efforts to secure purely domestic research funding. This risk reduces the attraction of international collaboration and, arguably, is a matter of concern given the importance of bringing together complementary research capabilities that reside in different nations.

### *The emerging paradigm*

The emerging paradigm is significantly different. It reflects growing awareness of the fact that the most highly cited research work tends to be associated with international research teams and therefore treats international collaboration as part of the “core business” of doing cutting-edge research. Those teams with sufficient critical mass, as can be found for example in a centre of excellence, build sustainable collaborative relationships as a key part of their core projects – not as an optional extra. This approach involves doing things like exchanging post-docs and PhD students and arranging regular networking of researchers to pool their insights and jointly interpret findings. Travel costs are born by a centre, or smaller team, as part of its core business.

The risks faced in working in this way are far lower because the challenge of trying to secure (limited) additional funding for international collaboration is greatly reduced. Indeed, the reciprocity involved in exchanging staff and students means that there can be a very high level of collaborative activity relative to any international flows of funding. Provided that the transaction costs involved in international research cooperation (i.e. travel funding) are covered teams can swap people with relative ease.

Of course, it can be very difficult for the policy community to track this “endogenous” international research collaboration precisely because it is central to “core” research efforts. This is why so little data are available on the real nature and extent of research collaboration between Australia and Europe. It is easiest to track the collaboration linked to targeted funding, although this is only the tip of the iceberg. Consequently, this new paradigm has always existed “under the radar” because many researchers have been building sustainable, internally resourced, collaboration with Europe (and the US) for decades. By implication, the trends in publications noted above are largely associated with this hidden but extremely important endogenous collaboration.

It is not hard to see that adopting this more “self-reliant” approach allows the size of the international research collaboration deal flow to grow in response to the demand for such collaboration without the constraint imposed by the limited availability of targeted funding.

Of course, any tendency for national funding bodies and research councils to cut requested travel funding when awarding research grants does tend to limit the effectiveness of this self-reliant approach – particularly if it is hard to raise funds for travel from other sources.

From this perspective, the rules and regulations surrounding research funding that restrict scope for international collaboration are *the* key impediment preventing researchers from building the collaborative relationships that they want to build. A more permissive approach to research funding would allow international collaborative relationships to be configured “bottom up” in line with researchers’ collective aims. Academic research is an inherently international self-organising system and funding arrangements should therefore be better aligned with this international system. Indeed, the very notion of a “national” research and innovation “system” is, arguably, a mental construct divorced from reality.

Consequently, Minister Carr’s recent announcement that the Australian Research Council will now be adopting a far more internationally engaged approach, involving a move toward truly global competition for funding for research to be performed in Australia, is therefore extremely welcome and commendable in its clarity of purpose. This aligns Australia with international trends in research policy – for example the new European Research Council (ERC) adopts a similar approach.

The overall result of these international trends will be that research will become more “borderless” and better able to exploit synergies and to avoid wasteful duplication. We are moving toward a global knowledge commons in which the nationality and geographical location of researchers will matter much less than the webs of global relationships in which these researchers are embedded.

Indeed, it is these webs of often complex relationships that will increasingly constitute the critical intangible “asset”, from which public policy will seek to obtain a social, environmental and economic pay-off. It is not hard to see that understanding and tracing the outcomes from spending on research and innovation is set to become far less about the direct benefits arising for a nation and region/city and more about the ways in which each nation, region and city performs research as part of a wider network that contributes to *global* advances. These global advances are then drawn upon in a more “customised” manner to address specific national, regional and indeed city-based challenges and opportunities. Such global advances relate both to academic research and business innovation. The generation of useful research outcomes, business and public sector innovation are the product of a complex global system of research and innovation.

Both research advances and innovation in business (and the public sector) tend to be achieved via interactive social networks: discrete elements of creativity are identified, examined, emulated, modified and generally built upon in a collective manner – generating innovation and progress in research that is *itself* a evolutionary system. We must move beyond notions of both academic research and business innovation that seek to reify progress (i.e. misrepresent outcomes from a complex system behaviour as discrete events). If we overlook the importance of the international webs of social interactions and information flows that are central to creativity and progress we distort our understanding of how research progress and innovation takes place.

