



Australian Government
Productivity Commission

SHIFTING THE DIAL



5 YEAR PRODUCTIVITY REVIEW

SUPPORTING PAPER NO. 12

AN OVERVIEW OF
INNOVATION POLICY

3 AUGUST 2017

© Commonwealth of Australia 2017

ISBN 978-1-74037-640-2 (PDF)



Except for the Commonwealth Coat of Arms and content supplied by third parties, this copyright work is licensed under a Creative Commons Attribution 3.0 Australia licence. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/3.0/au>. In essence, you are free to copy, communicate and adapt the work, as long as you attribute the work to the Productivity Commission (but not in any way that suggests the Commission endorses you or your use) and abide by the other licence terms.

Use of the Commonwealth Coat of Arms

For terms of use of the Coat of Arms visit the 'It's an Honour' website: <http://www.itsanhonour.gov.au>

Third party copyright

Wherever a third party holds copyright in this material, the copyright remains with that party. Their permission may be required to use the material, please contact them directly.

Attribution

This work should be attributed as follows, *Source: Productivity Commission, An Overview of Innovation Policy, Shifting the Dial: 5 year Productivity Review, Supporting Paper No. 12.*

If you have adapted, modified or transformed this work in anyway, please use the following, *Source: based on Productivity Commission data, An Overview of Innovation Policy, Shifting the Dial: 5 year Productivity Review, Supporting Paper No. 12.*

An appropriate reference for this publication is:

Productivity Commission 2017, *An Overview of Innovation Policy, Shifting the Dial: 5 year Productivity Review, Supporting Paper No. 12*, Canberra.

Publications enquiries

Media and Publications, phone: (03) 9653 2244 or email: maps@pc.gov.au

The Productivity Commission

The Productivity Commission is the Australian Government's independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians. Its role, expressed most simply, is to help governments make better policies, in the long-term interest of the Australian community.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

Further information on the Productivity Commission can be obtained from the Commission's website (www.pc.gov.au).

Contents

Abbreviations	ii
Key Points	iv
An overview of innovation policy	1
1 The Australian government's innovation policy	2
2 Supporting policies	14
3 Data	19
4 Some relevant statistics	20
5 Selected studies	22
6 Some key policy issues	24
A Research institutions	27
B Innovation programmes	33
References	37

Abbreviations

Abbreviations

ABN	Australian Business Number
ABS	Australian Bureau of Statistics
ARC	Australian Research Council
ATO	Australian Taxation Office
BLADE	Business Longitudinal Analysis Data Environment
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DIIS	Department of Industry, Innovation and Science
DST	Defence Science and Technology
ICT	Information and communication technology
INSEAD	Institut Européen d'Administration des Affaires
IP	Intellectual property
ISA	Innovation and Science Australia
NHMRC	National Health and Medical Research Council
NSW	New South Wales
NT	Northern Territory
OECD	Organisation for Economic Cooperation and Development
PCT	Patent Cooperation Treaty
Qld	Queensland
R&D	Research and development

RDC	Research and Development Corporation
SA	South Australia
SME	Small and medium-sized enterprises
SP	Supporting paper
STEM	Science, technology, engineering and mathematics
Tas	Tasmania
UK	United Kingdom
US	United States
Vic	Victoria
WA	Western Australia
WIPO	World Intellectual Property Organization

Key points

- In 2015, the Australian Government brought many of its separate, but related, policies together under the *National Innovation and Science Agenda*. They established a new body, Innovation and Science Australia, to develop and implement policy to promote innovation.
- Beyond investing in basic research and skills, the jury is out on whether there are specific government policies that can successfully promote innovation and whether this would be material to Australian economic growth. The Commission has previously argued that the government should conduct rigorous evaluations of all government innovation programmes to verify that they are achieving ‘additionality’ and are cost effective (PC 2007).
- The Department of Industry, Innovation and Science (DIIS) is building a data framework to, among other things, support the evaluation of their programmes, drawing on data from the ATO, the ABS and what they collect from the firms receiving support. This framework (BLADE), which is managed by the ABS and is progressively being made available to researchers beyond DIIS, is an important first step in providing better evaluation of industry programmes. This work should inform this question of what governments should and should not do to stimulate innovation in the next Productivity Review, in 5 years-time.
- In the meantime, there are several areas where the government should take action.
 - A recent review of the Australian economy by the OECD (2017) recommended consolidating the 150 Commonwealth programmes. Many of these schemes are small in terms of the funds involved — with 74 collectively accounting for under 2 per cent of Australian Government expenditure of just under \$10 billion in 2015-16 (with an average expenditure of \$2.6 million). While trials are to be applauded, they are not a valid test if they fail simply due to insufficient scale.
 - A third of the almost \$10 billion public investment in innovation-related activities (including basic research funding) is through the R&D tax incentive. The Ferris, Finkel and Fraser Review (2016) made six recommendations which largely sought to: limit the scope for creative accounting by greater clarity and transparency; reward collaborative research efforts; and better focus support to innovative investments by limiting the cash refund and imposing an intensity threshold while expanding the expenditure threshold to retain the incentive for large firms to increase R&D in Australia.
- The lack of connection between the research and private sector is an issue. Yet trying to make academics become entrepreneurs is rarely successful. Critical mass — for networks of contacts, to attract skilled workers, and to pool risk for investors — is well recognised as important for building sustainable innovative ecosystems. Governments at all levels have responded with investments in maker spaces, incubators, and accelerators that may bear fruit, but it is also possible that lack of scale will undermine these efforts. Addressing this is difficult, but greater cooperation between governments to build areas of expertise in specific locations would assist entrepreneurs and firms in building critical mass.

An overview of innovation policy

Innovation and science are seen as critical for maintaining Australia's high standard of living, ensuring its ongoing international competitiveness, creating jobs and ensuring future economic prosperity. Central to this is the creation and adoption of knowledge, ideas, products, processes and ways of doing business. This requires a culture that values and is open to new ideas and ways of doing things, takes risks and learns from mistakes made.

Technological progress has long been an important driver of economic growth in developed economies such as Australia. This rate of progress has quickened in recent years as technological advances open up new opportunities and lowers the cost of exploiting them. This progress gradually changes the nature of economic activity and society. Such changes challenge the viability of established ways of doing things and existing business models.

Innovation policy seeks to foster, nurture and develop knowledge, and to have these ideas put into practice by business in new and better products, processes and ways of doing business. Governments seek to encourage innovation by investing in the generation of knowledge, supporting basic and applied research and development (R&D), building the skills of the workforce, providing a sound regulatory environment (Supporting Paper 13 (SP 13)), and promoting a culture that values innovation.

The ways in which Australian governments have supported innovation are many and varied. At the basic research and skill development end of the spectrum, governments support research by academics mainly at universities. With a more applied focus, but still on research that may not have immediate commercial applications, government-owned institutions, such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO), undertake the research directly. Governments also offer a range of tax concessions, grants and other inducements to the private sector to boost their R&D, and in some cases assist them through the commercialisation process. This assistance is provided on the basis that, without assistance, markets would undertake insufficient R&D, as they would not take into account the external benefits arising to others from their research.

Australian governments have also invested in maker spaces, incubators, and accelerators with the hope of attracting entrepreneurs and building critical mass to attract skills and investors. Together this loose grouping of a wide range of different policies are governments' attempts to support Australian firms to innovate.

The Australian Government brought many of their separate, but related, policies together in 2015 under the *National Innovation and Science Agenda* (Commonwealth of Australia 2015).

This paper seeks to provide an overview of Australian Government innovation policy. It commences by outlining the key Australian Government policies that target innovation (section 1). It then outlines some other Australian Government policies that, while pursuing other objectives, also support innovation (section 2). The paper then provides an overview of a data framework being developed that could support future analysis of innovation policy in Australia (section 3). It then provides some selected statistics on innovation in Australia (section 4). The paper draws some policy-relevant findings from some recent reviews of innovation policy in Australia (section 5). It concludes by raising some issues for Australian innovation policy (section 6).

1 The Australian Government's innovation policy

Government expenditure

The Australian Government spent \$10.1 billion on research and other measures to support innovation in 2015-16 (figure 1).¹ The full list of Australian Government expenditure on innovation, science and R&D in this year is detailed in appendix B.

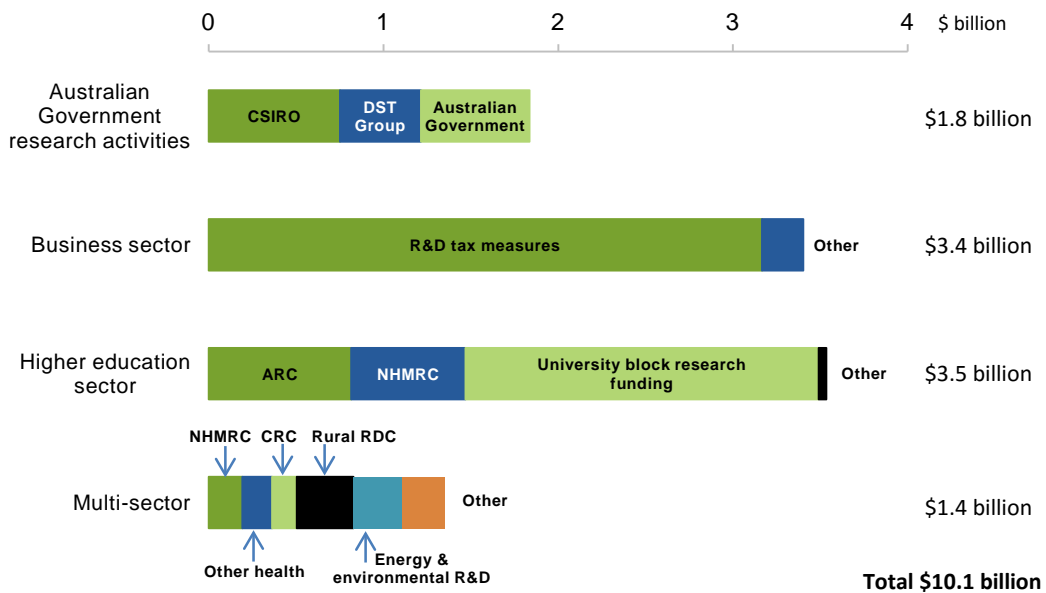
One-third of this expenditure was directed towards the business sector, primarily through tax measures aimed at encouraging R&D. Government research activities accounted for one-fifth of this investment, with the remainder targeting research (by universities, rural research and development corporations (rural RDCs), cooperative research centres (CRCs) and through grants).

