Review of Research Policy and Funding Arrangements for Higher Education

Issues paper

August 2015

1. OVERVIEW OF CURRENT POLICY AND FUNDING FRAMEWORK FOR UNIVERSITY RESEARCH

1.1. Introduction

1.1.1. In July 2015, the Minister for Education and Training commissioned Dr Ian Watt AO, supported by an expert working group, to conduct a review of research policy and funding arrangements to identify opportunities for reform and deliver on the Government's *Boosting the Commercial Returns from Research* agenda to encourage collaboration and engagement between universities and industry and other end users. The Terms of Reference (TOR) for the review and membership of the expert working group are on the Review of Research Policy and Funding Arrangements web page (http://education.gov.au/ review-research-policy-and-funding-arrangements).

1.1.2. This issues paper aims to describe current arrangements relevant to the review and includes questions to stimulate discussion.

1.1.3. The review invites responses to the issues raised in this paper. Submissions can be lodged via email at ResearchReview@education.gov.au. The deadline for submissions is 5 pm AEST, Friday, 18 September 2015.

1.1.4. The Terms of Reference require the review to consider the research policy and funding arrangements within the Education and Training portfolio, focusing on the Research Block Grants funding system. That said, it is important to recognise that the activities of universities are influenced by a range of policy settings and priorities, some of which are currently under review.

1.1.5. Accordingly, as set out in the terms of reference, the review will as far as practicable take account of, and align with, a number of other reviews and activities to implement the *Boosting the Commercial Returns from Research strategy*. These include, *inter alia*, the implementation of the National Science and Research Priorities, the Review of Australia's Research Training System by the Australian Council of Learned Academies, the Research Infrastructure Review, the Higher Education Infrastructure Working Group, the Miles Review of the Cooperative Research Centres Programme, and the review of the R&D Tax Incentive in the context of the forthcoming Tax White Paper. The Australian Government is also developing a long-term strategy for boosting Australia's capability in science, technology, engineering and mathematics.

1.2. Key issues

1.2.1 Australia's research sector is highly productive, internationally connected and globally recognised for quality research. For example, in 2013 we produced 3.9 per cent of the world's research output (in terms of publications and citations),

ranking 9th in the OECD with only 0.3 per cent of the world's population[1] and produced 1 per cent of world's GDP.[2]

1.2.2 This is not enough to ensure a productive future for Australia. Innovation fuelled by an entrepreneurial culture is an important driver of productivity and the capacity to innovate, grow businesses and create jobs increases when business and researchers work together.

1.2.3 Through the *Industry Innovation and Competitiveness Agenda* (Agenda), the Government is encouraging the development of an entrepreneurial and innovative culture across industry.

1.2.4 A core element of this Agenda is driving improvements in all facets of research by:

- embedding the national research priorities and their associated practical challenges in competitive grant processes
- increasing the incentives for the commercialisation of research, including by reviewing the rules for competitive research grants to better recognise industry-relevant experience
- promoting the sharing of intellectual property and data generated by publicly funded research
- ensuring our research training system builds skills in collaboration and innovation, as well as fundamental research skills, and
- establishing a sustainable, strategic approach to research infrastructure.

1.2.5 This Agenda aims to improve the poor performance of Australia on measures of collaboration between researchers in higher education and industry and other end users.

1.2.6 Australia ranks 29th and 30th out of 30 OECD countries on the proportion of large businesses and small to medium enterprises (SMEs) collaborating with higher education and public research institutions on innovation.[3]

1.2.7 This poor performance has been long standing. For example, comparisons over the decade of the 2000s show Australia continually performed poorly in collaboration between business, higher education and public research institutions on innovation.

[1] Incites™,Thomson Reuters (2014), Benchmarking Report, generated September 2014.

[2] IMF World Economic Outlook Database, April 2015

[3] *OECD Science, Technology and Industry Scoreboard 2013*, http://stats.oecd.org/

Table 1: International Comparison of Australia's Business Collaboration with Higher Education[4]

Ranking out of 19 OECD Member Countries

Business Size	2002-04	2004-06	2008-10
SME	19	11	19
Large firms	19	17	19

1.2.8 Similarly, Australia also ranks poorly in new-to-the-world innovation, ranking second last of 17 OECD countries on new-to-the-world innovation.[5] This is at least partly attributed to Australian businesses' preferences to instead adopt or modify existing innovations.[6] The performance in new-to-the-world innovation has worsened over time. Comparison of country shares of the total number of triadic patents sees Australia fall from 12th out of 34 OECD member countries in 2000 to 16th in 2013. [7]

1.2.9 Improving engagement between researchers and industry should see improvements in these measures of performance for the Australian economy.

1.3. Current arrangements

Australia makes a large investment in research

1.3.1 The total Gross Expenditure on Research and Development (GERD) has more than doubled over the past decade, rising 140 per cent from $13.2 billion in 2002-03 to $31.7 billion in 2011-12.[8]

[4] *OECD Science, Technology and Industry Scoreboard (various publications).* The Australian data is sourced originally from *ABS Innovation in Australian Business 8158.0*, which has experienced changes in scope over the period, and as such, the data from period to period are not directly comparable.

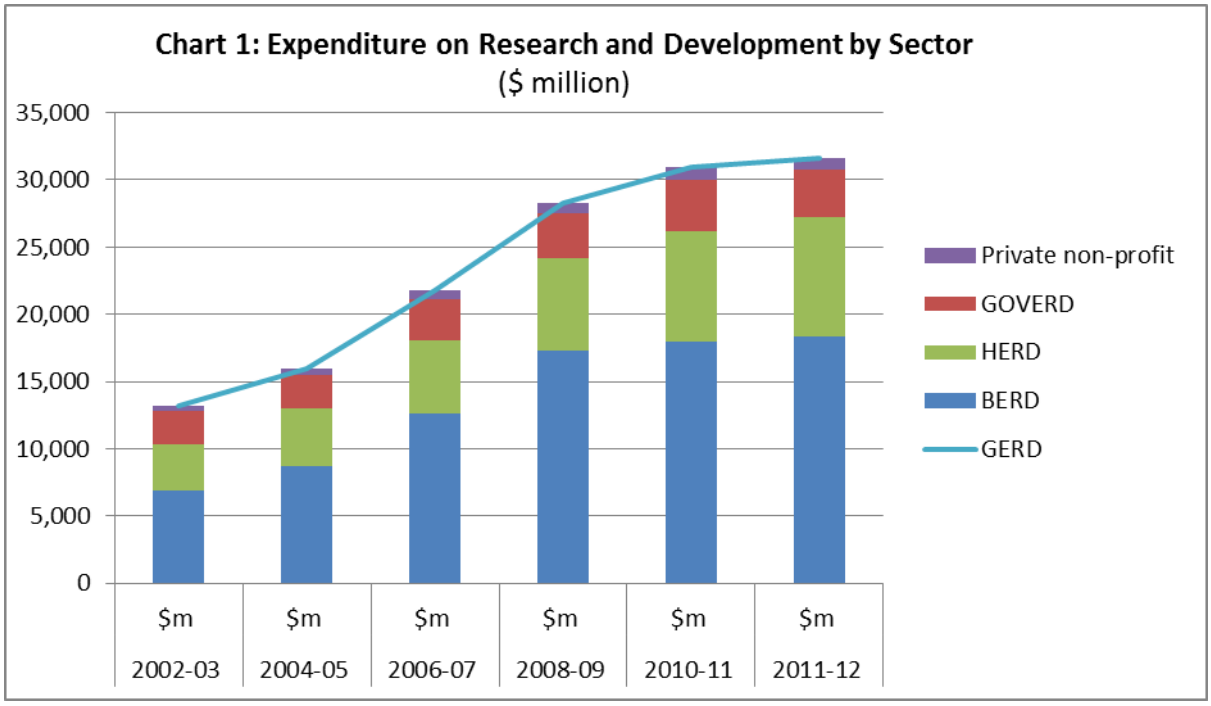
[5] The OECD defines new-to-the-world innovation as when the firm is the first to introduce the innovation for all markets and industries. Source: OECD and Eurostat (2005), Oslo Manual – Guidelines for Collecting and Interpreting Innovation Data, OECD, Paris.

[6] DIISR, *Australian Innovation System Report*, 2011.

[7] Triadic patents are a set of patents taken at the European Patent Office (EPO), the Japanese Patent Office (JPO), and the US Patent and Trademark Office (USPTO) that share one or more priorities ((first filing to a patent office for a patent to protect an invention). Counting triadic patent families provides indicators for measuring innovation performance of countries. Source: *OECD Science Technology and Industry Outlook* various years. http://stats.oecd.org/.

[8] The ABS estimates of GERD, BERD and GOVERD are the combination of the current and capital expenditure on R&D during the reference period (www.abs.gov.au). The current expenditure on R&D is all expenditure on direct labour costs, scholarships, materials, fuels, rent and hiring, repairs and maintenance, data processing, and so on, and the proportion of expenditure on general services and overheads which is attributable to R&D activity. Capital expenditure on R&D is all expenditure for the acquisition of fixed tangible assets such as land, buildings, vehicles, plant, machinery and equipment which is attributable to R&D activity.

- Gross expenditure on R&D (GERD) represents the total expenditure devoted to R&D by the business, government, higher education and private non-profit sectors.
- Business Expenditure on Research and Development (BERD) is expenditure and human resources devoted to R&D carried out by businesses in Australia.
- Government Expenditure on Research and Development (GOVERD) is expenditure and human resources devoted to R&D carried out by Commonwealth, state and territory governments.
- Higher Education Expenditure on Research and Development (HERD) is expenditure and human resources devoted to R&D undertaken by Australian higher education institutions.