This has important implications for how we go about both appraising potential research projects and evaluating the progress and outcomes that past projects have generated. Policy-makers must stop searching for the holy grail of easily traced

“smoking gun” audit trails that link research to useful outcomes via simple causal chains. They must learn to accept that research generates useful outcomes by a process that often cannot be traced in a simple manner precisely because a complex, but far more powerful, system of cause and effect is at work on a global scale. We therefore encourage this Review to recommend guidelines for which:

- research project selection and performance evaluation is better aligned with the *international* dimension to *national* research and innovation performance;
- making a significant contribution to global advances in knowledge is treated as sufficient in itself because most progress in research and innovation takes place via (global) interactive professional networks and information flows.

### **Prescience, preparedness and innovation**

Over the last decade or so a particularly strong emphasis has been placed upon research commercialisation as a key expected outcome from public research. The assumed simplicity – and measurability – of this type of outcome has undoubtedly contributed to the rise of this perspective. Patents, licenses, start-up companies and the like can all be measured as outputs. These tangible features tend to assist policy-makers in budget negotiations and help to re-assure the general community that “value for money” is being sought in a (reasonably) transparent manner.

However, the prevalence of research commercialisation as *the* high-profile outcome class associated with public science is now less clear-cut. A number of researchers and policy commentators have stressed the importance of “prescience” and “preparedness” as key outcomes from public science. The argument runs as follows. In an uncertain and risky world public science plays a critically important role in identifying risks and associated costs that we may have to face in the future (climate change being an excellent example) – this “prescience” is a key contributor to our preparedness to facing these challenges. The widespread dissemination of this information to business and the general community may (eventually) help to change behaviours – and in turn changes what the future may actually have in store for us. Consequently, the benefits generated by this type of outcome from public science tend to be reflected in less unfavourable futures than would otherwise be the case. As the Stern Report sought to stress, the economic value of mitigating risks in this manner is massive. Prescience and preparedness re-invigorate the traditional concept of capability-building by highlighting the uncertainty and risk dimension.

Well-regarded bodies, notably the Federation of Australian Scientific and Technological Societies (FASTS), have acted to support this shift in stance. In submissions to the 2006 Productivity Commission (PC) study of the returns to public support for science and innovation the importance of preparedness as an outcome class was stressed by FASTS, CSIRO and the Group of Eight. The PC reacted favourably to these arguments, the preparedness dimension featured strongly in their final report. In addition, preparedness outcomes are also a strong feature of the EU’s Framework Programme – although this concept is not currently used in Europe to frame research and innovation outcomes.

Previously, the term preparedness was used mainly in relation to defence, counter-terrorism and natural hazards. The wider use of this term, and the related concept of prescience, seeks to focus policy thinking on the far more extensive aspects of how science helps us to deal with uncertainty and risk. Of course, science and innovation are also partly responsible for many of these unfavourable future scenarios (from endocrine disrupters in our water supply through to weapons of mass destruction). The need for prescience and preparedness is generated in part by the unexpected consequences of science and innovation – the unwelcome downside of modernity.

Indeed, many areas of innovative activity address these unwelcome consequences of scientific and technological progress as *market opportunities*.

The increased recognition given to prescience and preparedness in research and innovation policy also raises questions about our funding priorities. Some areas of public science that have fared relatively badly over the last decade: e.g. environmental sciences, earth sciences, and agricultural science, and some of the social sciences and humanities (particularly area studies) are strong contributors to our levels of preparedness. The apparent weakness of such research areas in a research commercialisation-dominated policy framework tend to dissolve when prescience and preparedness outcomes are given due recognition.

If we are to pursue a more balanced approach in research policy in which commercialisation and prescience/preparedness outcomes *all* receive the attention they deserve then we need to articulate how prescience and preparedness can be measured – and their value estimated. Some techniques exist to do this because this is how investment banks make their money (so-called “value-at-risk” methods). Consequently, there may be much to be gained from far stronger engagement between the research community and the financial sector. One advantage of prescience and preparedness-based approaches is that they avoid the ‘more jam tomorrow’ problem: we obtain the benefits *now* because this is the point at which we judge the present value of future risks and associated costs – in exactly the same way that financial analysts calculate the present value of a future stream of investment yields. Preparedness-based thinking opens up a rich new seam for outcome measurement. It is this distinction between the research outcomes associated with prescience and preparedness and innovation per se that leads us to stress the importance of avoiding conflating research, including formal R&D, simply as part of innovation processes.