Expenditure across each of these sectors includes a mix of institutional and grant funding.

There were 150 separate Australian Government funded innovation programmes or activities in the 2015-16 budget (DIIS 2016). Expenditure on these initiatives totalled \$10.1 billion. This is a conservative estimate of all initiatives and funding, as it excludes related Australian Government programmes and those of state and territory governments.

¹ Financial data reported in this supporting paper are 'estimated actuals' for the financial year 2015-16, and generally sourced from the 2016-17 budget papers for the Department of Industry, Innovation and Science to enable comparability across programmes. There may be overlap in the expenditures reported across sections, as some funding consists of multiple strands (such as that for the National Health and Medical Research Council (NHMRC)).

Figure 1 **Australian Government investment in R&D, 2015-16**



Source: DIIS (2016).

Research organisations

Government research organisations

The Australian Government spent \$1.8 billion on the research activities of 16 government agencies in 2015-16 (table A.1 at the end of this paper).

Of these, the two main Australian Government research organisations are:

- the CSIRO (\$750 million)
- the Defence Science Technology Group (\$464 million).

Funding of the remaining government research organisations totalled \$621 million.

The higher education sector

The Australian Government spent \$3.5 billion on research and innovation undertaken by the higher education sector in 2015-16 (figure 1). The main government funding covers:

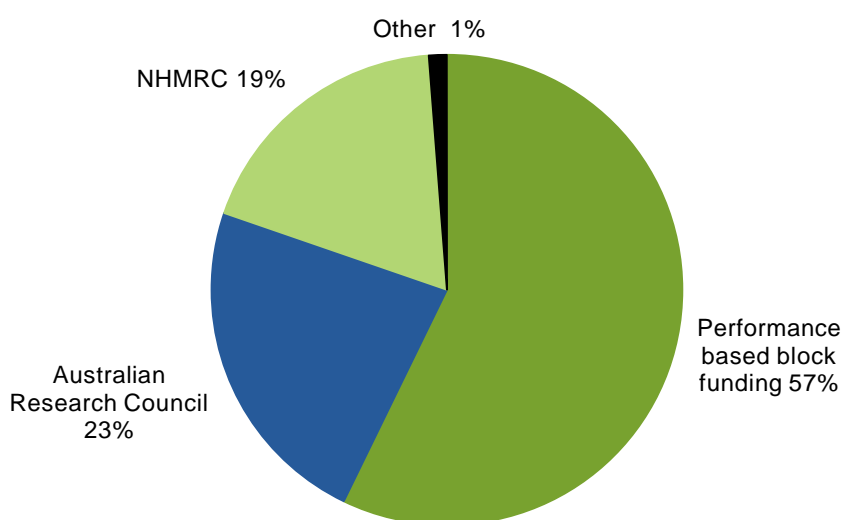
- performance based block funding to fund university research (\$2 billion)
- Australian Research Council (ARC) grants (\$816 million)
- National Health and Medical Research Council (NHMRC) (\$653 million)

-
- other Higher Education R&D (\$43 million) (figure 2).

Research performance block funding grants were provided to 42 higher education providers in 2016 (table A.2 at the end of this paper), with the single largest recipient being The University of Melbourne with \$185 million.

In addition to research funding, Australian universities received an additional \$19.2 billion in 2015 to fund their teaching and other activities (SP 7).

Figure 2 **Australian university research funding by source, 2015-16**



Source: DIIS (2016).

Multi-sector

Some R&D is undertaken by more than one sector. For example, NHMRC grants fund research undertaken by universities, medical research institutes, government bodies and hospitals. Other research involves joint public-private sector partnerships.

The Australian government spent \$1.4 billion on multi-sectoral research in 2015-16 (figure 1). The main multi-sectoral research funding agencies are:

- rural RDCs (\$323 million)
- NHMRC (excluding university) (\$193 million)
- CRCs (\$141 million).

Funding of the remaining innovation undertaken by multi-sector organisations totalled \$695 million and primarily covered R&D in the areas of energy, environment and health.

Rural RDCs and rural R&D

Rural RDCs invest in R&D and innovation to improve the profitability, productivity, competitiveness and long-term sustainability of Australia's primary industries. The Rural RDCs act as investment managers, custodians of public and private funds, and service providers to industry and government. There were 15 Rural RDCs in Australia in 2015-16 (table A.3 at the end of this paper). These organisations are primarily funded through statutory R&D levies (or charges) on the commercial production of various commodities, with matching funding from the Australian Government.

Five Rural RDCs are statutory corporations or authorities that are owned by the Australian Government and established under legislation:

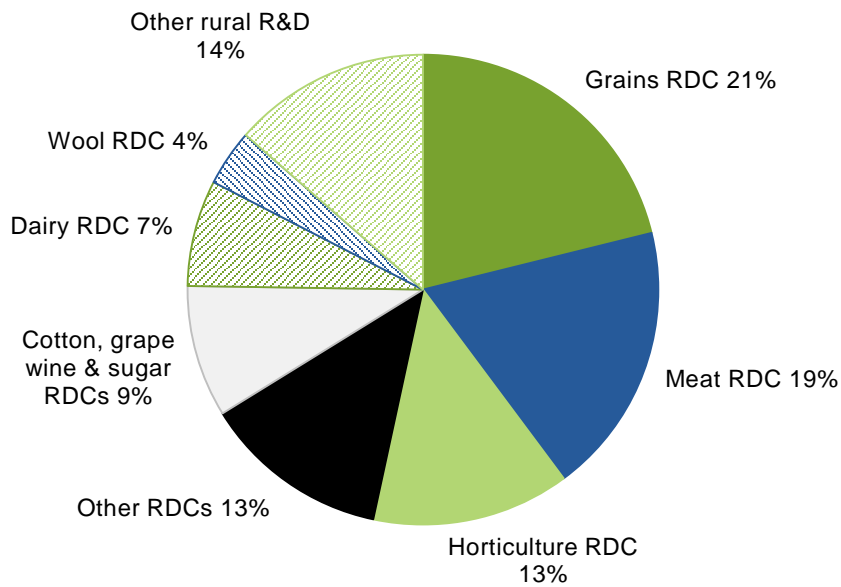
- the Australian Grape and Wine Authority
- the Cotton Research and Development Corporation
- the Fisheries Research and Development Corporation
- the Grains Research and Development Corporation
- the Rural Industries Research and Development Corporation.

The remaining 10 Rural RDCs are industry-owned, not-for-profit companies established under Australia's corporations law and declared through regulation as the service providers to industry for specific activities. These Rural RDCs cover: dairy, eggs, forest and wood products, horticulture, livestock export, meat and livestock, meat processing, pork, sugar and wool.

The Australian Government expenditure on rural R&D in 2015-16 was \$323 million. This expenditure consisted of:

- \$279 million on rural RDCs, with the largest Australian Government matching payments being made to: grains (\$68 million); meat (\$60 million); horticulture (\$44 million); and dairy (\$24 million)
- \$44 million on other rural R&D, including research into fisheries, landcare, pest and weed control as well as rural extension and outreach (figure 3).

Figure 3 Rural R&D expenditure by sector, 2015-16^a



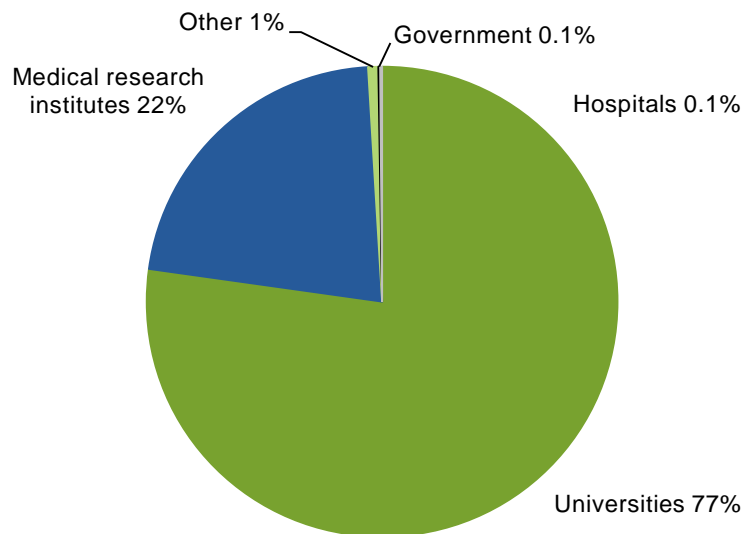
^a Source reports individual payments made to some RDCs. The remaining RDCs are grouped together.
Source: DIIS (2016).

National Health and Medical Research Council

The NHMRC is the main funder of clinical, health and other medical research in Australia. It also develops advice for the community, health professionals and governments. The Council seeks to promote the development and maintenance of public and individual health standards in Australia.

The NHMRC funds this research by providing grants, usually to universities, medical research institutes, hospitals and government (figure 4).

Figure 4 **NHMRC expenditure by research sector, 2015-16**



Source: DIIS (2016).

Australian Government research funding allocated by the NHMRC in 2015-16 was \$846 million. This was split between:

- grant funding for university researchers of \$653 million (part of university funding)
- grant funding of government, medical research institutes and other of \$193 million (part of multi-sector funding).

In addition, the cost of running the NHMRC in 2015-16 was \$41 million (NHMRC 2016).