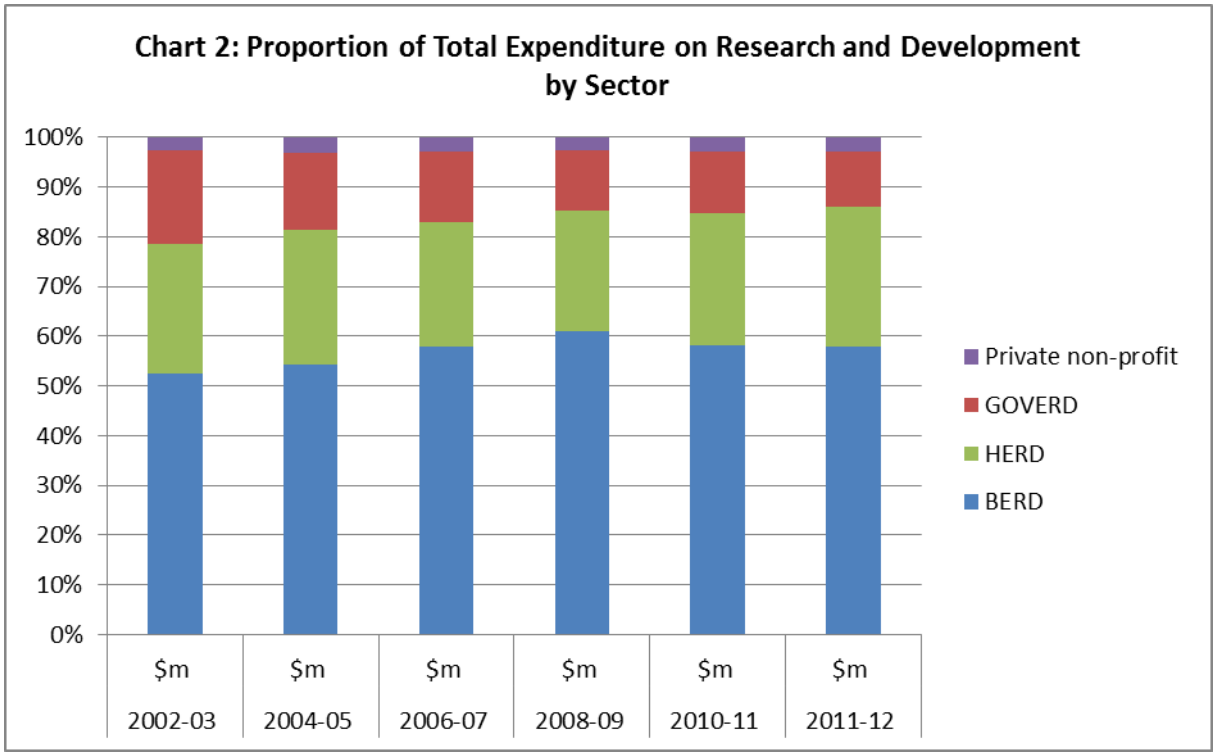
Source: ABS, 8111.0 - Research and Experimental Development, Higher Education Organisations, Australia, 2012

1.3.2 Chart 1 shows that Business Expenditure on Research and Development (BERD) has risen the fastest at 164 per cent, from $6.9 billion in 2002-03 to $18.3 billion in 2011-12. Government Expenditure on Research and Development (GOVERD) – which relates to research and development within government, not investment by government – has shown a more modest increase of 42 per cent from $2.5 billion in 2002-03 to $3.5 billion in 2011-12. Higher Education Expenditure on Research and Development (HERD) has risen strongly by 159 per cent from $3.4 billion in 2002-03 to $8.9 billion in 2011-12. While the increase in BERD has been associated with the mining boom, the decline in Australian mining and manufacturing may change the balance of investment if demand rises for new skills and the economy shifts to new sectors.[9]

1.3.3 Chart 2 shows the contributions to GERD have shifted over time, with BERD increasing its contribution from 53 per cent in 2002-03 to 58 per cent in 2011-12. GOVERD has declined as a proportion of the total, falling from 19 per cent in 2002-03 to 11 per cent in 2011-12. HERD has made a moderate increase over the period, rising from 26 per cent in 2002-03 to 28 per cent in 2011-12.

- Note that these measures of R&D are expenditure measures, not measures of the source of funds. This means that GOVERD and HERD are mutually exclusive. HERD is largely sourced by government funds, with the block grants making up around one-third of that income (see chart 9).

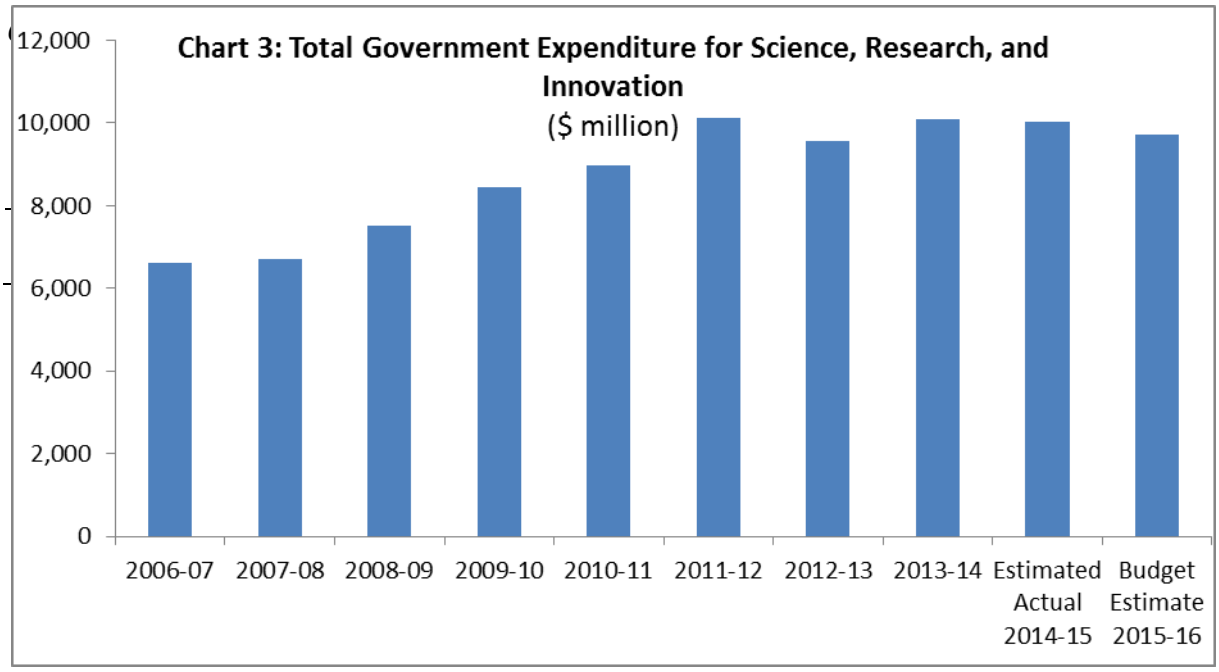
[9] http://adminpanel.ceda.com.au/FOLDERS/Service/Files/Documents/26792~Futureworkforce_June2015.pdf



Source: ABS, 8111.0 - Research and Experimental Development, Higher Education Organisations, Australia, 2012

1.3.4 In 2015-16, the Australian Government's overall support for science, research and innovation across all portfolios will exceed $9.7 billion. This includes:

- the R&D Tax Incentive: $2.9 billion
- direct support to the higher education sector (excluding ARC): $2.0 billion
- competitive grants (e.g., the Australian Research Council and the National Health and Medical Research Council): $1.6 billion
- science agencies - CSIRO, ANSTO, Geoscience Australia and the Australian Institute of Marine Science: $1.0 billion
- Rural Research and Development (R&D) Corporations: $0.3 billion, and
- other science and innovation activities: $1.9 billion.



Source: Science, Research and Innovation Budget Tables

Research funding for universities

1.3.5 University research is supported from a number of sources. Important, and very visible, sources are the RBG and competitive grant programmes. In addition, universities source funding to support research from international undergraduate and postgraduate student fees, income derived from the Commonwealth Grants Scheme (CGS), industry partnerships and other, smaller, contributions such as donations and bequests.[10]

1.3.6 While this review focuses primarily on the role of the RBG, it is necessary to acknowledge the importance of the CGS as a source of research funding. The *Higher Education Base Funding Review: Final Report* (2011) highlighted that the CGS funding system includes a significant embedded contribution for research activities that support teaching and research.

1.3.7 The RBG have six programmes supporting three key components of university research activity[11]:

- $980 million for training of the next generation of researchers (55 per cent)
- $433 million supporting indirect costs of Australian competitive grant (ACG) research (25 per cent), and
- $357 million supporting non-ACG research and general research fabric (20 per cent).

[10] Of the $9.6 billion HERD in 2012, $0.4 billion or 4.1 per cent was sourced from business. A further $0.1 billion was sourced from private bequests, donations or foundations. Overseas funding provided an additional $0.2 billion or 2.4 per cent. Source: ABS 8111.0 - Research and Experimental Development, Higher Education Organisations, Australia, 2012.

[11] The programmes constituting the RBG have been introduced over time but were established with integrated policy underpinnings from 2002 as a result of the 1999 white paper, *Knowledge and Innovation*.

1.3.8 The research funding framework includes RBG and the competitive, merit-based, peer-reviewed funding programmes administered by the Australian Research Council (ARC), National Health and Medical Research Council (NHMRC), Rural R&D corporations and private funding bodies. These competitive programmes only fund the direct costs of individual research projects.

1.3.9 Two of the RBG schemes distribute funding to universities for the indirect costs of supporting competitive grants but this funding is not tied to specific funded projects, allowing universities to make strategic decisions on their research investments. This particular arrangement is referred to as the 'dual funding system' and has been in place since the mid-1990s.

1.3.10 The RBG funds are allocated to universities based on formulae designed to reward performance and excellence in research and research training. While this approach has been successful in assisting Australian universities achieve high international standing for research and high quality research training, Australian universities appear to be less successful in achieving commercial returns from the research.

1.3.11 One of the purposes of this review is to consider the drivers of funding allocations for the RBG and explore options to encourage universities to have greater interaction with industry.

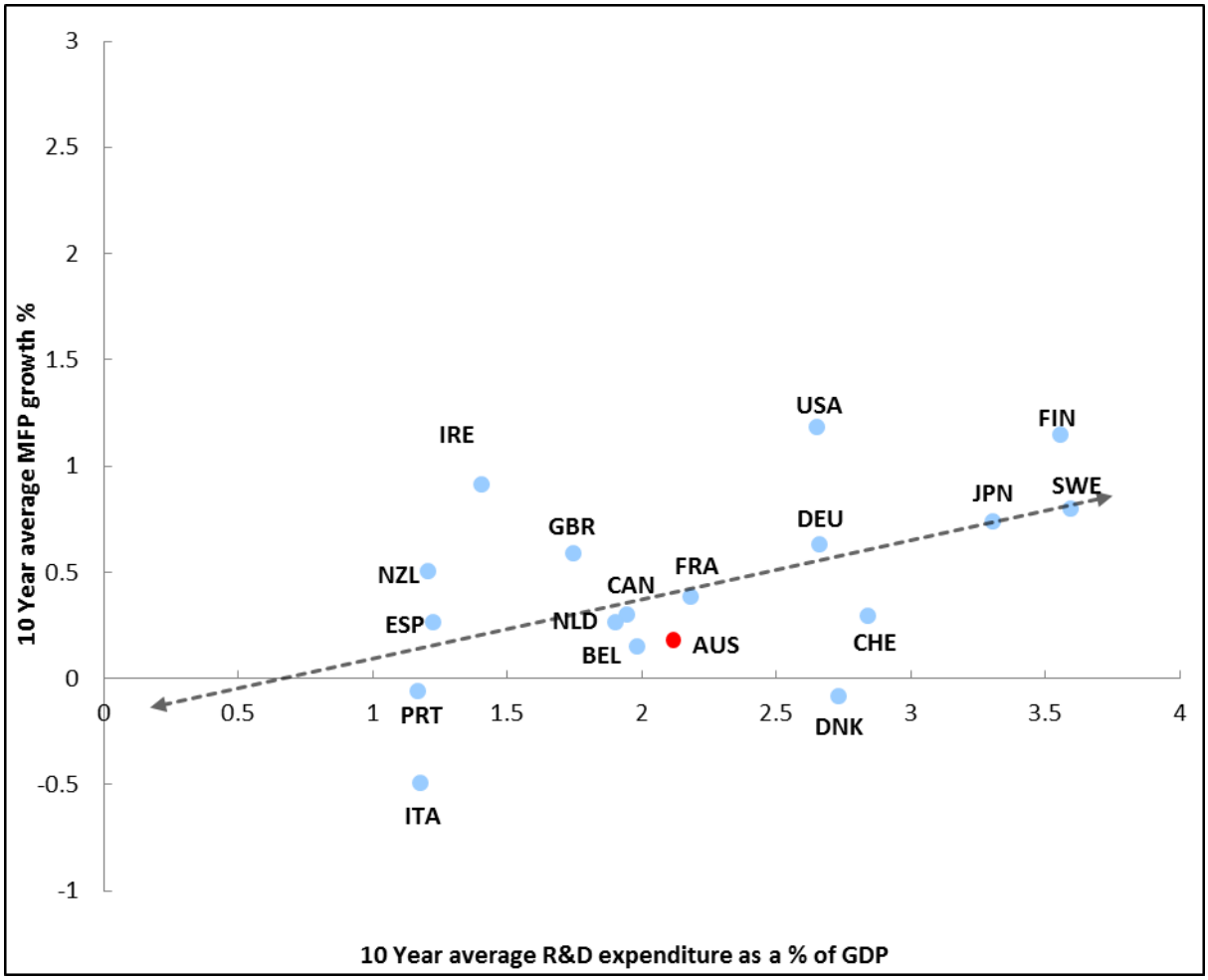
1.3.12 Further details are provided in *Chapter 2: Research Block Grants* and *Chapter 3: Competitive Grant programmes - Australian Research Council and the National Health and Medical Research Council*.