FEAST therefore commends the Review for noting the relevance of the management of uncertainty and risk to research and innovation policy. In order to operationalise this aspect we stress the importance of:

- developing measures of *prescience* (forewarning of possible future consequences of current actions);
- developing measures of *preparedness* (the responses to this prescience);
- articulating clearer links between prescience, preparedness and innovation (the move from prescience to preparedness is both a stimulus to innovation and a means of increasing levels of preparedness).

FEAST is well positioned to facilitate Australian-European cooperation over these important policy matters of mutual interest. Indeed, this could be an area of great future importance to research and innovation policy worldwide. Effective cooperation with the financial sector and professional services firms is essential to operationalising these ideas.

### **Standard International Research and Innovation Cooperation Agreements (SIRICAs)**

This submission concludes with a specific proposal intended to support the developments highlighted above. The consultations we have carried out have highlighted two related areas in which the adoption of a more standardised approach to drawing up international cooperation agreements would be very useful.

Firstly, with regard to academic-to-academic research cooperation, there are substantial transaction costs and time lags involved in drawing up multilateral research cooperation agreements. If more than one research team in Australia seeks to cooperate with a research consortium overseas then it can be expensive and time-

consuming to draw up a suitable cooperation agreement. This makes it difficult for Australian researchers to engage effectively with, for example, a EU Framework Programme consortium if more than one Australian institution is involved. As these sorts of research links with Europe continue to evolve, particularly through special 'coordinated' bids for cooperative research funding, these transaction costs and lead times will become an increasingly severe impediment to intensified and 'self-reliant' research cooperation, particularly as we move towards more globally engaged research funding arrangements. The current situation is characterised by multiple parallel efforts to draw up MoU's and contracts without the benefits of collective learning, information exchanges and legal template standardisation. This is a costly and inefficient approach.

Secondly, with regard to businesses seeking to innovate via multilateral international cooperation the same sorts of transaction costs and difficulties are faced. In particular, it is not easy to develop "agile" research and innovation partnerships involving business-academic collaboration across national borders. It is taking too long to conclude contract negotiations that relate to complex intellectual property and funding/in-kind resource commitment issues (evidenced by experience within the Cooperative Research Centres program). Given that the EU Framework Programme addresses major innovation objectives involving business-academic partnerships this is a significant limit to international engagement. These difficulties mean that the scope to resource business-academic collaboration of an *international* nature via the R&D Tax Concession Programme (and similar programs overseas) is limited.<sup>3</sup> This means that the tremendous potential to utilise the R&D Tax Concession Programme to fuel international engagement in innovation (e.g. with the EU Framework Programme) is not currently being exploited.

One possible solution lies in emulating key aspects of US *Cooperative Research and Development Agreements* (CRADAs). These are a standard legal template designed to reduce the transaction costs of forming and running an industry-academic partnership for defined objectives. CRADAs provide a simpler, and arguably more pragmatic solution to the cooperative research centre challenge. Importantly, they encourage project and programme focus rather than "institution" building efforts. As such, a legal template-based approach encourages better and more agile linkages between institutions involved in research and innovation – one of the major challenges for research and innovation policy.

The basic idea is to formulate a CRADA-type approach specifically targeting *international* research and innovation cooperation. These *Standard International Research and Innovation Cooperation Agreements* (SIRICAs) would be clearly aligned with the policy objective of encouraging more self-reliant "bottom-up" approaches to international research and innovation cooperation. SIRICAs would work by reducing the transaction costs and lead times associated with establishing effective international partnerships, including those involving businesses. In a more permissive globally oriented context they would constitute a robust case for government intervention that would leverage and complement many existing funding programs and subsidies. All that government would be required to do would be to:

- fund the development, piloting and demonstration of a standard SIRICA template:
- liaise with other governments over the internationalisation of this template.

This is a budget neutral recommendation. It would be possible to fund the development of the SIRICA template from existing Australian Government programs supporting international engagement in research and innovation.

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<sup>3</sup> The bulk of costs incurred in international cooperation are still spent domestically, hence the 10 per cent cap on overseas spending in claiming the R&D Tax Concession is not problematic.