Cooperative Research Centres

CRCs undertake industry-led and outcome-focused collaborative research partnerships between industry, researchers and the community. They link business with researchers. A CRC is defined as:

... a company formed through a collaboration of businesses and researchers. This includes private sector organisations (both large and small enterprises), industry associations, universities and government research agencies such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO), and other end users. This team of collaborators undertakes research and development leading to utilitarian outcomes for public good that have positive social and economic impacts. (Cooperative Research Centres Association 2016)

The Australian Government funds CRCs through competitive, merit-based grants program run by the Department of Industry, Innovation and Science.

The number of operational CRCs varies over time, as new CRCs are created and as old ones do not have their funding extended. Each CRC is funded for a fixed term — ranging from two to ten years (with an average of 6.6 years) — and for a specified financial outlay. Some CRCs receive subsequent tranches of funding after their initial funding expires. There were 31 CRCs funded in the 2015-16 budget (table A.4 at the end of this paper).

Funding consists of two streams:

- CRCs to support medium to long-term industry-led collaborative research
- CRC Projects to support short-term, industry-led collaborative research.

Australian Government expenditure on CRCs in 2015-16 was \$141 million.

Research grants

University block research funding

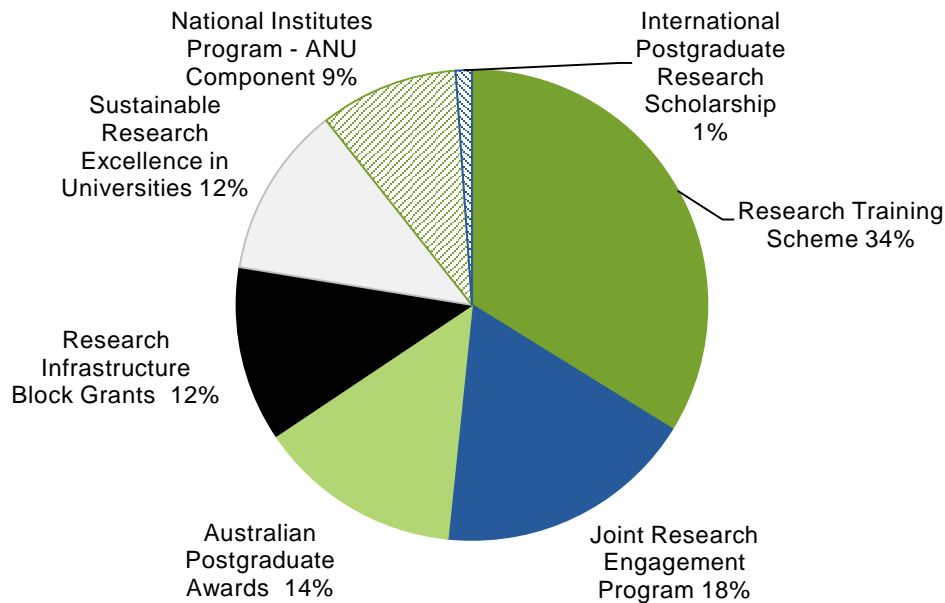
The Australian Government employs a dual approach to funding research undertaken by the higher education sector.

Competitive and other grants support the direct costs of research under the *Higher Education Support Act (HESA) 2003* (Cwlth).

Australian Government expenditure on block grants in 2015-16 totalled \$2 billion (figure 5). This consisted of seven types of grants:

- *Australian Postgraduate Awards*, which fund scholarships for students of exceptional research potential undertaking a doctorate or master's degree by research (\$282 million)
- *International Postgraduate Research Scholarship*, which fund scholarships for overseas students of exceptional research potential undertaking a doctorate or master's degree by research at Australian universities (\$22 million)
- *Joint Research Engagement Program*, which fund research-related activities by Australian higher education providers (\$360 million)
- *National Institutes Program — ANU Component*, which funds research and research training provided to the Institute of Advanced Studies of the Australian National University (\$192 million)
- *Research Infrastructure Block Grants*, which help fund research infrastructure such as libraries, laboratories, computing centres, animal houses, herbaria, and experimental farms (not including construction of buildings or staff salaries) (\$242 million)

Figure 5 **University performance-based block funding by grant type, 2015-16**



Source: DIIS (2016).

- *Research Training Scheme*, which supports the costs associated by higher education providers in providing research training for domestic students undertaking a higher degree by research (\$684 million)
- *Sustainable Research Excellence in Universities*, which gives higher education providers discretion in how they fund the indirect costs associated with carrying out research projects supported by the ARC, NHMRC or other national competitive research granting programs (\$239 million).

An eighth block grant, *Research Training Program*, was scheduled to commence in 2016-17 to support the training of the next generation of researchers and innovators by offsetting fees otherwise payable, supporting general living costs and providing ancillary allowances to students.

As part of the National Innovation and Science Agenda, funding arrangements for six of these block grants were consolidated from 1 January 2017 into two:

- *Research Support Program*², which support the systemic indirect costs of research, including the indirect costs, such as libraries, laboratories, consumables, computing centres and the salaries of support and technical staff

² This stream replaced the Joint Research Engagement program, Research Infrastructure Block Grants and the Sustainable Research Excellence grants.

-
- *Research Training Program*³, which supports domestic and overseas students undertaking research doctorate and research masters degrees. The payments may cover: tuition fees offset; stipend for general living costs; and allowances related to the ancillary cost of research degrees.

The funding grants are administered by the Department of Education and Training.

National Health and Medical Research Centre grants

The NHMRC provides grants to universities, medical research institutes⁴, hospitals and government to fund a wide range of health and medical research. Some grants fund infrastructure and others research. Some grants are annual and others one-off. Some grants are highly targeted (such as for dementia research) and others general. NHMRC grant funding is determined by the allocation in the Australian Government budget.

Current NHMRC grants cover:

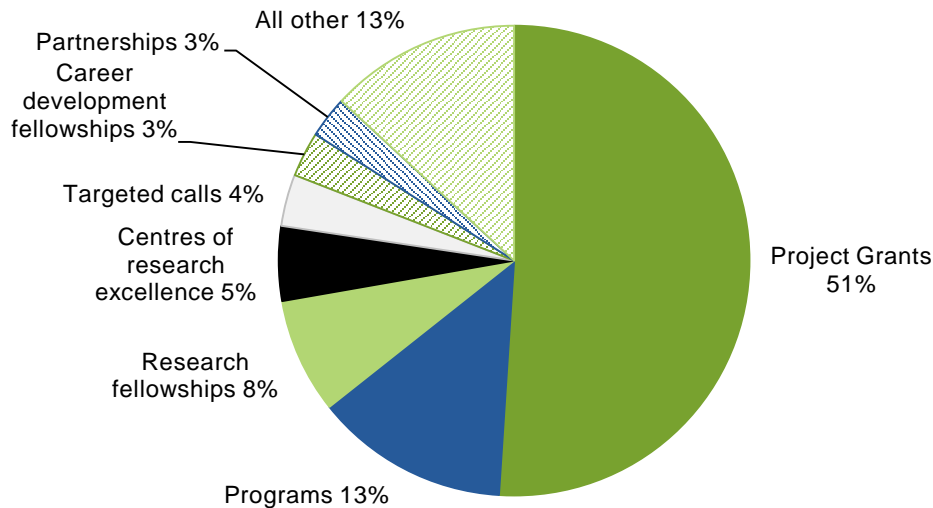
- *Grants to Accelerate Research Translation*, which funds research to support the production of scholarly evidence to inform policy and/or practice and the intellectual work to better deal with complex translation pathways
- *Grants to Build Australia's Future Capability*, which funds researchers, research teams and infrastructure to complete health and medical research in Australia
- *Work with Partners*, which seeks to improve the availability and quality of research evidence to decision makers who design policy and to inform the policy process by supporting more effective connections between decision makers and researchers
- *Collaborative Grants*, which assist Australian researchers to participate in multinational research collaborative projects with international researchers to create knowledge and/or translate research
- *Gap Funding*, which helps external organisations that may have funding available to identify fundable research and/or researchers.

The NHMRC funded \$846 million in research in 2015-16 (\$653 million to universities and \$193 million to Government, medical research institutes, hospital and other). This funding was provided by a variety of different grants (figure 6). The NHMRC funded 50 institutions in 2016 (table A.5 at the end of this paper). It funded 986 projects out of the 5519 applications received (a funding rate of 17.9 per cent).

³ This stream replaced the Australian Postgraduate Awards, International Postgraduate Research Scholarships and the Research Training Scheme.

⁴ The Department of Health lists 67 independent medical research institutes in Australia (DoH 2017).

Figure 6 **NHMRC expenditure by grant type, 2015-16**



Source: DIIS (2016).

Australian Research Council grants

The ARC is an Australian Government agency that seeks to advance Australian research and innovation globally for the benefit of the Australian community. It provides advice to the Australian Government on research matters, administers the National Competitive Grants Program, and administers Excellence in Research for Australia. The cost of running the ARC in 2015-16 was \$26 million (ARC 2016).

The ARC supports fundamental and applied research and research training through national competition across all disciplines. The ARC also brokers partnerships between researchers and industry, government, community organisations and the international community.

The ARC funded \$816 million in research in 2015-16 (figure 1).

The key National Competitive Grants were:

- Discovery programme
 - Australian laureate fellowships (15 awards; \$45 million)
 - discovery early career researcher award (200 awards; \$70.7 million)
 - discovery indigenous (10 awards; \$4.1 million)
 - discovery projects (635 awards; \$244.9 million)
 - future fellowships (50 awards; \$38.6 million)

- Linkage programme
 - industrial transformation research hubs (5 awards; \$15.7 million)
 - industrial transformation training centres (6 awards; \$22 million)
 - linkage infrastructure, equipment and facilities (54 awards; \$38 million)
 - linkage projects (252 awards; \$86.9 million) (ARC 2016, pp. 159–61).