<u>Investment in research is a significant driver of economic growth and prosperity</u>

1.3.13 Sound R&D investment produces valuable returns in the future. OECD data shows countries that invest more in R&D as a proportion of GDP tend to experience higher GDP growth.

1.3.14 Investment in R&D can provide returns through higher productivity growth. Chart 4 shows that countries such as Sweden, Finland, Japan, USA and Germany with high R&D expenditure also have high 10-year average Multi-Factor Productivity (MFP) growth rates. Countries such as Spain, Italy and Portugal with low R&D expenditure experienced zero or negative 10-year average MFP growth rates through the decade.

Chart 4: Intensity of R&D expenditure – Research and Development and MFP growth rate (10 year average 2002-2012)



Source: World Development Indicators 2015, OECD stats.

1.3.15 The findings are similar to other work that shows a positive correlation between R&D investment, commercialisation and productivity growth. A recent study by the University of New South Wales School of Business, for example, found that over 1993-2012 a sustained increase in investment of 1 per cent in public sector R&D expenditure leads to a 0.46 per cent increase in MFP. The authors examined the four sectors of research investment classified in the Commonwealth's Science, Research and Innovation (SRI) budget tables — research agencies, higher education sector, business enterprise sector, and multi-sector — and found positive effects from investments in research agencies such as CSIRO and in higher education institutions through block grants and the ARC.[12]

<u>What drives excellent and engaged research?</u>

1.3.16 Analysis by the OECD suggests that countries that successfully translate their research into commercial outcomes tend to exhibit research excellence, targeted

[12] Elnasri, Amani and Fox, Kevin J., *The Contribution of Research and Innovation to Productivity and Economic Growth* (February 2014). UNSW Australian School of Business Research Paper No. 2014-08.

research effort which builds on comparative research strengths as well as addressing the country's economic and social goals, better cooperation between research and industry, and entrepreneurship skills and experience to support the translation of research outcomes into commercial benefits.[13]

1.3.17 As noted in the introduction, Australia is globally recognised for producing high quality research. Australian researchers consistently publish in premium journals and are highly cited by other researchers – both widely accepted indicators of research excellence. Australia has improved its global share of the top 1 per cent of highly cited publications by 75 per cent between 2005 and 2013, an indicator of more high quality research. A combination of well-designed incentives in funding programmes and transparency of outcomes through measurement has produced improvements in Australian research.

1.3.18 Excellence in Research Australia (ERA) has helped recognise and drive the emphasis on high-quality research. ERA evaluates the quality of research performed in Australian universities against national and international benchmarks. The ratings are determined by committees of distinguished Australian and overseas researchers. Since its introduction in 2010, ERA has driven a 17 per cent increase in the share of university research in areas where Australia is at or above world standard.[14]

1.3.19 International university rankings also provide an indication of the high quality and reputation of Australia's universities. Research performance, a key indicator in international university ranking systems, is usually measured by citations, publications in prestigious journals, academic prizes and research income. Australian universities are well represented in the rankings due to a relatively strong research performance. While there are annual variations in Australia's standing, between four and eight Australian institutions have ranked in the top one hundred over the last few years. That said, none of the major rankings adequately reflect research commercialisation, an area where we are weak.

1.3.20 In contrast to most ranking systems, the Universitas 21 Ranking assesses national higher education systems rather than the performance of individual institutions. This different approach allows governments to benchmark their national investment against other countries.

[13] See e.g., OECD, *Commercialising Public Research: New Trends and Strategies,* 2013; Market Line, *Switzerland*, Country Profile Series, 2013; P Lundequist and A Waxell, 'Regionalising "Mode 2"? The adoption of Centres of Excellence in Swedish research policy', *Geografiska Annaler: Series B, Human Geography*, Vol. 92, Issue 3, 2010.

[14] Australian Research Council. Excellence in Research for Australia 2012 National Report, Commonwealth of Australia. http://www.arc.gov.au//era/era_2012/era_2012.htm

1.3.21 There are some good examples of research-industry collaboration in Australia, particularly where there has been dedicated investment in organisations that have an industry or collaboration focus, such as the CSIRO, the ARC Linkage Programme, the Cooperative Research Centres (CRC) programme, the NHMRC Development Grants, and the Rural R&D corporations. Private sector examples of successful collaboration include:

- the partnership between AW Bell and CSIRO which led to the development of new metal processing for the aerospace industry, and
- UNSW and Onesteel working together to develop new technology for recovering steel from car tyres.

1.3.22 However, only 3 per cent of Australian businesses involved with innovation activity sourced their ideas from universities or higher education institutions, compared to 59 per cent who sourced their ideas for innovation from within the business or company.[15] Only 10 per cent of innovative businesses had collaborative arrangements with universities and higher education institutions.[16]

1.3.23 A lack of person-to-person and institution-to-industry links can prevent knowledge, skills, and resources from being shared. Organisations with the specific purpose of translating and transferring technological development into industry practice can help build these links. At present, outside of a few sectors such as mining and agriculture, Australia does not have organisations of this type at the scale of more highly ranked innovating countries such as the UK, the Netherlands and Germany.[17]

1.3.24 Better linkages between the research sector and industry, including movement of academics and business people between universities and industry, can help build an innovation culture. An example is Australia's investment in quantum computing since 2000 through the ARC Centre of Excellence for Engineering and Quantum Systems, based at The University of Sydney and the University of New South Wales. The Centre has led ground breaking research, established collaborations with international universities including Harvard and Tokyo, and attracted industry investment including from the Commonwealth Bank.

1.4. Consultation questions

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

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

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[15] ABS, *Innovation in Australian Business*, 8158.0, 2012-2013: This percentage reflects only direct knowledge transfer from higher education institutions. It is not possible to identify indirect flows of knowledge between the research sector and business, although it should be noted that 27.1% of Australian businesses reported sourcing ideas from 'websites, journals, research papers or publications'.

[16] ABS, *Innovation in Australian Business*, 8158.0, 2012-2013.

[17] E Webster, Proposal for Industry-Led Innovation Consortia, 2014; for example, see the Catapult Centres in the UK, the Dutch 'TTI' and 'MTI' brokerage organisations and the Fraunhofer Institutes in Germany: Department of Industry, Tourism and Resources, *Study of the Role of Intermediaries in Support of Innovation*, 2007, http://www.innovation.gov.au/innovation/reportsandstudies/Documents/InnovationIntermediariesReport.pdf; Office of the Chief Scientist, 'Information Brief: UK Technology Strategy Board (TSB)', 16 April 2014; UK Government Department for Business, Innovation and Skills, Technology Strategy Board, Triennial Review, October 2013; Rathenau Instituut, 'The Dutch science system: TTIs and MTIs', http://www.rathenau.nl/en/web-specials/the-dutch-science-system/organisations/ttis-and-mtis.html.

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

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?

2. RESEARCH BLOCK GRANTS (RBG)

The TORs for the review call for the development of simpler, more transparent RBG arrangements which continue to focus on quality and excellence, support greater industry and end-user engagement, and improve knowledge transfer with industry.

In particular, the review will consider arrangements that:

- ensure the quality and excellence of Australian university research and research training
- allocate existing RBG funding in a simpler and more transparent manner
- provide incentives to universities to increase and improve engagement and collaboration with industry and other end-users
- encourage universities to engage in research commercialisation and knowledge transfer with industry and the broader community, including through funding incentives, and
- focus on more effective management of intellectual property (see also Chapter 4).

2.1. Key Issues

2.1.1. Government investment in R&D, including through the RBG, can make a greater contribution to economic outcomes. The Government is seeking advice on whether the current policy settings inhibit institutions from maximising industry engagement or whether the settings are best structured to support this policy aim.

2.1.2. The current suite of RBG has multiple programmes which support similar policy objectives. Two programmes support the indirect costs of research and three programmes support higher degree by research training. This creates the potential for relatively high administration costs, misalignment and overlap of policy objectives. Further, in some elements of the RBG, the complexity of the allocation formulae undermines the policy intent by obscuring the intended incentives for university research activity.

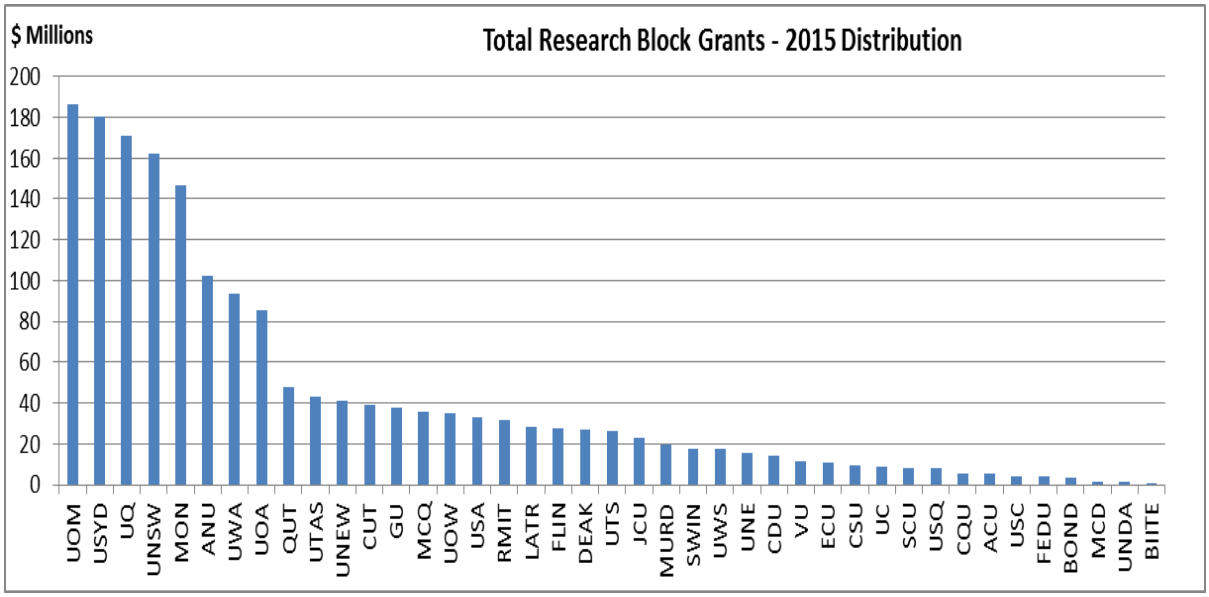
2.1.3. The current allocation formulae are based on measures of academic success such as research income, research publications and Higher Degree by Research (HDR) graduates.