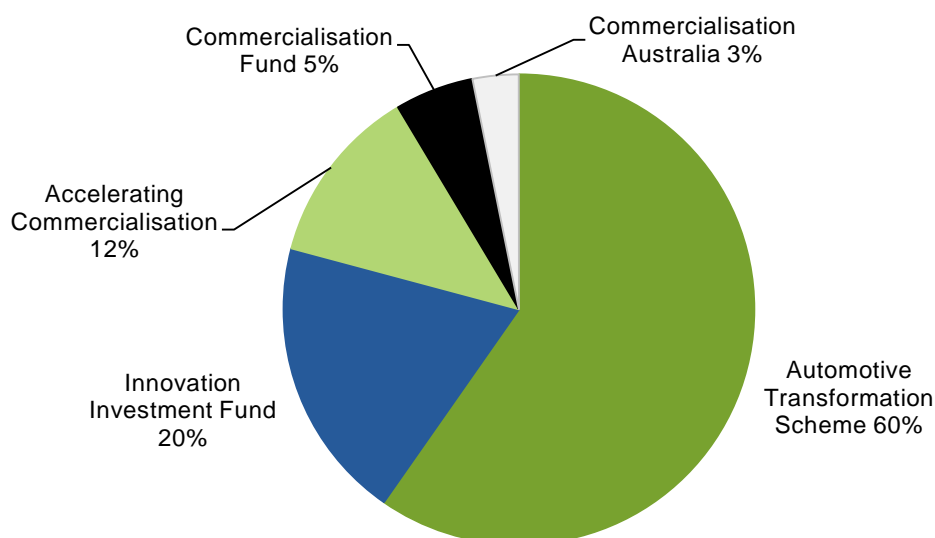
Private sector research

The Australian government funded \$3.4 billion of business sector research in 2015-16 (figure 1). This funding was directed towards:

- R&D tax measures (\$3.2 billion)
- business innovation and other R&D measures (\$236 million).

The funding for business innovation and other R&D includes \$43 million for the Innovation Investment Fund, \$27 million for Accelerating Commercialisation, \$12 million for the Commercialisation Fund and \$7 million for Commercialisation Australia (discussed later) (figure 7).

Figure 7 **Business innovation and other R&D grants, 2015-16^a**



^a Accelerating Commercialisation: Entrepreneurs' Programme — Accelerating Commercialisation. Innovation Investment Fund includes Innovation Investment Follow-on Fund.

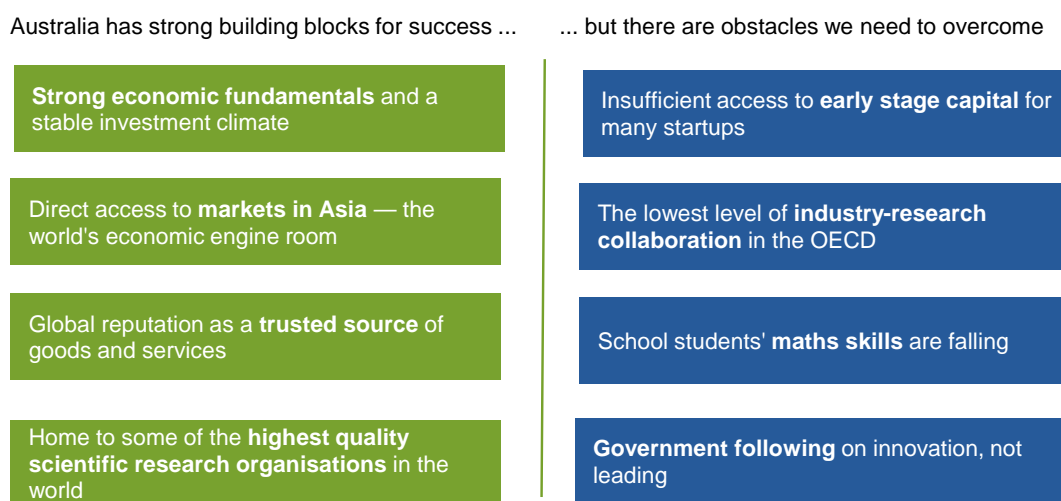
Source: DIIS (2016).

National Innovation and Science Agenda

The National Innovation and Science Agenda covers a range of related policy initiatives in the areas of innovation and science. It is intended to promote a more innovative and entrepreneurial economy as well as providing an overarching framework for innovation policy in Australia (Commonwealth of Australia 2015).

The Agenda states that the main building blocks for successful innovation in Australia are its strong economic fundamentals, direct access to Asian markets, a global reputation as a trusted source of goods and services and home to some of the highest quality scientific research organisations in the world. It identifies that the main obstacles to overcome are: insufficient access to early stage capital for many start-ups; the lowest level of industry-research collaboration in the OECD; falling student maths skills; and that the government is not leading on innovation, but rather following (figure 8).

Figure 8 **Characterisation of Australia's strengths and weaknesses in the National Innovation and Science Agenda**



Source: Commonwealth of Australia (2015, p. 1).

To achieve these goals, the Agenda consists of four key pillars:

- *culture and capital*, which aims to develop an Australia that is confident, embraces risk, pursues ideas and learns from mistakes, and for investors to back these ideas at an early stage
- *collaboration*, which seeks to encourage Australian researchers and businesses to collaborate to shape future industries and generate wealth

-
- *talent and skill*, which supports Australian students to embrace the digital age by promoting coding and computing in schools to ensure that students have the problem solving and critical reasoning skills for high wage jobs
 - *government as an exemplar*, which aspires to place innovation and science at the centre of the Government and to lead by example by becoming more innovative in how government:
 - delivers services
 - makes data openly available to the public
 - makes it easier for start-ups and innovative small businesses to sell technology services to government.

The Agenda includes 24 policy initiatives, with \$1.1 billion in expenditure over the four-year forward estimates. Just under half of this expenditure targets critical research infrastructure (\$459 million). Other significant expenditure items include:

- sharper incentives for engagement (\$127 million)
- tax incentives for angel investors (\$106 million)
- inspiring all Australians in digital literacy and STEM (\$84 million)
- intangible asset depreciation (\$80 million)
- *Data61*, which is a data innovation group created from the merger between National ICT Australia and CSIRO's digital research unit (\$71 million).

2 Supporting policies

A range of other government policies and expenditures also support or target innovation, research, investment and the diffusion of knowledge.

Intellectual property laws

Intellectual property laws provide an important platform for innovation policy in Australia. These laws aim at 'safeguarding creators and other producers of intellectual goods and services by granting them certain time-limited rights to control the use made of those productions' (WIPO 2004, p. 3).

The underlying rationale for these laws is that creations and ideas, once known, may be copied at little cost which may in turn lead to under-investment in intellectual goods and services, in the absence of intellectual property protection (PC 2013, p. 65).

These laws seek to overcome this market failure by enabling the developer of this intellectual property to, for a specified period of time, prevent others from using this property for personal gain. The granting of IP rights is a driver for innovation, but requires

that the owner of the IP can defend their rights — which can be an expensive process. Secrecy and staying ahead of the market are also ways in which firms can ensure that they benefit from their investment in R&D. But the system also influences the activities of firms and individuals that seek to use intellectual property in the production of their own goods and services. IP can be used as a barrier to entry, and to extract rents from firms that access IP under license. For example, the Commission has argued that a shift in copyright law to fair use could well be a game changer by removing a barrier to innovation in Australia, and that applications of IP should not provide for an exemption from competition law (chapter 5, SP 13).

The intellectual property system covers a diverse range of legal protections including:

- patents
- trade marks
- geographical indications of source
- designs
- plant breeder's rights
- copyrights
- moral rights
- performers' rights
- circuit layout rights.

Each type of intellectual property confers different legal rights to the intellectual property holder, for different durations and different capacities to derive pecuniary benefits from their inventions and creations (PC 2013).

Patent use in Australia

There were 28 605 *standard patent* applications in Australia in 2015, an increase of 10 per cent on the previous year. Patent applications have risen more-or-less steadily since 2006 (IP Australia 2016, p. 8).

Most Australian patent applications came from non-residents, with most being filed under the Patent Cooperation Treaty (PCT). Non-residents accounted for 92 per cent of all patent applications in 2015. US, Japanese, German and the UK companies accounted for 63 per cent of all applications in that year. Australian residents accounted for 2291 patent applications (eight per cent) (IP Australia 2016).

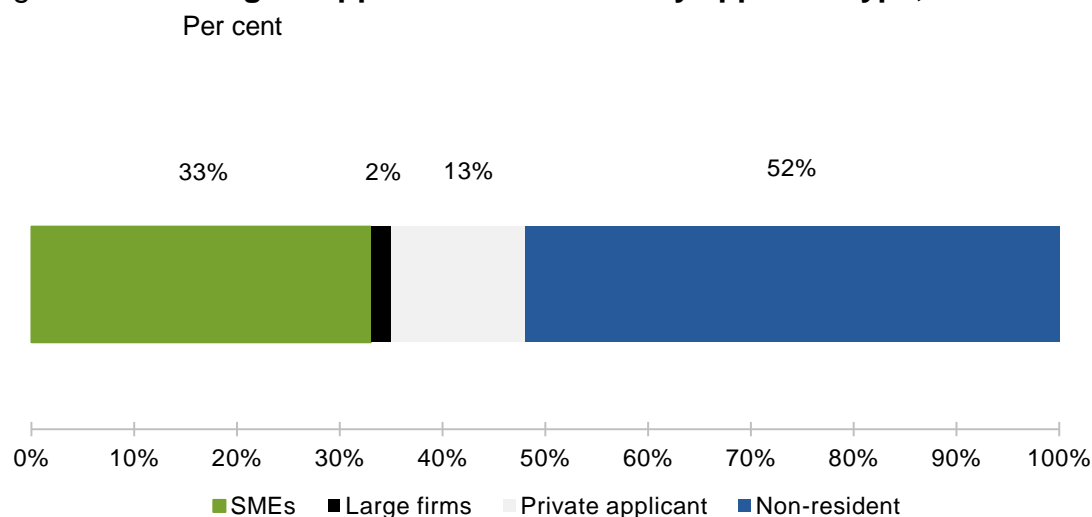
Provisional applications allow applicants to claim an early priority date before filing a standard or innovation patent. Although the number granted has increased slightly in the last three years, the use of provisional applications has declined substantially since 2006 (by three per cent per year). There were 5343 provisional applications filed in 2015.