2.1.4. The funding rules for student programmes are prescriptive and are substantially unchanged over more than a decade despite a more complex research landscape. The level of detail may generate barriers to innovative HDR delivery, especially in relation to engaging with industry to provide employer relevant skills to HDR students.

2.2. Current Arrangements

2.2.1. In 2015, the Australian Government is providing $1.8 billion to 41 Australian higher education institutions through six schemes and one sub-scheme administered by the Department of Education and Training.

Chart 5 shows 2015 RBG funding allocations by institution



Source: Departmental RBG funding records

The RBG Programmes

2.2.2 The Research Infrastructure Block Grants (RIBG) scheme ($240.1 million in 2015) helps institutions meet the costs incurred when carrying out research projects supported by the ARC, the NHMRC and other national competitive grant programmes. RIBG is allocated to institutions on the basis of their relative success in attracting research income from programs listed on the Australian Competitive Grants Register (ACGR).[18]

2.2.3 The Sustainable Research Excellence (SRE) in universities scheme ($192.6 million in 2015) also provides support to institutions for the indirect costs associated with conducting research funded by competitive grants.

2.2.4 The Research Training Scheme (RTS) ($678.5 million in 2015) is the largest of the block grants. The RTS provides support to institutions for the cost of domestic students' research doctorate and research masters degrees.

2.2.5 The Australian Postgraduate Awards (APA) scheme ($279.8 million in 2015) provides funding directly to postgraduate students of exceptional research promise who are undertaking their higher degree by research at an eligible Australian university. The scheme provides an annual stipend ($25,849 in 2015) and supports approximately 3,500 commencing students each year, 1,900 more than were funded in 2008 – and around 10,600 students at any one time.

2.2.6 The International Postgraduate Research Scholarships (IPRS) scheme ($22.3 million in 2015) enables eligible international students to undertake a postgraduate research qualification in Australia and gain experience with leading Australian

[18] http://www.education.gov.au/australian-competitive-grants-register

researchers. Since 2011, commencing IPRS recipients have been eligible to also apply for an APA.

2.2.7 The Australian Council of Learned Academies (ACOLA) will undertake a review of the research training system and report to the Minister for Education and Training in March 2016. More detail on the ACOLA review is in Chapter 5.

2.2.8 The Joint Research Engagement (JRE) scheme ($352.8 million in 2015), provides block grants to eligible Australian universities to support infrastructure other than buildings and the maintenance of capital items (not capital purchases). The JRE complements the additional funding for the indirect costs of competitive grant-funded research by being more closely focused on collaboration between institutions, industry and other end-users. The JRE programme utilised the same funding pool previously assigned to the Institutional Grants Scheme (IGS) from 2001-2009 and which, prior to that, comprised the Research Quantum (RQ) of the university operating grant.

2.2.9 The JRE Grant – Engineering Cadetships sub-scheme ($4.4 million in 2015) enables institutions to support the research training costs associated with higher degree by research students undertaking a cadetship in relevant areas of engineering and science. Cadetships involve a combination of formal research training with the institution and concurrent employment with a business to carry out R&D activities.

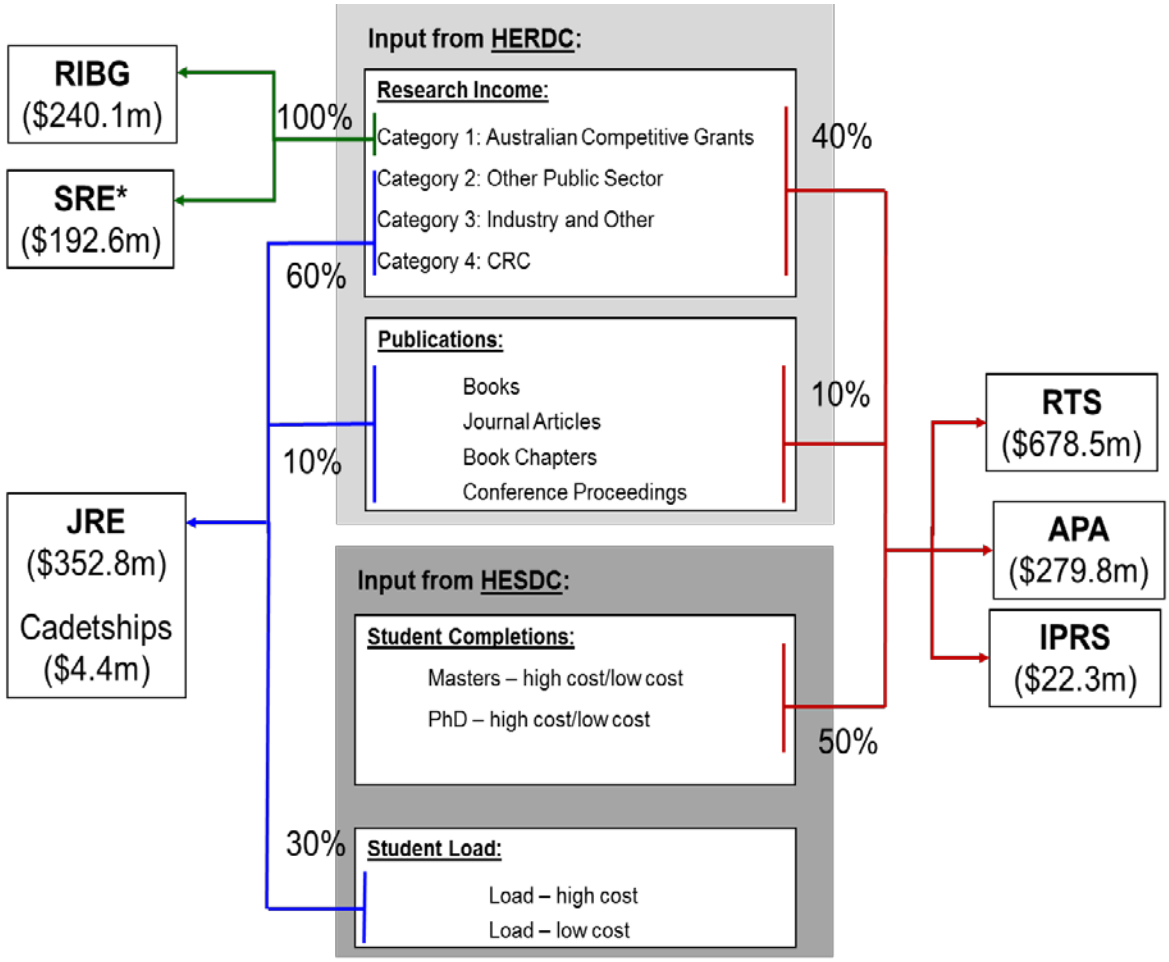
<u>The effectiveness of the RBG</u>

2.2.10 RBG are allocated to universities using programme-specific formulae that seek to reward the performance of institutions in:

- attracting research income from government and non-government sources including industry
- disseminating research results in peer-reviewed research publications
- the successful completion of research degrees by students, and
- higher degree by research student load.

2.2.11 These formulae use these data types in different proportions depending on the programme objectives. The proportional contribution of each data type to each funding formula is shown in Chart 6. The estimated value of the funding allocations by data type is shown in Chart 7.

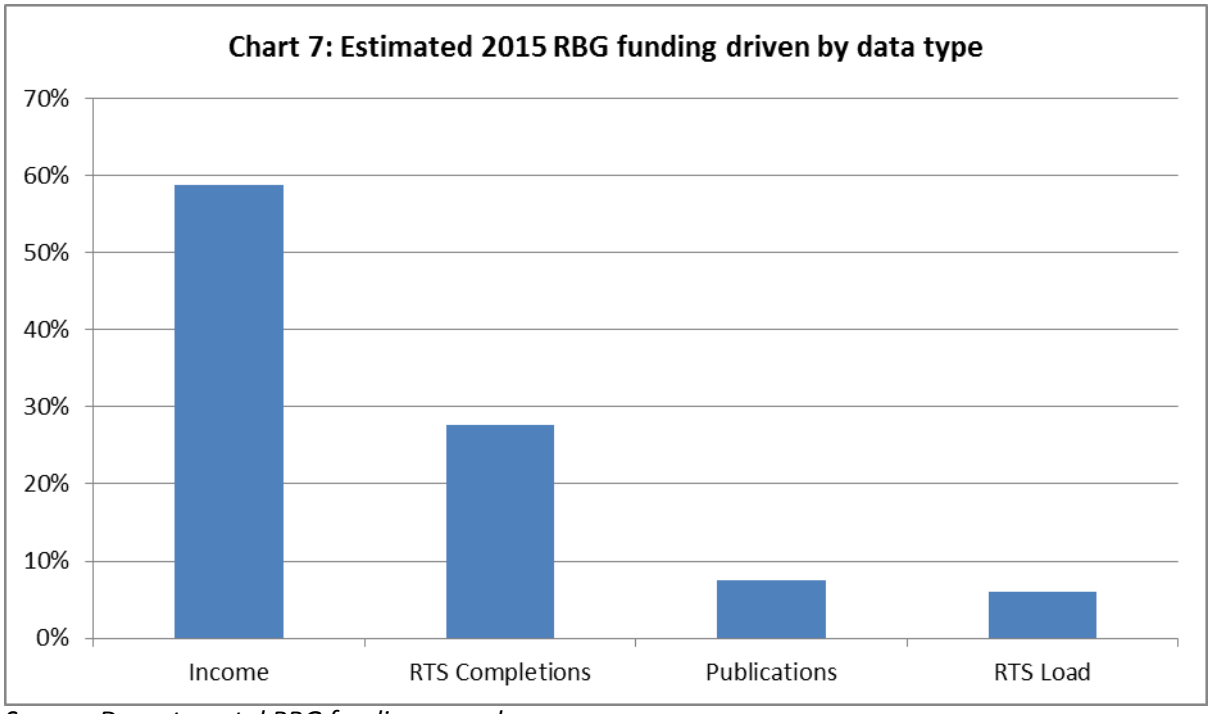
Chart 6 – Contribution of data types to programme performance indexes (2015 RBG funding)[19]