Innovation patents have a lower application fee, last up to eight years and do not require examination unless the patent needs to be enforced. In 2015, 1828 innovation patent applications were filed in Australia. Of these, Australian residents accounted for 61 per cent of filings. Most non-resident applications came from China, the US and Taiwan. These three countries accounted for 77 per cent of nonresident applications (30 per cent of all innovation patent applications).

The innovation patent system has proved more harmful than helpful. Its lower threshold has increased the prospect for gaming the system and the number of low value patents, reducing its credibility to attract finance. The Commission recently recommended that the innovation patents system be abolished (PC 2016).

One-third of all IP applications were from Australian small-to-medium enterprises, mostly in the area of trade marks (figure 9).

Figure 9 **IP rights applications received by applicant type, 2015^a**



^a Patents, trade marks, designs and plant breeder's rights.

Source: IP Australia (2016, p. 26).

Funding of higher education

The teaching-side of higher education adds to the pool of human capital available to undertake future innovation, research, investment and the diffusion of knowledge. This human capital is subsequently further developed by engaging in innovation and research (such as through post-doctoral research).

Under current funding arrangements, university students cross-subsidise research through tuition fees (in particular from international students and Commonwealth-supported

domestic students). This funding mechanism can distort university incentives, and can affect the quality of education provided (see chapter 3, SP 7).

Extension services

Australian and state and territory governments provide some extension services to facilitate the dissemination of knowledge and innovation amongst business. Historically, these services have been primarily focused on the agricultural sector, but more recently funding has been directed towards small business.

Other government grants, expenditure and initiatives

Innovation and Science Australia

Innovation and Science Australia (ISA) is an independent statutory board that provides guidance on innovation, science and research across the Australian Government. It is chaired by Bill Ferris, with Chief Scientist Dr Alan Finkel as Deputy Chair. The Board includes innovators, scientists and entrepreneurs with track records of success.

ISA also promotes investment in industry, innovation, science and research in Australia, including showcasing successful innovators, entrepreneurs and researchers. It is charged with directly engaging international, business and community sectors to improve the overall performance of the national innovation and science system.

Global Innovation Strategy

The Global Innovation Strategy is a \$36 million, four year plan to advance Australia's international industry, science and research collaboration. It aims to:

- establish five 'landing pads' in global innovation hotspots to support entrepreneurial Australians (\$11.2 million)
- provide seed funding to support global small and medium-sized enterprises (SME)-to-researcher collaborations to enable viable projects to grow and test commercialisation through the *Global Connections Fund* (\$4.9 million)
- provide funding to assist Australian businesses and researchers to collaborate with global partners on strategically focused, leading-edge research and development projects through the *Global Innovation Linkages* programme (\$16.5 million)
- build strong regional linkages in the Asia-Pacific through the *Regional Collaborations Programme* which supports multi-partner activities that facilitate greater science, research and industry collaboration in delivering innovative solutions to shared regional challenges (\$3.2 million).

This strategy funds a number of programs.

Landing pads

Landing pads provide market-ready start-ups with a short-term (90 day) operational base where they can access entrepreneurial talent, mentors, investors and a wider connected network of innovation hubs in global innovation hotspots — Berlin, San Francisco, Shanghai, Singapore and Tel Aviv.

Global Connections Fund

The Global Connections Fund supports global SME-to-researcher collaborations to enable viable projects to grow and test commercialisation in industries of strategic growth in Australia.

The fund consists of two types of grants:

- *Bridging Grants* — larger grants of up to \$50 000 designed as seed funding capital to enable viable projects to grow in scope and scale, test commercialisation and proof-of-concept activities
- *Priming Grants* — small grants of around \$7000 to enable Australian SMEs and Australian researchers to meet and collaborate with international partners to further develop their ideas.

The grants are administered by the Australian Academy of Technology and Engineering.

Global Innovation Linkages programme

The programme supports groups (or consortia) of Australian industry and research organisations with grants of up to \$1 million over a maximum period of four years, to engage with international partners in key economies to undertake research and development projects.

Regional Collaborations Programme

This programme, administered by the Australian Academy of Science, aims to deliver solutions to shared regional challenges in the Asia-Pacific region through multi-partner research and collaboration activities.

Entrepreneurs' Programme

The programme is intended to drive business growth and competitiveness by supporting business improvement and promoting economic growth through research connections and commercialisation of novel products, processes and services.

Regional Collaborations Programme Accelerating Commercialisation (AC)

Accelerating Commercialisation is part of the Australian Government's \$482.2 million Entrepreneurs' Infrastructure Programme. It replaced Commercialisation Australia in November 2014.

The programme provides grants of up to \$1 million to commercialise novel products, processes and services. It aims to help Australian entrepreneurs, researchers, inventors, start-ups, commercialisation offices and small and medium enterprises address the challenges associated with commercialising novel intellectual property in the form of new products, processes and/or services and bringing them to market.

The priority areas for the scheme are: advanced manufacturing; food and agribusiness; medical technologies and pharmaceuticals; mining equipment, technology and services; oil, gas and energy resources; and enabling technologies and services that support one or more of these industries.

3 Data

Business Longitudinal Analysis Data Environment

The ABS and DIIS have developed the Business Longitudinal Analysis Data Environment (BLADE) methodology to link detailed information on the characteristics and finances of Australian businesses through a common identifier (the ABN). Integrating administrative data with directly collected survey data increases the capacity of the research community to undertake firm-level analysis and improves the evidence base for policy development and evaluation.

The government administrative data covered includes:

- Australian Taxation Office (ATO) data — Business Activity Statements (BAS), Business Income Tax (BIT), and pay as you go (PAYG)
- DIIS data — programme data
- IP Australia data.

BLADE is managed by the ABS. It has been used by the DIIS in a number of studies. It is progressively being made available to researchers beyond DIIS, and its value will grow

with use as new variables are added, the data is cleaned, and metadata descriptions improved. BLADE is suited to analysing business performance and dynamics, business demography and characteristics, and the prospect of linking it with employee data to create a longitudinal employer employee dataset is attractive. The range of policy relevant research produced in New Zealand, where such a data resource is available, illustrates the potential value of BLADE to helping build the much needed evidence base for industry and labour policy.

With regard to innovation, BLADE can be used to analyse the impacts of innovation activities on firm-level performance and productivity through the integration of additional data with ATO data. It also has the potential to improve the evaluation of innovation programs run by the DIIS. This work should inform this question of what governments should and should not do to stimulate innovation in the next Productivity Review, in five years-time.

4 Some relevant statistics

International rankings

Australia ranked 19th out of 128 countries and economies in the 2016 *Global Innovation Index*, down from 17th in the 2015 Index (Cornell University, INSEAD and WIPO 2016). Australia ranked well in terms of the inputs to innovation, particularly its infrastructure (6th), human capital and research (9th), institutions (10th) and market sophistication (10th). Australia ranked poorly in terms of knowledge and technology outputs in general (32nd) and knowledge diffusion in particular (107th).

The *Global Competitiveness Report 2015–2016* ranked Australia 23rd out of 140 world economies in terms of innovation. Australia ranked:

- 8th for quality of scientific research institutions
- 17th for availability of scientists and engineers
- 21st for university-industry collaboration in R&D
- 21st for PCT patents, applications/million population
- 25th for capacity for innovation
- 27th for company spending on R&D
- but only 70th for government procurement of advanced technology products.

The 2015 *Global Start-up Ecosystem Ranking* report ranked Sydney as 16th best city in the world in terms of ‘start-up ecosystem’ (Schwab 2015). Across the five criteria, Sydney ranked:

- 6th on talent

-
- 10th on start-up experience
 - 16th on funding
 - 17th on market reach
 - 20th on performance.

Who does what in innovation?

A common perception is that intellectual property rights benefit large Australian firms that have the financial resources to fund the research and to defend their legal rights in court.

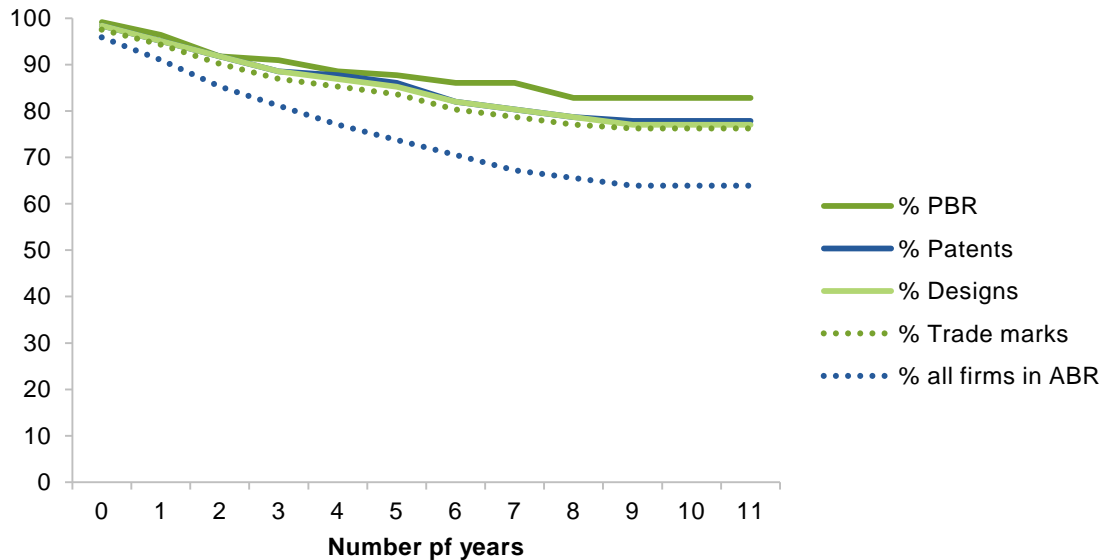
The actual situation is not as straightforward as this suggests:

- investment in intellectual property accounted for 10.4 per cent of all Australian private investment in fixed capital in 2014-15 — R&D accounted for 4.9 per cent and computer software 3.9 per cent (ABS 5206.0 reported in IP Australia (2016, p. 25))
- 53 per cent of patent applications in 2015 were by Australian SMEs, up from 43 per cent in 2006 (IP Australia 2016, p. 26)
- firms aged over 10 years old file proportionately more intellectual property applications than do firms that are younger (IP Australia 2016, p. 27)
- older firms tend to file around three times the number of patents of younger firms (IP Australia 2016, p. 28)
- there were 732 licences, options and agreements executed and 2236 active in 2014. Australian universities account for most licences, options and agreements in Australia.⁵ These agreements generated \$136 million in licence income for their Australian owners (DIIS 2015, p. 8)
- there were 15 463 research contracts, consultancies and collaborations in 2014, valued at \$1.8 billion (DIIS 2015, pp. 10–11)
- firms that take out intellectual property rights have higher ten-year survival rates than those that do not — the 10-year survival rate for firms that take out IP rights is in the range from high 70 to low 80 per cent, depending on the right, compared to an average of 65 per cent across all firms in the Australian Business Register (figure 10).
- firms that have taken out IP rights are less likely to have cancelled their Australian Business Number or GST registration than those that do not (25 per cent compared to 35 per cent, respectively), which aligns with the finding that firms with IP rights tend to live longer than firms without (DIIS 2015, p. 28).