HERDC – Higher Education Research Data Collection

HESDC – Higher Education Student Data Collection

[19] SRE also uses ERA results and the indirect costs of research as moderators to make adjustments to SRE Threshold 2 (67 per cent of the total SRE allocation) funding amounts, calculated on the basis of a higher education provider's (HEP) performance index. HEP's ERA Ratings for each four digit Field of Research are weighted such that the ratings 5, 4, 3, 2, 1 have a weighting of 7, 3, 1, 0, 0, respectively. For more information, see http://education.gov.au/research-block-grants-calculation-methodology#calculation-logic-for-sustainable



Source: Departmental RBG funding records

2.2.12 The RBG help support the indirect costs of research and research training through:

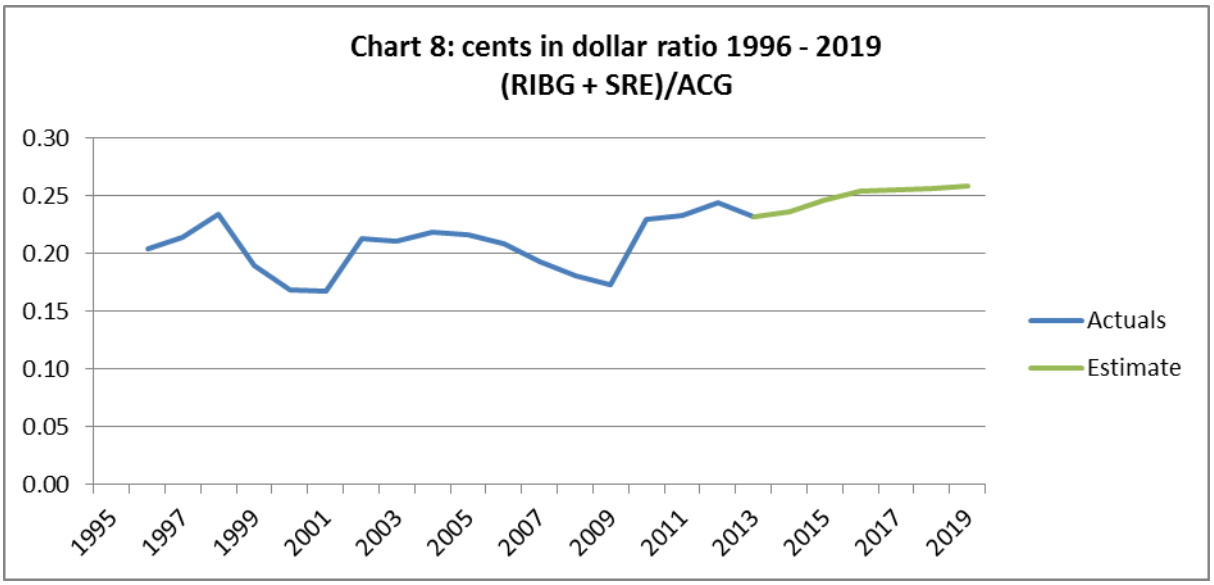
- enabling funding that allows universities to build research capacity and to engage with the competitive research system
- performance-based funding using formulae aligned to programme objectives to recognise and reward those institutions that provide high quality research training environments and support excellence and diverse research activities
- formulae structured to allow winners and losers within the fixed funding pools but with stabilising elements to control the rate of change, and
- funding through block grants to remove government from decision-making and allow universities to set their own priorities for expenditure, with the outcomes of their decisions feeding back into future allocations through the performance data in the funding formulae.

2.2.13 The allocation methods for the RBG reflect both the scale of institutions as well as relative performance. For example, the 10 largest universities receive around 69 per cent of RBG in reflection of the size and quality of their research programmes. The remaining 31 per cent of funding is shared between 31 institutions.

2.2.14 The RBG formulae provide for changing shares of funding over time. However, the volatility of funding levels and the rate of change is controlled by incorporating stabilising elements such as data averaging, pipelines and safety nets. This system provides significant stability across institutions and a high degree of funding certainty from year to year.

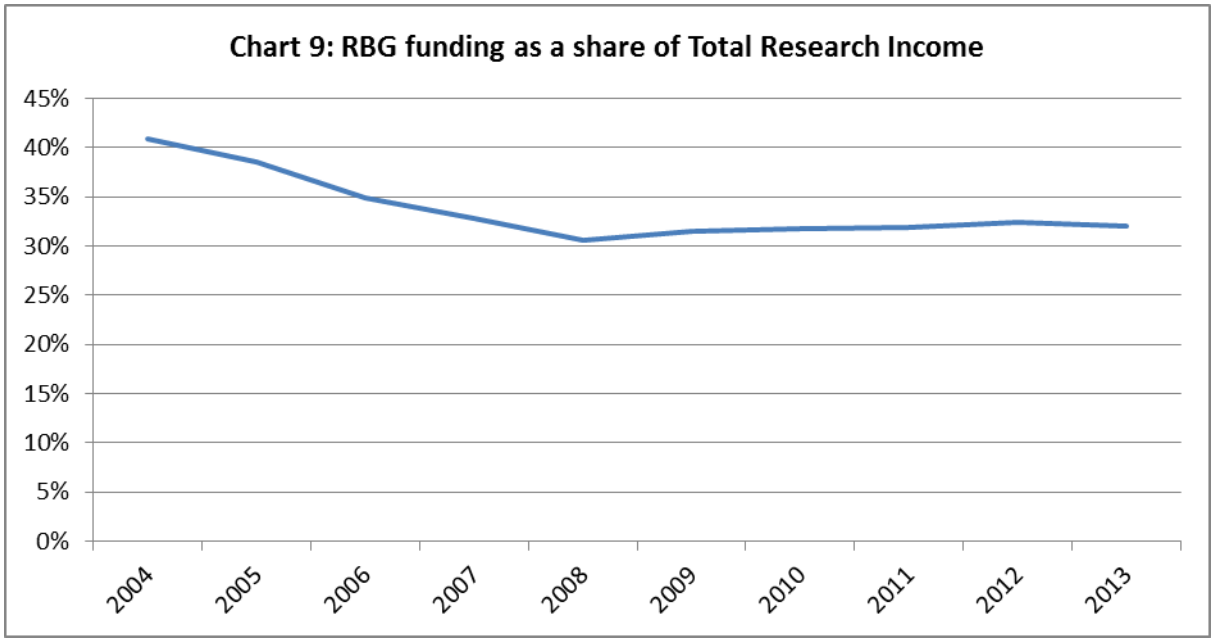
2.2.15 A key role of the RBG is to provide funding for the indirect costs of competitive research grants. Under current levels of funding through competitive grants and block grant funding schemes, the level of funding for the indirect costs of research

is shown by the 'cents in the dollar' ratio. This ratio compares funding distributed by the SRE and RIBG programmes to Australian Competitive Grants (ACG) funding. The ratio is calculated as (RIBG + SRE)/ACG income, where all numbers relate to the same calendar year. Using this method, the calculation for 2013, the most recent year for which ACG income is available, is: ($220.6m + $169.9m)/$1,683.7m = 0.232 or 23.2 cents in the dollar. A time series of the cents in dollar ratio is shown in Chart 8.

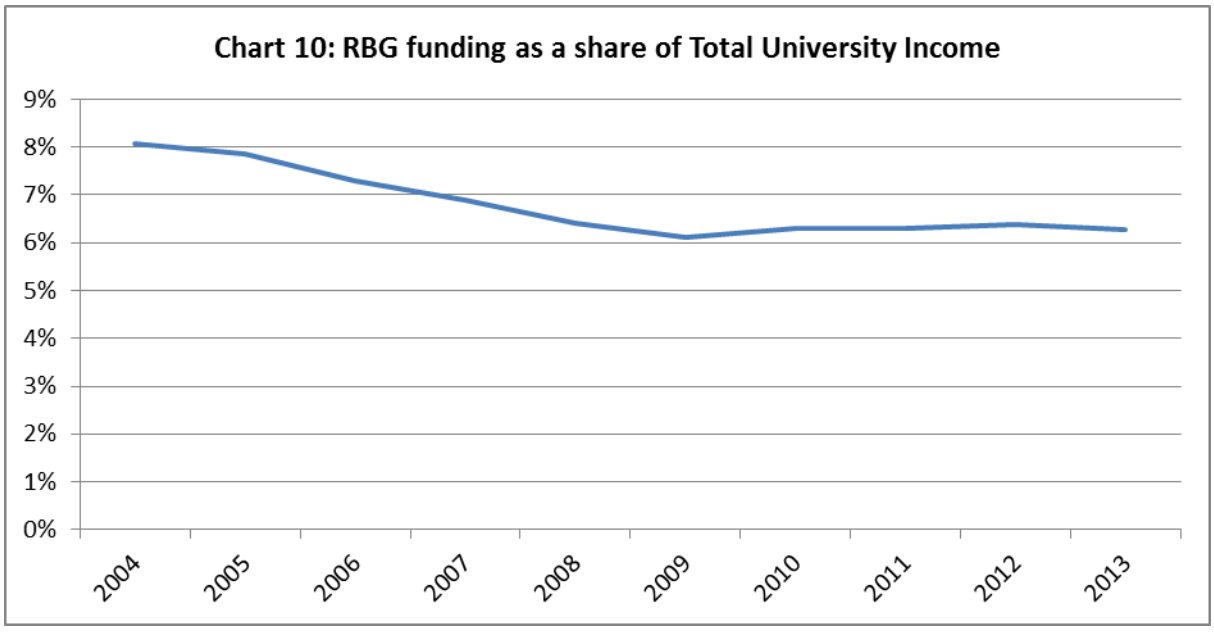


Source: Higher Education Research Data Collection, Departmental RBG funding records and budget forward estimates.

2.2.16 While the cents in the dollar ratio has varied over time and risen recently as a result of the government's additional investment in the SRE, the share of RBG in university income has declined, both in terms of research income and total institutional income. Total university research income includes all sources of revenue that universities receive for research, and total university income includes all sources of revenue (see Charts 9 and 10).



Source: Higher Education Research Data Collection and RBG funding records



Source: Higher Education Finance Collection and RBG funding records

2.2.17 The RBG vary significantly across the sector as a share of total university income with percentages ranging from almost 16 per cent to under 1 per cent. The top five universities with highest percentage are older, more research intensive universities and the lowest five universities are relatively newer and smaller institutions.

2.3. Consultation Questions

2.3.1 Does block grant funding still have a role to play in funding research?

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?

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?

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?

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?

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?

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?

3. COMPETITIVE GRANTS PROGRAMMES

The TORs for the review call for advice on how the Australian Research Council and the National Health and Medical Research Council rules for competitive grants can ensure that industry-relevant expertise or research are appropriately recognised.

In particular, the review will consider arrangements that:

- ensure the quality and excellence of Australian university research
- ensure that competitive grant criteria recognise the quality of the proposal and where appropriate the opportunity for commercialisation and collaboration with industry
- provide incentives to universities to increase and improve engagement and collaboration with industry and other end-users.

3.1. Key issues

3.1.1 Competitive research grants are an important source of research funding for universities because they support specific research projects. Competitive grants are a key driver of indirect research funding allocated through RBG.

3.1.2 Competitive grants are also an important element of the reward structure within universities. Success at winning competitive grants is a factor in the recruitment and promotion of researchers, and can have an influence on a university's reputation.

3.1.3 Peer review is the primary mechanism for evaluating the merit and quality of research grants applications and principally focusses on measures of academic excellence such as publications and prior success in competitive grants.

3.1.4 Current ARC and NHMRC competitive grant processes allow for some recognition of industry experience alongside research excellence. Increased recognition could improve support for collaboration between researchers and industry and increase career mobility for researchers wanting to move between different sectors.

3.2. Current arrangements

<u>Australian Research Council (ARC)</u>

3.2.1 The ARC administers the National Competitive Grants Programme (NCGP) which has two primary components – Discovery and Linkage.

3.2.2 Discovery is focussed on fundamental (blue sky) research. Linkage promotes collaborative research between university researchers, business, industry, publicly funded research agencies (PFRA) and community organisations. Both components are generally allocated through competitive grants rounds.

3.2.3 The ARC's Linkage schemes generally require a cash and/or in-kind contribution from partners, although there are instances where cash is not required. To be taken

into account in the Linkage scheme assessment process, contributions provided by industry partners must be specific to the project, must be made in the period when the research is being undertaken and cannot be part of a broader contribution to the university. Cash contributions cannot be for salaries for named investigators.

3.2.4 Occasionally, the ARC directly funds projects to meet specific government priorities for research investment.

3.2.5 The NCGP will provide over $3.1 billion over the four years from 2015-16.

National Health and Medical Research Council (NHMRC)

3.2.6 The NHMRC administers a range of grants which support the aims set out in its Act, specifically to foster medical research and training and public health research and training throughout Australia. This includes grants to create new knowledge through discovery research, accelerate research translation, build Australia's future capacity for research and translation and work with partners such as state and territory health bodies, health industries, and community and consumer groups.

3.2.7 NHMRC has policies and processes that aim to translate health and medical research into commercial opportunities and improvements in health policy and practice. NHMRC's funding schemes encourage two key types of industry collaborations, namely between:

- research and commercial industries (e.g. pharmaceutical or medical devices companies), and
- research and health service industries (e.g. Commonwealth and State and Territory Governments, health care providers (primary, tertiary, quaternary and allied).

3.2.8 Funding of $3.4 billion over the four years from 2015-16 will be provided through NHMRC grant programmes.[20]

Incentives for and barriers to industry participation in competitive funding programmes

3.2.9 Consideration could be given to whether there are any barriers to industry participating with universities in competitive funding schemes - for example, around intellectual property arrangements, the timing of selection rounds and business cycles, and the profile and understanding of programmes within industry - and whether any changes could address these barriers and provide incentives for collaboration.

Improving recognition of industry experience

3.2.10 Historically, there has been only limited movement of researchers between universities, research agencies and industry in Australia.

[20] National Health and Medical Research Council, www.nhmrc.gov.au

3.2.11 This is generally regarded to be the result of a number of factors, including university recruitment and promotion policies that do not take into account time spent in the private sector, industry reluctance to recognise traditional measures of academic performance, and the focus in competitive grants programmes on academic outputs.

3.2.12 Within the selection criteria for ARC competitive grants, the weighting applied to the quality of the investigators ranges from 20 per cent for the Linkage Programme to 40 per cent for fellowship schemes and the Discovery Projects scheme. Under ARC rules, this is assessed under the Research Opportunity and Performance Evidence (ROPE) principles, which aim to recognise research excellence in the context of diversity of career and life experiences. Similar assessment criteria apply to NHMRC grant processes.[21]

3.2.13 The ROPE principles have been in place since 2010. Under the ROPE principles, the track record of the researcher/s must be relevant to the proposed research. The required components of ROPE may vary between funding schemes, reflecting the differing career stage of researchers applying and the objectives of the scheme. For example, the Industrial Transformation Research Programme (ITRP) includes up to three additional components which relate to performance evidence:

- evidence of experience in management of collaborative industrial and end-user focussed research
- most significant outcomes on industry-related projects, and
- evidence of capacity to provide effective supervision, support and mentoring for higher degrees by research candidates and postdoctoral fellows.

3.2.14 The current Linkage Programme Funding Rules include selection criteria on the involvement of partner organisations and the benefits of the project to the partner organisations and other end users, as well as criteria focussed on economic, environmental and/or social benefit to Australia. An impact statement is required in all ARC applications. By comparison, the approach recently adopted by Research Councils UK goes further and requires applications for funding to include academic, economic and societal impact as 'an essential component of research proposals and a condition of funding'.[22]

3.2.15 Variation to selection processes for specific ARC and NHMRC grant programmes could be considered to increase the weighting given to industry experience in the assessment criteria. This would mean that applications in which the researcher/s had stronger track records of industry and end-user engagement would have an increased chance of being funded. This would build on current arrangements.

3.3. Consultation questions

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

[21] http://www.nhmrc.gov.au/book/nhmrc-funding-rules-2015/6-assessment-criteria

[22] See http://www.rcuk.ac.uk/innovation/impacts/

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

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?

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?

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'?

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?

4. PERFORMANCE OF THE RESEARCH SYSTEM

The TORs for the review call for advice on options to improve the assessment of the research system as well as to facilitate research-industry collaboration and the commercialisation of ideas. This will include improved metrics on engagement and knowledge transfer with industry, research outcomes and impact.

In particular, the review will consider:

- arrangements that ensure the quality and excellence of Australian university research
- arrangements that encourage universities to engage in research commercialisation and knowledge transfer with industry and the broader community, including through funding incentives and a focus on more effective management of intellectual property
- incentives to universities to increase and improve engagement and collaboration with industry and other end-users
- the development of measures of research-industry engagement and collaboration, including the availability of international rankings to compare performance and drive improvement over time.

4.1. Key issues

4.1.1 While Australian universities produce world class research and high quality graduates, the incentives for engagement with industry and commercialisation of intellectual property (IP) appear to have only a limited effect on behaviour. For example, Australian publicly-funded research organisations tend to produced few spin-off companies compared to the US, UK and Canada.[23]

4.1.2 The creation of ongoing links between business and universities is essential to maximising the economic value of university research and lifting the current low incidence of new-to-market or radical innovation by comparison to other OECD countries. However, relationships tend to be short-term and ad hoc, reducing the ability of businesses to understand research developments and access IP early enough to capture maximum value, and reducing the ability of universities to understand what business really wants.

4.1.3 Ongoing collaborations between university and industry generate a greater understanding of the priorities of both parties, assist in breaking down barriers to effective cooperation and can provide greater opportunities for HDR students, providing a positive feedback loop.

4.1.4 In the same way that ERA and international university rankings recognise quality and excellence and provide measures of prestige and reputation, a robust

[23] This includes spin-off companies formed by universities, medical research institutes and major publicly funded research agencies. From 2004-11, in Purchasing Power Parity terms. OECD, Commercialising Public Research: New Trends and Strategies, 2013.

measurement system is likely to be an important contribution to the cultural change required to improve researcher-industry engagement. Funding mechanisms, incentives and opportunities for researchers will also need to be a core part of policy design in this area.

4.2. Current Arrangements

4.2.1 There are a range of quality measures available which cover various aspects of performance of the research system. However, these measures do not encompass collaboration and commercialisation and collectively have strong focus on research excellence, and Australia does not currently assess research activity and performance across the entire system (publicly funded research agencies as well as universities).

4.2.2 Australian universities are subject to a number of measures focused on quality:

- ERA, which assesses the quality of university research
- international university ranking systems, and
- annual reporting by publicly funded research agencies.

4.2.3 As a result, we have clear indications of the high quality of our research system. For example, the 2012 ERA found that Australia has 20 areas of national research strength:

- astronomical and space sciences
- cultural studies
- electrical and electronic engineering
- evolutionary biology
- historical studies
- immunology
- macromolecular and materials chemistry
- medical microbiology
- nursing
- plant biology
- clinical sciences
- ecology
- environmental science and management
- geology
- human movement and sports science
- law
- materials engineering
- medical physiology
- pharmacology and pharmaceutical sciences
- psychology

4.2.4 Details of 2012 ERA results by institution are at Attachment A. The 2012 ERA outcomes show a clustering of above world standard ratings in the largest research universities.

4.2.5 Universities are also assessed through a range of international university ranking systems. These systems are heavily influenced by research inputs and outputs, but also incorporate other domains of university activity such as teaching. While informative, none of them are sufficiently robust or sophisticated to be adopted for the purposes of research assessment.

4.2.6 Each PFRA reports on its performance through an annual reporting process. However, this information is presented in a detailed way that can be difficult to comprehend and does not readily allow for comparison with other agencies.

4.2.7 Universities and publicly-funded research organisations provide information on commercialisation outcomes through the National Survey of Research Commercialisation, but this information is not taken into account in performance assessments.

Engagement between industry and research

4.2.8 Collaboration between the research sector and business is crucial for the production of research that meets the need of the community, and for innovation to drive growth. Internationally, innovation has flourished in locations where researchers and industry have come together to collaborate, such as Silicon Valley and the Cambridge Science Park. The Cambridge Science Park is built on the foundation of scientific research undertaken at the University of Cambridge and features firms in sectors such as electronics, computing, software, scientific instruments and pharmaceuticals. Today, it includes 1,400 firms, which employ over 53,000 people and turn over £13 billion a year.[24]

4.2.9 The success of Silicon Valley and initiatives such as the Cambridge Science Park is based in part on long-term partnerships, with investment aimed at improving the competitiveness of both the company and university — providing benefits for both parties.

4.2.10 Long-term engagement can meet a company's research needs, provide opportunity for staff to work across sectors, and lead to more collaboration and knowledge sharing. One example is IBM's 10-year partnership with the Swiss Federal Institute of Technology (ETH Zurich) to advance energy and information technologies.

4.2.11 The experience of the Belgium-based Science-Business Innovation Board suggests that partnerships need to go beyond the traditional funding of discrete research projects.[25] However, in Australia the relationships between research organisations and industry generally are focused on discrete projects, and as a result, tend to be short-term and ad hoc.

4.2.12 It should be acknowledged though, that information on research-industry relationships in Australia is limited, scattered across a wide range of sources (including, for example, university and some company annual reports), and mainly focused on quantitative rather than qualitative measures.

[24] J Silver, 'Cambridge: The UK's first tech city', *Informilo*, 2 March 2013, http://www.informilo.com/20130302/cambridge-uks-first-tech-city-769.