⁵ A licence agreement formalises the transfer of technology between two parties, where the owner of the technology grants rights to the other party. An option agreement grants the potential licensee a time period during which it may evaluate the technology and negotiate the terms of a licence agreement. An assignment agreement conveys all rights, title and interest in the licenced subject matter to the named assignee.

Figure 10 Firm survival rate by intellectual property right^a

Per cent of firms surviving



^a ABR: Australian Business Register. PBR: plant breeders rights.

Source: IP Australia (2016, p. 29).

5 Selected studies

Public Support for Science and Innovation

In its *Public Support for Science and Innovation* report (PC 2007), the Productivity Commission found that there were:

... widespread and important economic, social and environmental benefits generated by Australia's ... public funding support of science and innovation.

- On the basis of multiple strands of evidence, the benefits of public spending are likely to exceed the costs.
- But, given a host of measurement and methodological issues, it is not possible to provide anything other than broad estimates of the overall return to government contributions.

The report identified that major improvements were needed across the sector, including some key institutional and program areas.

The Commission's analysis suggested that many investments that produce spillovers have sufficient private returns for firms to invest without support'. However, although it is difficult to estimate with any precision, the overall return to total and business R&D was found to be high (PC 2007, p. XIX).

Review of the R&D Tax Incentive

The R&D Tax Incentive seeks to encourage industry to invest in R&D activities that might otherwise not be conducted through the provision of refundable and non-refundable tax offsets (\$0.9 billion and \$2.3 billion, respectively, in 2015-16 (DIIS 2016)). It replaced the R&D Tax Concession in 2011.

The rationale for the incentive is to encourage additional R&D that, while it may not be viable for an individual company to ordinarily undertake this R&D, the outcomes of the R&D may have a wider benefit to Australian society.

The 2016 Ferris, Finkel and Fraser Review was asked to identify opportunities to improve the effectiveness and integrity of the R&D Tax Incentive, including by sharpening its focus on encouraging additional R&D spending. The review was completed in April 2016 (Ferris, Finkel and Fraser 2016).

The Review found that R&D activities were a key driving force of productivity and economic growth. The R&D Tax Incentive was part of a mix of innovation policies that sought to improve the quality and quantity of R&D investments in Australia, and accounted for around one-third of government support for innovation.

However, the Review found that the R&D Tax Incentive fell short of meeting its stated objectives of encouraging additional R&D (additionality) and producing spillovers and made six recommendations to be considered as a package of measures to improve the overall effectiveness and integrity of the programme while encouraging additional R&D:

1. retain the current definition of eligible activities and expenses under the law, but develop new guidance, including plain English summaries, case studies and public rulings, to give greater clarity to the scope of eligible activities and expenses
2. introduce a collaboration premium of up to 20 per cent for the non-refundable tax offset to provide additional support for the collaborative element of R&D expenditures undertaken with publicly-funded research organisations. The premium would also apply to the cost of employing new STEM PhD or equivalent graduates in their first three years of employment. If an R&D intensity threshold is introduced (see Recommendation 4), companies falling below the threshold should still be able to access both elements of the collaboration premium
3. introduce a cap in the order of \$2 million on the annual cash refund payable under the R&D Tax Incentive, with remaining offsets to be treated as a non-refundable tax offset carried forward for use against future taxable income
4. introduce an intensity threshold in the order of 1 to 2 per cent for recipients of the non-refundable component of the R&D Tax Incentive, such that only R&D expenditure in excess of the threshold attracts a benefit
5. if an R&D intensity threshold is introduced, increase the expenditure threshold to \$200 million so that large R&D-intensive companies retain an incentive to increase R&D in Australia

-
6. that the Government investigate options for improving the administration of the R&D Tax Incentive (such as adopting a single application process; developing a single programme database; reviewing the two-agency delivery model; and streamlining compliance review and findings processes) and additional resourcing that may be required to implement such enhancements. To improve transparency, the Government should also publish the names of companies claiming the R&D Tax Incentive and the amounts of R&D expenditure claimed.

The review found that the areas of improvement identified would be likely to generate greater benefit for the Australian economy. In particular, although collaboration was not a focus for the programme, the panel suggested the modest existing levels of collaboration between industry and research institutions represented a lost opportunity and that providing a higher tax offset could encourage greater levels of collaboration.

6 Some key policy issues

Australia is assessed as having good innovation infrastructure, public-sector organisations and human capital by international standards. Despite these strengths, Australia does not perform as well in terms of commercialising its ideas and innovations and in terms of diffusion as other countries. Recent government initiatives are placing greater emphasis on targeting the so called ‘valley of death’ where conceptual ideas need to be turned into working prototypes in order to demonstrate that they work, and the costs of scaling up production assessed, including the costs of the equipment and processes needed for manufacture. Developing a business case that can convince potential investors that the risks are manageable and the prospects for an above-market return are good is an essential step in successful commercialisation, and one often neglected by Australian want to be start-ups.

The lack of private sector innovation in Australia is likely to reflect the confluence of many factors. Possible explanations include that Australia:

- has been able to develop a relatively good standard of living through primary production (agriculture and mining) without the significant innovation (although in these sectors investment in R&D is acknowledged to be relatively high)
- has a relatively small domestic market
- lacks proximity to many larger markets (and incurs higher transport costs)
- has relatively small venture capital markets compared to other countries.

Identifying the actual underlying causes and the appropriate policy remedies requires analysis. An issue worthy of further investigation, is how other countries with a better track record at innovation, R&D and commercialisation (such as Israel and Singapore) have managed to overcome similar issues. More work is also needed to better understand the challenges for entrepreneurs in developing a viable business case for their product.

Notwithstanding the need for more work in this area, some higher-level policy-relevant observations can be made.

Need for programme consolidation

A recent review of the Australian economy by the OECD (2017) recommended consolidating the 150 Commonwealth programmes. Many of these schemes are small in terms of the funds involved — with 74 collectively accounting for under two per cent of Australian Government expenditure of just under \$10 billion in 2015-16 (with an average expenditure of \$2.6 million). While trials are to be applauded, they are not a valid test if they fail simply due to insufficient scale.

Need for rigorous programme evaluations

Beyond investing in basic research and skills, the jury is out on whether there are specific government policies that can successfully promote innovation and whether this would be material to Australian economic growth. The Commission has previously argued that the government should conduct rigorous evaluations of all government innovation programmes to verify that they are achieving ‘additionality’ and are cost effective (PC 2007).

The Australian National Audit Office is currently undertaking a performance audit to assess the effectiveness of the design process and monitoring arrangements for the National Innovation and Science Agenda. The audit is scheduled for completion in September 2017.

Such evaluations should not just cover the probity of the processes followed and the expenditure involved but also whether the programmes are meeting their intended objectives in the most efficient and cost-effective manner. Having a longitudinal business data set (BLADE) should provide greater scope for more rigorous evaluations than could be undertaken in the past.

Need to target innovation activity that would not otherwise occur

The rationale for much innovation policy is to target R&D that would not otherwise occur.

As outlined above, the Ferris, Finkel and Fraser Review (2016) found that the R&D Tax Incentive fell short of meeting its stated objectives of encouraging additional R&D (additionality) and producing spillovers.

These observations apply not just to the R&D Tax Incentive but to innovation and R&D policy more widely. Targeting such activity that would otherwise occur delivers no additional benefits for taxpayer funds or the wider community.

Other OECD recommendations

In its recent assessment of the performance of the Australian economy, the OECD made some recommendations aimed at boosting the outcomes from R&D:

- put a greater weight, as envisaged, on collaboration in university funding
- develop a more coordinated approach to industry placements for research students to strengthen the linkages between research and business sectors
- assess research outcomes and impacts in the same way across public-sector research organisations
- develop a more integrated, ‘whole-of-government’ approach to science, research and innovation and consolidate innovation support programmes
- make the R&D Tax Incentive more effective (OECD 2017).

A Research institutions

Table A.1 Australian Government research agencies, 2015-16
\$ million; Estimated actual

<i>Agency</i>	<i>Abbreviation</i>	<i>Budgetary outlay</i>
Antarctic Division		93.9
Australian Astronomical Observatory	AAO	11.9
Australian Centre for International Agricultural Research	ACIAR	94.1
Australian Institute of Aboriginal and Torres Strait Islander Studies	AIATSIS	0.8
Australian Institute of Criminology Research Program		3.0
Australian Institute of Marine Science	AIMS	40.5
Australian National Maritime Museum	ANMM	0.2
Australian Nuclear Science & Technology Organisation	ANSTO	192.6
Bureau of Meteorology Research Activities	BoM	24.3
Commonwealth Scientific and Industrial Research Organisation	CSIRO	750.2
Defence Science and Technology	DST Group	464.3
Geoscience Australia		121.3
Great Barrier Reef Marine Park Authority	GBRMPA	1.0
National Measurement Institute	NMI	7.5
National Acoustic Laboratories	NAL	4.3
Supervising Scientist		14.0
Total		1 835.9

Source: DIIS (2016).