[25] http://www.sciencebusiness.net/Assets/94fe6d15-5432-4cf9-a656-633248e63541.pdf. The Science Business Innovation Board is a Belgian not-for-profit scientific association, whose membership includes a number of major international corporations.

Innovation in Australia

4.2.13 Countries that excel in innovation tend to exhibit a high degree of entrepreneurship in both the research community and industry.[26] This is partly a function of market drivers, and cultural and historical factors. However, regulatory settings and access to finance can support or hinder entrepreneurial activity. Countries such as the US, the UK and Sweden have supportive environments for start-ups and entrepreneurial risk-taking, including taxation arrangements for employee share schemes, initiatives to improve access to funding, and clearly-defined Intellectual Property (IP) rights regimes coupled with pro-competition policies, to incentivise firms' uptake of knowledge-based capital.[27]

4.2.14 As discussed earlier, Australian businesses have a lower incidence of new-to-market or radical innovation than many other OECD countries. Australia also ranks lower than each of the US, UK and Canada on the number of public research spin-off companies for US$100 million of research expenditure.[28]

4.2.15 As is the case with other countries, the innovation performance of Australian businesses is the result of market drivers and historical and cultural factors. The different cultures of universities and businesses is one of the most commonly identified barriers to collaboration and innovation, but one which can be overcome with the appropriate policies and incentives.

4.2.16 The R&D Tax Incentive is one of the policy levers seeking to promote industry engagement in research. It offers a tax offset for eligible R&D activities and is targeted toward R&D that benefits Australia. The program is administered jointly by AusIndustry (on behalf of Innovation Australia) and the ATO. The R&D Tax Incentive is being reviewed in the context of the forthcoming Tax White Paper.

4.2.17 The Australian Government's new Industry Growth Centres, part of the Industry Innovation and Competitiveness Agenda, will also help overcome many of the market forces and historical and cultural factors that have inhibited collaboration and innovation. The Industry Growth Centres will bring industry together with publicly funded research organisations, the university sector and science to better work together, increasing innovation opportunities and providing a framework to transition industry to products and services that are high-value added. The Initiative is industry-led, which will also help create more of a 'demand-pull' for research.

4.2.18 The Government is also re-focusing the well-established, highly successful Cooperative Research Centres programme to ensure the research done by CRCs is translated into practical and commercial outcomes. Future CRCs will be industry-led, and undertake innovative research to support the work of the Industry Growth Centres.

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[26] Cornell University, INSEAD, and WIPO, *Global Innovation Index Report,* 2013.

[27] OECD, *Raising the Returns to Innovation: Structural Policies for a Knowledge-Based Economy*, 2013.

[28] This includes spin-off companies formed by universities, medical research institutes and major publicly funded research agencies. From 2004-11, in Purchasing Power Parity terms. OECD, *Commercialising Public Research: New Trends and Strategies*, 2013.

IP issues

4.2.19 Australian universities determine their own policies for managing and exploiting intellectual property (IP). While there is some variation in these policies, all are required to adhere to the *National Principles of Intellectual Property Management* and the *Australian Code for the Responsible Conduct of Research*. Both the Principles and the Code are jointly supported by the ARC, the NHMRC and Universities Australia.

4.2.20 Some Australian universities assert university ownership of IP created by staff members within the course of their duties. Others allow researchers to retain ownership of IP but require them to give the university first option for commercialisation. In either case, a potential commercial partner must negotiate with the university about use of the IP.

4.2.21 Publicly funded research agencies also have their own IP policies, which are subject to the *Statement of IP Principles for Australian Government Agencies*, managed by the Attorney General's Department.

4.2.22 Universities and publicly funded research agencies provide information on the commercialisation of their IP through the National Survey of Research Commercialisation.

4.2.23 In contrast to the decentralised approach to IP in Australia, the US has a uniform federal policy for IP arising from publicly-funded research, established via the *Bayh-Dole Act* in 1980. The Act is seen as a major driver of collaboration between universities and industry and is believed to have inspired much of the growth in patenting and spin-off companies by US universities over the past 35 years.

4.2.24 The lack of a consistent approach to IP across the publicly funded research sector could serve as a barrier to collaboration and the commercialisation of IP. However, a single national model for exploitation of IP would need to avoid being overly regulated and further complicating university-industry engagement.

4.2.25 Under the current arrangements, negotiations can be complex and time-consuming, especially for SMEs that may not have the expertise or resources to undertake the negotiations on an equal footing. Common problems in the negotiation process include ownership of the project IP, publication rights, and accurate valuation of the IP.[29]

4.2.26 The Department of Industry and Science has developed an IP toolkit to help overcome some of these issues. The toolkit includes a simple model IP agreement for universities and industry that will protect both parties but minimise the time and effort required to commercialise research. The IP toolkit will assist research-industry negotiations by providing guidance and good practice examples of IP management and contracts.

[29] Advisory Council on Intellectual Property, *Collaborations between the Public and Private Sectors,* 2012,.

Measuring impact and engagement

4.2.27 To encourage greater impact and engagement in research, the first challenge is to develop ways to measure and promote greater engagement. Measuring the impact of research is problematic given the many ways in which research outcomes are taken up by society and the economy. It is unlikely that any single measure will fully identify research impact in any meaningful way.

4.2.28 In addition, the time lag between research outcomes and eventual uptake can be substantial and generally the final impact comprises a variety of research outputs. It is very rare that there is a linear, self-contained process of discovery and implementation of a single research finding. Time lags are regularly multi-decadal.

4.2.29 The alternatives include:

- engagement metrics, which measure knowledge transfer activity (or impact pathways) between universities and potential end users
- usage metrics, which measure knowledge publishing and access, such as bibliometrics (publications and citations), web usage and relative citation impact (RCI) citations.
- case studies, which provide a qualitative framework to describe, demonstrate and potentially assess research benefits.

Work on measures of commercial engagement

4.2.30 There have been a number of projects undertaking preliminary assessment of metrics for university research engagement and impact. These include the recent report of the Australian Academy of Technological Sciences and Engineering (ATSE), which identified metrics based on research income derived from research undertaken in collaboration with industry and other end-users, adjusted for research effort across universities at the discipline level.

4.2.31 The Australian Technology Network (ATN) has examined a wider range of potential metrics, ranging from income measures to others based on repeat business or transfers of knowledge to research users via mobility of human capital. The limitations of the available measures have been acknowledged and further work is being undertaken to validate candidates.

4.2.32 The Innovative Research Universities (IRU) is also developing a proposal, which includes panel judgement (by knowledgeable and competent peers) on the value of university research for end users, judgements based on relevant data sets, and industry-based classifications rather than disciplined-based categories for ratings.[30]

4.2.33 In addition, the Times Higher Education (THE) and the ATN are developing an international ranking of engagement, which will include commercialisation metrics. Work is underway on the range of metrics to include in a pilot.

[30] http://www.iru.edu.au/media/55230/measuring%20research%20value%20for%20external%20users.pdf

4.2.34 Case study approaches to measuring impact have been trialled in Australia and the UK, with the latter incorporating this approach in the most recent Research Excellence Framework (REF) exercise. These approaches attempt to provide broader assessment of research impact, rather than quantitative measurement, although the results have been incorporated into research resource allocation decisions in England. An evaluation of the first round of case study assessments has been undertaken by RAND Europe. This evaluation found generally positive outcomes, though the process will take some time to develop maturity, stability and coverage. The relatively high cost of peer assessment of case studies on a scale needed to ensure representative coverage is also a consideration.[31]

4.2.35 The ATSE has proposed metrics, which seek to measure and make it possible to incentivise research collaboration between universities, industry and other end-users of research. These metrics are described in the 2015 ATSE report *Research Engagement for Australia (REA): Measuring research engagement between universities and end users*.[32] A process to validate the measures is currently underway. The ATSE identify some limitations of REA, including data limitations, methods for deriving rankings and/or ratings from metrics and additional data to be included in the metrics.

4.2.36 Consideration could be given to using some or all of the approaches from these exercises to better measure research-commercial engagement in Australia.

Global ranking systems

4.2.37 There are a number of ranking systems and the performance of Australian universities varies according to the different ranking methodologies. University rankings are usually based upon weighted combinations of indicators or scores which aim to measure factors such as the quality of research outputs and to a limited extent the quality of the teaching and learning environment. In addition to entire institutions, specific programmes, departments, schools and disciplines may be ranked.

4.2.38 A number of organisations produce worldwide university rankings. Three of the best known systems are the Academic Ranking of World Universities (ARWU, previously known as the Shanghai Jiao Tong rankings), the Times Higher Education World University Rankings and the QS World University Rankings.

4.2.39 The performance of Australian universities in the most prominent ranking systems is generally high with at least some universities represented in the top ranks (usually top 100). Some rankings systems extend further than 100. In the case of ARWU, Australia has 19 institutions in the top 500 worldwide, reflecting the overall strength of the Australian higher education sector.

[31] http://www.rand.org/pubs/research_reports/RR278.html

[32] http://www.atse.org.au/atse/content/publications/reports/industry-innovation/research-engagement-for-australia.aspx

4.2.40 The value of rankings is limited by a number of well-known issues:[33]

- As a variety of plausible methodologies exist, none of the rankings can be taken as solely authoritative.
- Rankings do not take into account those qualities of an institution that cannot be assessed quantitatively.
- The weightings given to various criteria of quality are arbitrary.
- The criteria support some disciplines over others (e.g. science, technology, engineering and mathematics over the humanities, arts and social sciences), and support academic impact over broader economic, social and environmental impact.
- Ranking exaggerates the differences between institutions, some of whose scores may not be statistically significant.
- Rankings are misleading in that they project an image of technical complexity while actually addressing quality in only a superficial way.
- Many existing ranking systems have inherent biases to reward scale in research.

4.2.41 All these rankings systems have their weaknesses. The results of major global rankings are often similar and commentators have suggested this commonality arises from the fact that rankings measure socio-economic advantage and the benefits of scale factors such as age, size and funding. As none of the current global ranking systems effectively capture university-industry engagement and commercial benefits, they are not meaningful measures of commercial engagement.

4.3. Consultation Questions

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

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

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

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

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

4.3.6 How could research impact be measured?

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

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

[33] Ranking of Higher Education Institutions. August 2006. Dr Antony Stella and Dr David Woodhouse. Australian Universities Quality Agency.

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

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?

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

5. RESEARCH TRAINING AND EMPLOYMENT

The TORs for the review call for recommendations that reflect the Government's commitment to a world-class research and research training system

In particular, the review will consider options that:

- ensure the quality and excellence of Australian university research and research training
- allocate existing research block grant funding in a simpler and more transparent manner

5.1. Key Issues

5.1.1 The Minister for Education and Training announced on 20 May 2015 that the Australian Council of Learned Academies will undertake a review of the research training system with the final report due in March 2016.

5.1.2 The ACOLA review and this review have intersecting interests but will focus on substantially different aspects of the research training system:

- The ACOLA review will help to support innovation in degree models, to enhance the quality of research training and the structural funding barriers affecting the movement from undergraduate to HDR studies.
- This review will focus on the structure and focus of research training funding programmes, the optimal allocation methodologies and rationalising programme rules that hinder the achievement of innovation, quality and commercialisation knowledge for HDR students.