Table A.2 Research block grants by higher education provider, 2016

\$ million; Estimated actual

<i>Higher education provider</i>	<i>Budgetary outlay</i>
Australian Catholic University	6.9
Batchelor Institute of Indigenous Tertiary Education	0.4
Bond University	3.8
Central Queensland University	6.0
Charles Darwin University	14.6
Charles Sturt University	9.7
Curtin University of Technology	41.3
Deakin University	29.1
Edith Cowan University	11.5
Federation University Australia	4.0
Griffith University	38.1
James Cook University	25.8
La Trobe University	29.4
Macquarie University	39.5
MCD University of Divinity	1.5
Monash University	155.1
Murdoch University	18.6
Queensland University of Technology	50.2
Royal Melbourne Institute of Technology	34.1
Southern Cross University	7.9
Swinburne University of Technology	18.4
The Australian National University	105.2
The Flinders University of South Australia	27.7
The University of Adelaide	87.3
The University of Melbourne	185.0
The University of Notre Dame Australia	1.5
The University of Queensland	176.6
The University of Sydney	180.9
The University of Western Australia	91.3
Torrens University Australia	49.5
University of Canberra	9.3
University of New England	15.8
University of New South Wales	164.0
University of Newcastle	41.3
University of South Australia	34.7
University of Southern Queensland	8.3
University of Tasmania	43.2
University of Technology, Sydney	27.0
University of the Sunshine Coast	4.8
University of Western Sydney	18.2
University of Wollongong	36.1
Victoria University	11.4
Total	1 814.4

Source: DIIS (2016).

Table A.3 Rural Research and Development Corporations, 2015-16

\$ million; Estimated actual

<i>Ownership</i>	<i>Cooperative Research Centre</i>	<i>State^a</i>	<i>Budgetary outlay</i>
Government owned	Cotton Research and Development Corporation	NSW	b
	Fisheries Research and Development Corporation	ACT	19.2
	Grains Research and Development Corporation	ACT	68.2
	Grape & Wine Research & Development Corporation	SA	b
	Rural Industries Research and Development Corporation	NSW	12.4
Industry-owned	Australian Egg Corporation Limited	NSW	1.8
	Australian Livestock Export Corporation Limited	NSW	c
	Australian Meat Processor Corporation	NSW	c
	Australian Pork Limited	ACT	c
	Australian Wool Innovation Limited	NSW	12.5
	Dairy Australia Limited	VIC	23.6
	Forest and Wood Products Australia Limited	VIC	4.3
	Horticulture Innovation Australia Limited	NSW	43.8
	Meat & Livestock Australia	NSW	60.4
Sugar Research Australia Limited	QLD	b	
Total			269.0

^a State of headquarters. ^b Not reported separately, but forms part of the collective total of \$22.8 million.

^c Not reported

Sources: Department of Agriculture and Water Resources (2016); DIIS (2016).

Table A.4 Cooperative Research Centres funded in the 2015-16 budget

<i>Sector</i>	<i>Cooperative Research Centre</i>	<i>State</i>	<i>Grant years</i>	<i>Committed funding^a</i>
Agriculture	CRC for High Integrity Australian Pork (Pork CRC)	SA	8	19.86
	CRC for Sheep Industry Innovation (Sheep CRC)	NSW	5	15.50
	Dairy Futures CRC	Vic	6	27.72
	Invasive Animals CRC	ACT	5	19.70
	Poultry CRC	NSW	7	27.000
	Plant Biosecurity CRC	ACT	6	29.65
Environmental services	Antarctic Climate and Ecosystems CRC	Tas	5	25.00
	Bushfire and Natural Hazards CRC	Vic	8	47.00
	CRC for Contamination Assessment and Remediation of the Environment (CARE CRC)	SA	9	29.10
	CRC for Low Carbon Living	NSW	7	28.00
	CRC for Water Sensitive Cities	Vic	10	30.00
	Space Environment Research Centre	ACT	5	19.84
Manufacturing	CRC for Cell Therapy Manufacturing	SA	6	20.00
	CRC for Polymers	Vic	5	14.50
	Excellerate Australia (Automotive Australia CRC)	Vic	5	26.00
	Rail Manufacturing CRC	Vic	6	31.00
Medical services	Cancer Therapeutics CRC	Vic	6	34.01
	CRC for Living with Autism	Qld	10	31.00
	CRC for Alertness Safety and Productivity	Vic	7	14.48
	CRC for Mental Health	Vic	7	23.11
	CRC for Aboriginal and Torres Strait Islander Health	Vic	5	25.00
	HEARing CRC	Vic	5	28.00
	Oral Health CRC	Vic	8	30.25
	Wound Management Innovation CRC	Qld	8	27.93
Young and Well CRC	Vic	5	27.46	
Mining & energy	Deep Exploration Technologies CRC	SA	8	28.00
	Energy Pipelines CRC	NSW	10	17.48
Social & economic development	Capital Markets CRC	NSW	10	32.35
	CRC for Remote Economic Participation	NT	7	32.50
	CRC for Spatial Information	Vic	8	32.19
	Data to Decisions CRC	SA	5	25.00

^a Total funding committed (not funding in 2015-16).

Source: DIIS (2016).

Table A.5 NHMRC competitive grant recipients by institution, 2016

<i>Administering institution</i>	<i>State</i>	<i>Applications</i>	<i>Funded</i>	<i>Amount</i>
		No.	No.	\$m
ANZAC Research Institute	NSW	11	1	0.1
Australian Catholic University	NSW	23	1	0.1
Australian National University	ACT	106	25	19.7
Baker IDI Heart and Diabetes Institute	Vic	122	22	16.6
Bionic Ear Institute	Vic	11	3	1.9
Bond University	Qld	7	1	0.3
Cancer Council Victoria	Vic	8	3	1.6
Centenary Institute of Cancer Medicine and Cell Biology	NSW	33	5	3.5
Central Queensland University	Qld	8	1	0.3
Centre for Eye Research Australia Ltd	Vic	25	4	1.7
Curtin University of Technology	WA	72	5	3.9
Deakin University	Vic	85	9	6.6
Edith Cowan University	WA	17	3	2.9
Federation University Australia	WA	5	1	0.4
Flinders University	SA	95	8	5.0
Florey Institute of Neuroscience and Mental Health	Vic	101	18	27.5
Garvan Institute of Medical Research	NSW	78	16	13.4
Griffith University	Qld	89	5	4.2
James Cook University	Qld	33	5	3.4
La Trobe University	Vic	77	15	7.0
Macfarlane Burnet Institute for Medical Research and Public Health	Vic	34	13	14.6
Macquarie University	NSW	67	12	6.8
Melbourne Health	Vic	16	1	0.1
Menzies School of Health Research	NT	33	8	10.2
Metro South Hospital and Health Service	Qld	3	2	0.8
Monash University	Vic	622	111	86.7
Murdoch Childrens Research Institute	Vic	158	41	23.9
Murdoch University	WA	10	1	1.3
Queensland Institute of Medical Research	Qld	121	23	45.5
Queensland University of Technology	Qld	107	11	5.9
RMIT University	Vic	30	3	2.4
South Australian Health and Medical Research Institute (SAHMRI)	SA	33	7	4.0
St Vincent's Institute of Medical Research	Vic	45	12	9.0
Swinburne University of Technology	Vic	11	2	0.7
The George Institute for International Health	NSW	7	3	0.2
University of Adelaide	SA	257	27	17.8
University of Melbourne	Vic	581	124	103.9
University of New South Wales	NSW	426	86	59.5
University of Newcastle	NSW	164	28	18.4
University of Notre Dame	WA	7	1	0.2

(Continued next page)

Table A.5 (continued)

<i>Administering institution</i>	<i>State</i>	<i>Applications</i>	<i>Funded</i>	<i>Amount</i>
University of Queensland	Qld	445	83	51.2
University of South Australia	SA	108	22	13.8
University of Sydney	NSW	557	107	116.2
University of Tasmania	Tas	60	7	5.0
University of Technology Sydney	NSW	33	2	0.2
University of Western Australia	WA	253	48	35.9
University of Western Sydney	NSW	41	2	2.6
University of Wollongong	NSW	49	5	2.9
Victor Chang Cardiac Research Institute	NSW	20	4	3.6
Walter and Eliza Hall Institute	Vic	159	39	24.9
Total		5 519^a	986	788.4

^a Total includes 56 applications from institutions that did not receive funding in 2016: Asbestos Diseases Research Institute (5); Charles Sturt University (4); CSIRO (5); Ear Science Institute Australia (1); Institute for Breathing and Sleep (3); Southern Cross University (1); Sydney West Area Health Service (1); University of New England (5); University of Southern Queensland (1); University of the Sunshine Coast (11); Victoria University (15).

Source: NHMRC (2017).

B Innovation programmes

Table B.1 Australian Government innovation expenditure by programme and portfolio, 2015-16

\$ million; Estimated actual

<i>Programme / Activity</i>	<i>Portfolio</i>	<i>Budgetary outlay</i>
R&D Tax Incentives – Refundable	Industry, Innovation and Science	2 340
R&D Tax Incentives – Non Refundable	Industry, Innovation and Science	850
NHMRC Research Grants	Health	846
Australian Research Council (ARC) – National Competitive Grants Program	Education and Training	816
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Industry, Innovation and Science	750
Research Training Scheme	Education and Training	684
Defence Science and Technology Group (DST Group)	Defence	464
Joint Research Engagement Program	Education and Training	360
Australian Postgraduate Awards	Education and Training	282
Research Infrastructure Block Grants	Education and Training	242
Sustainable Research Excellence in Universities	Education and Training	239
Australian Nuclear Science & Technology Organisation (ANSTO)	Industry, Innovation and Science	193
National Institutes Program – ANU Component	Education and Training	192
Australian Renewable Energy Agency (ARENA)	Environment and Energy	169
National Collaborative Research Infrastructure Strategy	Education and Training	150
Cooperative Research Centres Programme	Industry, Innovation and Science	141
Automotive Transformation Scheme	Industry, Innovation and Science	132
Biomedical Translation Fund	Health	125
Geoscience Australia	Industry, Innovation and Science	121
Australian Centre for International Agricultural Research (ACIAR)	Foreign Affairs and Trade	94
Antarctic Division	Environment and Energy	94
Grains	Agriculture and Water Resources	68
Meat Research	Agriculture and Water Resources	60
Carbon Capture and Storage (CCS) Flagships	Industry, Innovation and Science	44
Horticulture Research	Agriculture and Water Resources	44
Innovation Investment Fund including Innovation Investment Follow-on Fund	Industry, Innovation and Science	43
Australian Institute of Marine Science (AIMS)	Industry, Innovation and Science	40
DFAT Aid Research and Development	Foreign Affairs and Trade	37

(Continued next page)

Table B.1 (continued)

<i>Programme / Activity</i>	<i>Portfolio</i>	<i>Budgetary outlay</i>
A Competitive Agriculture Sector – boosting farm profits through rural R&D	Agriculture and Water Resources	29
Entrepreneurs' Programme – Accelerating Commercialisation	Industry, Innovation and Science	27
Other Rural Research	Agriculture and Water Resources	25
Bureau of Meteorology Research Activities	Environment and Energy	24
Dairy Australia Limited	Agriculture and Water Resources	24
International Postgraduate Research Scholarship	Education and Training	22
National Environmental Science Programme	Environment and Energy	22
ICT Centre of Excellence	Industry, Innovation and Science	21
Fishing Industry Research	Agriculture and Water Resources	19
Office of Water Science	Environment and Energy	18
Supervising Scientist	Environment and Energy	14
Wool Research	Agriculture and Water Resources	13
Rural Industries R&D Corporation	Agriculture and Water Resources	12
Industry Growth Centres Initiative- Commercialisation Fund	Industry, Innovation and Science	12
Australian Astronomical Observatory (AAO)	Industry, Innovation and Science	12
Coal Mining Abatement Technology Support Package	Industry, Innovation and Science	11
Health Surveillance Fund – Research Centres	Health	10
Collaborative Research Networks Program	Education and Training	9
Household, Income and Labour Dynamics in Australia (HILDA) Survey	Social Services	9
Carbon Farming Futures – Filling the Research Gap	Agriculture and Water Resources	9
Longitudinal Survey of Australian Children (LSAC)	Social Services	8
Drug and Alcohol Research	Health	8
National Measurement Institute (NMI)	Industry, Innovation and Science	8
Commercialisation Australia	Industry, Innovation and Science	7
Support for Cancer Clinical Trials	Health	7
Square Kilometre Array Radio Telescope Project	Industry, Innovation and Science	7
Defence Future Capability Technology Centre Program	Defence	7
Australian Climate Change Science Programme (ACCSP)	Environment and Energy	6
National Landcare Programme Innovation Grants	Agriculture and Water Resources	5
Priority-driven Collaborative Cancer Research Scheme	Health	5
Higher Education Research Promotion	Education and Training	5
Three dedicated Prostate Cancer Research Centres (two centres funded from 2008-09 and a third from 2013-14)	Health	5
National Low Emissions Coal Initiative	Industry, Innovation and Science	4
National Acoustic Laboratories	Health	4

(Continued next page)

Table B.1 (continued)

<i>Programme / Activity</i>	<i>Portfolio</i>	<i>Budgetary outlay</i>
Forestry	Agriculture and Water Resources	4
Carbon Farming Futures – Action on the Ground	Agriculture and Water Resources	4
Payments to Austroads/ARRB Transport Research Ltd.	Infrastructure and Regional Development	4
Carbon Farming Futures – Extension and Outreach	Agriculture and Water Resources	4
Industry Growth centres Initiative - Project Fund	Industry, Innovation and Science	4
National Climate Change Adaptation Research Facility (NCCARF) – support	Environment and Energy	3
Great Barrier Reef Foundation – contribution	Environment and Energy	3
Competitive Pre-Seed Fund	Industry, Innovation and Science	3
Longitudinal Study of Indigenous Children (LSIC)	Social Services	3
Australian Institute of Criminology (AIC) Research Program	Attorney-General's	3
Entrepreneurs' Programme – Innovation Connections	Industry, Innovation and Science	3
Australia-India Strategic Research Fund	Industry, Innovation and Science	3
Establishment of an ICT-enabled Research Laboratory – Commonwealth Assistance	Industry, Innovation and Science	3
Australian Sports Commission (ASC) Research Programs – Intramural	Health	3
Australian War Memorial – Official Histories	Veterans' Affairs	3
ANROWS core funding	Social Services	2
Australian Biological Resources Study	Environment and Energy	2
Australian Longitudinal Study on Male Health	Health	2
Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) – Radiation in Health Care – Safe and Better Use	Health	2
Australian Sports Commission (ASC) Research Programs – Extramural	Health	2
Centres of Excellence – Biosecurity Risk Analysis and Research	Agriculture and Water Resources	2
Clean Technology Innovation Programme	Industry, Innovation and Science	2
Department of Veterans' Affairs Applied Research Program	Veterans' Affairs	2
Environmental Water Knowledge and Research	Environment and Energy	2
Global Connections Fund	Industry, Innovation and Science	2
International Whaling Commission Southern Ocean Research Partnership	Environment and Energy	2
National Disability Research and Development Agenda	Social Services	2
National Health Survey	Health	2
ANCAP-Vehicle Testing/Stars on Cars	Infrastructure and Regional Development	1
ARC Linkage Grant – Creating the conditions for collective impact: transforming the child serving system in disadvantaged communities.	Social Services	1

(Continued next page)

Table B.1 (continued)

<i>Programme / Activity</i>	<i>Portfolio</i>	<i>Budgetary outlay</i>
Australian Civil-Military Centre – Research and Lessons Learnt	Defence	1
Australia Consensus	Education and Training	1
Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS)	Education and Training	1
Australian Institute of Criminology (AIC) – Criminology Research Grant Program	Attorney-General's	1
Australian Institute of Criminology (AIC) – National Drug and Law Enforcement Research Program	Attorney-General's	1
Australian Longitudinal Study on Women's Health	Health	1
Australian National Preventive Health Agency Research Fund	Health	1
Building a New Life in Australia (BNLA) Longitudinal Study of Humanitarian Migrants (Australian Institute of Family Studies)	Social Services	1
Bush Blitz Strategic Taxonomy Grants Scheme	Environment and Energy	1
Cancer data to improve cancer care	Health	1
Commonwealth-ANU Strategic Relationship	Education and Training	1
Established Pest Animals and Weeds Initiative	Agriculture and Water Resources	1
Great Barrier Reef Marine Park Authority	Environment and Energy	1
Giving Australia	Social Services	1
Improving lung cancer outcomes	Health	1
Joint Force Integration – IMD Study	Defence	1
Maintaining support for women with gynaecological cancers	Health	1
Mechanical Fuel Load Reduction Trial	Agriculture and Water Resources	1
Natural Resource Management Planning for Climate Change	Environment and Energy	1
National Survey on Community Attitudes to Violence Against Women (VicHealth and then ANROWS from June 2016)	Social Services	1
National Centre for Immunisation Research and Surveillance	Health	1
Phoenix Australia – Centre for Posttraumatic Mental Health	Veterans' Affairs	1
Primary Health Care Research Evaluation and Development – Primary Health Care Research and Information Service	Health	1
Research under the National Framework for Protecting Australia's Children 2009–2020	Social Services	1
Veteran Health Research	Veterans' Affairs	1
R&D Refundable Tax Offset	Industry, Innovation and Science	-25
Total		10 124

Source: DIIS (2016).

References

- ARC (Australian Research Council) 2016, *Annual Report 2015-16*.
- Commonwealth of Australia 2015, *National Innovation and Science Agenda*, Department of the Prime Minister and Cabinet.
- Cooperative Research Centres Association 2016, *About the CRC Programme*.
- Cornell University, INSEAD and WIPO (Cornell University, Institut Européen d'Administration des Affaires and World Intellectual Property Organization) 2016, *The Global Innovation Index 2016: Winning with Global Innovation*.
- Department of Agriculture and Water Resources 2016, *Research and Development Corporations and Companies*, www.agriculture.gov.au/ag-farm-food/innovation/research_and_development_corporations_and_companies (accessed 19 January 2017).
- DIIS (Department of Industry Innovation and Science) 2015, *National Survey of Research Commercialisation, Data Summary 2012–2014*.
- 2016, *2016-17 Science, Research and Innovation Budget Tables*, 18 August.
- DoH (Department of Health) 2017, *List of Independent Medical Research Institutes*.
- Ferris, B., Finkel, A. and Fraser, J. 2016, *Review of the R&D Tax Incentive*, 4 April, Department of Industry Innovation Science Research and Tertiary Education.
- IP Australia 2016, *Australian Intellectual Property Report 2016*.
- NHMRC (National Health and Medical Research Council) 2016, *Annual Report 2015–2016*, Annual Report, NH172.
- 2017, *Results of the 2016 NHMRC Grant Application Round*.
- OECD (Organisation for Economic Co-operation and Development) 2017, *OECD Economic Surveys: Australia*, March.
- PC (Productivity Commission) 2007, *Public Support for Science and Innovation*, Research Report.
- 2013, *Trade and Assistance Review 2011-12*, June.
- Schwab, K. 2015, *The Global Competitiveness Report 2015–2016*, World Economic Forum.
- 2016, *Intellectual Property Arrangements*, Inquiry Report, 23 September, Report no. 78.