5.1.3 HDR programmes produce essential skills for the higher education sector and the broader society and economy. The rigorous application of research techniques to new discoveries is a mindset relevant to many walks of life.

5.1.4 The value of research skills to the economy as a whole is demonstrated by the good employment outcomes for HDR graduates. At least 60 per cent of PhD and Masters by Coursework graduates go on to careers outside academia.[34]

5.1.5 With these outcomes in mind, it is likely that the research training experience, as well as the quality of the research undertaken, can be enhanced by more engagement with business and the community as well as through broader opportunities for the development of workplace skills in HDR programmes.

[34] Graduate Careers Australia. Postgraduate Destinations 2013 – a report on the work and study outcomes of recent higher education postgraduates. http://www.graduatecareers.com.au/wp-content/uploads/2014/09/Postgraduate_Destinations_2013_FINAL.pdf

5.2. Current Arrangements

5.2.1 The Australian Government supports research training for domestic HDR students through:

- the Research Training Scheme (RTS), which provides support to institutions for domestic students' tuition fees and
- the Australian Postgraduate Awards (APA) scheme, which provides a stipend awarded on a competitive basis to approximately 40 per cent of students supported under the RTS.

5.2.2 The Government also supports a modest number of international HDR students through competitive scholarships awarded under the International Postgraduate Research Scholarships (IPRS) scheme. An IPRS scholarship provides support for student fees in the manner of the RTS and students in receipt of an IPRS are also eligible to apply for an APA.

5.2.3 Funding for all programmes is allocated using a mix of performance measures that equally balance the research environment (Income and Publications) and research training effectiveness (HDR completions).

5.2.4 None of the HDR programmes specify content or method of delivery of research training as a requirement, as this is a decision of the universities. While this may provide universities with flexibility in the design and delivery of research training, there is no incentive to include potential commercial outcomes from research.

5.2.5 The rules for support under the RTS, APA and IPRS are complex with strict rules on the period of support, providing limited flexibility to institutions in the identification of optimal support for individual students.

5.2.6 The limitations of separate programme funding streams also limit flexible packaging of fee and income support to optimise HDR support for each institution's mix of student characteristics.

5.2.7 Some universities have nonetheless adapted their approaches to research training to include more industry engagement, and to reflect the changing employment outcomes for HDR graduates.

5.2.8 For example, the Australian Technology Network of Universities Industry Doctoral Training Centre in Mathematics and Statistics (ATN IDTC) is an Australian PhD training initiative, co-funded by the Australian Government, to deliver mathematics and statistics PhD graduates ready for industry. Through the course of their PhD programme, students work directly with industry on a research problem identified by the industry partner.

5.2.9 These rules could be simplified substantially as long as the funding drivers are effective in driving universities towards optimal behaviour.

5.2.10 The University of Queensland Career Development Framework (CDF) was developed in consultation with students and industry, and provides skills development opportunities for PhD students. The Framework includes

opportunities to work with industry to develop commercialisation and entrepreneurship skills, as well as more traditional academic development.

5.3. Consultation Questions

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

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

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

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

ATTACHMENTS

A. ERA 2012 results

B. University chart names and legal names

ATTACHMENT A

ERA 2012 2-digit Field of research results

Institution	01 Mathematical Sciences	02 Physical Sciences	03 Chemical Sciences	04 Earth Sciences	05 Environmental Sciences	06 Biological Sciences	07 Agricultural and Veterinary Sciences	08 Information and Computing Sciences	09 Engineering	10 Technology	11 Medical and Health Sciences	12 Built Environment and Design	13 Education	14 Economics	15 Commerce, Management, Tourism and Services	16 Studies In Human Society	17 Psychology and Cognitive Sciences	18 Law and Legal Studies	19 Studies In Creative Arts and Writing	20 Language, Communication and Culture	21 History and Archaeology	22 Philosophy and Religious Studies
Melbourne	4	4	4	4	4	3	4	5	5	5	5	4	4	5	5	4	5	5	4	5	5	4
Sydney	5	4	4	4	4	4	5	4	5	4	5	3	4	4	4	4	5	5	4	5	5	5
Queensland	4	5	5	3	4	5	4	4	5	5	5	3	5	4	4	4	4	4	4	5	4	4
New South Wales	4	3	5	4	3	4	n/a	4	4	4	5	4	3	4	5	4	5	5	5	4	5	4
ANU	5	5	3	5	5	5	4	5	4	n/a	4	n/a	n/a	5	4	5	3	5	3	5	5	5
Monash	3	4	5	3	n/a	4	n/a	4	5	5	5	3	4	5	4	3	3	5	4	4	5	5
Adelaide	4	5	4	4	4	3	4	4	3	2	5	3	2	4	2	3	3	4	5	3	3	4
Western Australia	3	5	3	4	4	4	3	3	4	n/a	5	3	3	4	4	3	4	3	4	4	4	3
Macquarie	2	5	3	5	5	4	n/a	3	3	n/a	2	3	3	3	2	3	3	4	3	4	4	4
QUT	4	3	3	3	4	3	n/a	3	3	3	3	3	4	3	3	2	3	4	4	5	n/a	n/a
Tasmania	3	4	4	4	3	4	4	2	2	n/a	3	2	2	2	2	3	2	4	3	3	4	3
UTS	3	3	3	n/a	5	3	5	3	3	n/a	3	3	3	5	3	3	n/a	4	3	4	3	n/a
Griffith	n/a	3	3	3	3	3	4	3	2	n/a	3	3	3	2	3	4	2	4	4	3	4	3
Wollongong	4	3	5	4	n/a	3	n/a	3	4	n/a	2	n/a	3	2	2	3	3	4	4	3	4	3
Deakin	n/a	n/a	5	n/a	3	3	3	2	4	4	5	2	3	3	2	2	2	3	3	3	3	3
Newcastle	3	2	3	5	n/a	4	n/a	2	5	n/a	4	3	3	1	2	3	5	n/a	3	3	3	3
Western Sydney	4	1	3	n/a	3	4	3	2	3	n/a	3	2	3	2	2	3	2	3	4	4	3	3
Curtin	3	3	3	5	3	2	3	2	3	n/a	2	3	3	2	2	3	3	2	3	3	3	n/a
La Trobe	2	3	2	n/a	3	5	3	3	n/a	n/a	3	n/a	2	3	3	3	2	3	3	4	5	3
Flinders	2	1	3	2	1	3	3	3	2	4	3	n/a	2	3	2	3	3	3	3	3	3	2
James Cook	3	3	3	4	5	4	4	2	3	n/a	2	n/a	2	1	2	2	2	3	2	3	3	n/a
Murdoch	2	n/a	3	n/a	2	3	4	2	3	5	4	n/a	2	n/a	2	3	3	3	2	3	3	2
RMIT	3	3	3	n/a	3	3	n/a	3	4	n/a	4	4	2	2	2	3	n/a	3	3	4	n/a	n/a
South Australia	4	n/a	5	n/a	4	n/a	n/a	3	4	n/a	3	3	2	3	3	3	3	2	3	3	n/a	n/a
New England	3	n/a	1	4	3	3	3	n/a	n/a	n/a	1	n/a	2	2	1	3	3	3	3	3	3	3
Swinburne	n/a	5	3	n/a	n/a	n/a	n/a	3	4	n/a	1	3	2	n/a	1	2	4	n/a	n/a	3	3	n/a
Charles Sturt	n/a	n/a	2	n/a	4	2	3	2	n/a	n/a	1	n/a	3	2	1	2	1	n/a	2	2	2	3
Central Queensland	5	n/a	n/a	n/a	2	1	5	2	2	n/a	3	n/a	1	2	1	2	n/a	n/a	2	2	n/a	n/a
Southern Queensland	3	3	n/a	n/a	n/a	n/a	3	2	2	n/a	2	n/a	1	2	2	1	1	2	2	2	2	n/a
Charles Darwin	n/a	2	n/a	n/a	4	3	4	3	n/a	n/a	3	n/a	2	3	1	2	n/a	n/a	n/a	n/a	2	n/a
Victoria	3	n/a	n/a	n/a	n/a	1	n/a	2	3	n/a	3	n/a	2	2	1	2	2	2	3	3	n/a	n/a
Canberra	n/a	n/a	3	n/a	3	3	n/a	2	n/a	n/a	1	2	2	1	1	3	n/a	2	3	2	n/a	n/a
Southern Cross	n/a	n/a	n/a	5	n/a	4	5	n/a	n/a	n/a	2	n/a	1	n/a	2	2	n/a	2	3	n/a	n/a	n/a
Edith Cowan	n/a	n/a	n/a	n/a	2	3	n/a	1	2	1	3	n/a	2	2	1	2	1	n/a	2	3	n/a	n/a
ACU	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3	n/a	2	n/a	2	2	2	n/a	2	2	3	3
Federation	2	n/a	n/a	n/a	2	n/a	n/a	2	2	n/a	2	n/a	2	2	1	2	n/a	n/a	1	2	n/a	n/a
Bond	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2	n/a	n/a	4	2	1	2	2	2	1	3	n/a	n/a	n/a	n/a
Sunshine Coast	n/a	n/a	2	n/a	n/a	3	4	1	n/a	n/a	1	n/a	1	n/a	2	1	n/a	n/a	2	n/a	n/a	n/a
Notre Dame	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2	n/a	1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1
MCD	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3
Batchelor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Ratings key:

5 rating – Well above world standard
4 rating – Above world standard
3 rating – At world standard
2 rating – Below world standard
1 rating – Well below world standard

ATTACHMENT B

University chart Names and full names as listed (or to be listed) on Table A and Table B of HESA.

Chart name	Full name
ACU	Australian Catholic University
BIITE	Batchelor Institute of Indigenous Tertiary Education
BOND	Bond University
CQU	Central Queensland University
CDU	Charles Darwin University
CSU	Charles Sturt University
CUT	Curtin University of Technology
DEAK	Deakin University
ECU	Edith Cowan University
FEDU	Federation University Australia
GU	Griffith University
JCU	James Cook University
LATR	La Trobe University
MCQ	Macquarie University
MCD	MCD University of Divinity
MON	Monash University
MURD	Murdoch University
QUT	Queensland University of Technology
RMIT	Royal Melbourne Institute of Technology
SCU	Southern Cross University
SWIN	Swinburne University of Technology
ANU	The Australian National University
FLIN	The Flinders University of South Australia
UOA	The University of Adelaide
UOM	The University of Melbourne
UNDA	The University of Notre Dame Australia
UQ	The University of Queensland
USYD	The University of Sydney
UWA	The University of Western Australia
UC	University of Canberra
UNE	University of New England
UNSW	University of New South Wales
UNEW	University of Newcastle
USA	University of South Australia
USQ	University of Southern Queensland
UTAS	University of Tasmania
UTS	University of Technology, Sydney
USC	University of the Sunshine Coast
UWS	University of Western Sydney
UOW	University of Wollongong
VU	Victoria University