

DEPARTMENT OF EDUCATION BOOSTING THE COMMERCIAL RETURNS FROM RESEARCH

Submission by the Australian Research Council

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Introduction

This submission

On 28 October 2014, the Australian Government released a discussion paper¹ seeking submissions on the policy and programme changes necessary to ensure Australia's research effort supports the translation of research into commercial outcomes. The discussion paper invited comments on:

- adjusting research funding mechanisms to provide greater incentives for collaboration between research and industry
- ensuring research infrastructure facilitates increased collaboration between researchers and industry
- providing industry and other end-users with better access to research
- ensuring that the research workforce is equipped to work with industry and bring their ideas to market
- improving assessment of the research system
- ensuring the new Medical Research Future Fund supports collaboration between researchers and industry and drives the uptake of Australian medical research.

The Australian Research Council (ARC) welcomes the opportunity to provide a submission responding to the discussion paper. The submission addresses the issues above and provides a brief overview of the ARC's role in supporting the translation of research into outcomes through the four factors identified in the discussion paper:

- research excellence
- targeted research effort
- cooperation between research and industry
- entrepreneurship.

The Australian Research Council

The ARC is an entity within the Australian Government. Its mission is to deliver policy and programs that advance Australian research and innovation globally and benefit the community. In seeking to achieve its mission, the ARC provides advice to the Government on research matters, manages the National Competitive Grants Program (NCGP), and administers Excellence in Research for Australia (ERA).

Through the NCGP—a significant component of Australia's investment in research and development—the ARC supports the highest-quality fundamental and applied research and research training through national competition across all disciplines². The NCGP comprises two Programs: the Discovery Program (which targets individual researchers and research teams); and the Linkage Program (which brokers partnerships between sectors). The overarching aim of all funding schemes of the NCGP is to deliver outcomes of benefit to Australia, including social, environmental, cultural and economic benefits.

ERA assesses research quality within Australia's higher education institutions and gives government, industry, business and the wider community assurance of the excellence of

¹ Boosting the commercial returns from research, Australian Government, 2014

² The ARC may fund health and medical research, either in concert with the National Health and Medical Research Council (NHMRC) or directly, to address specific Australian Government health and medical research priorities, however, the ARC does not normally fund health and medical research through its competitive funding schemes. More information is contained in the ARC Medical Research Policy (www.arc.gov.au > Information for Applicants > ARC Medical Research Policy)

research conducted. It also provides a national stocktake, by research discipline areas, of research strength against international benchmarks and makes a strong contribution to the innovation system by:

- providing a valuable information resource for universities, government and industry to make strategic investments that promote research and innovation
- showing that there is growing evidence that research quality underpins the wider benefits of research.

Section 1: Creating stronger incentives for research-industry collaboration

The Government will identify opportunities to adjust funding mechanisms to provide greater incentives for collaboration between researchers and industry. To achieve this outcome the Government is seeking input from the research and end-user community on opportunities to:

- modify rules for competitive research grants to appropriately recognise industry-relevant experience
- develop research block grant arrangements that retain a focus on quality and excellence while supporting greater industry and end-user engagement
- leverage greater collaboration between publicly funded research agencies and industry
- consolidate existing programmes that focus on collaboration with industry to increase their scale and effectiveness
- consider whether the R&D Tax Incentive sufficiently encourages collaboration between industry and researchers.

Opportunities to modify rules for competitive research grants to appropriately recognise industry-relevant experience

The ARC currently recognises industry-relevant experience through: specific objectives within relevant scheme funding rules; selection criteria; and a range of other mechanisms (including assessment processes and eligibility conditions).

Objectives

The *Linkage Projects* scheme is designed to foster collaborative research between university researchers and partner investigators. Both researchers and partner investigators are understood to have industry experience and to have developed the research problem together. The scheme is designed to recognise and reward long-term and sustainable experience of industry collaboration. The funding rules facilitate this aim by including, amongst others, the following objectives:

- support the initiation and/or development of long-term strategic research alliances between higher education organisations and other organisations, including industry and end-users, in order to apply advanced knowledge to problems and/or to provide opportunities to obtain national economic, social or cultural benefits;
- provide opportunities for researchers to pursue internationally competitive research in collaboration with organisations outside the higher education sector, targeting those who have demonstrated a clear commitment to high-quality research

Selection criteria

Scheme selection criteria are an important instrument to ensure industry-relevant experience is recognised. ARC scheme selection criteria include:

- Research Opportunity and Performance Evidence (ROPE) under all funding schemes of the NCGP
- specific criterion under the Linkage Program funding schemes aimed at developing partnerships with end-user organisations.

Research Opportunity and Performance Evidence

ROPE is one element of the selection criteria aimed at assessing the excellence of the investigators involved in a proposal. It aims to ensure that the assessment processes accurately evaluate an investigator's career history relative to their current career stage, and considers whether their productivity and contribution is commensurate with the opportunities that have been available to them. ROPE provides a framework within which the quality and benefit of achievements is given more weight than the quantity or rate of particular achievements. Specifically:

- Research Opportunity is designed to provide assessors with an accurate appreciation of career history against a timeline of years since graduation from highest educational qualification. It allows assessors to recognise research opportunities and experience in the context of employment situations including those outside academia.
- Performance Evidence is designed to provide assessors with information that will enable them to contextualise research outputs relative to the opportunity of a participant. Both research output assessment and contextualising within disciplinary expectations of research impact are required. In addition to standard academic publications, research outputs can include grey literature, consultancy reports or reviews, patents and policy advice, competitive grants and other research support, higher degree student completions, major exhibitions, compositions or performances, plant breeding rights, registered designs, invited keynote and speaker addresses and other professional activities and contributions to the research field.

To support the implementation of ROPE, the ARC released a statement in 2013 to provide clarification for both applicants and assessors around the ARC's expectations with regard to this criterion. The instructions to applicants for all funding schemes also provide detailed supporting information (see extract from *Linkage Projects* scheme instructions in **Box 1**).

In addition to the ROPE components, other relevant elements of the 'Investigator' criteria include:

- under the Industrial Transformation Research Hubs and Training Centres schemes: experience in management of collaborative industrial and end-user focussed research
- under the *Linkage Projects* scheme: the potential to engage in collaborative research with end-users.

Specific criterion

As noted above, the *Linkage Projects* scheme is designed to foster collaborative research between university researchers and partner organisations. The selection criteria used to assess proposals under the scheme explicitly include criterion about collaboration, including:

- potential of the investigators to engage in collaborative research with end-users
- benefits of the project to partner organisation(s) and other relevant end-users
- potential links with organisations outside the Australian publicly-funded research and higher education sectors
- evidence that each of the partner organisation(s) is genuinely committed to, and prepared to collaborate in, the research project
- extent the project will encourage and develop strategic research alliances between the higher education organisation(s) and other organisation(s).

Under the *Linkage Projects* scheme, proposals are assessed in terms of both track records and the strength of the collaboration, as shown not just through investment but through the commitment of in-kind contributions of expertise and experience.

Other mechanisms that recognise industry relevant-experience

Assessment processes

Proposals for funding submitted to the ARC are considered by members of the ARC College of Experts or Selection Advisory Committees. Committee members are experts of international standing drawn from the Australian research community including from higher education, industry and public sector research organisations.

Under the Industrial Transformation Research Program, emphasis is placed on engaging a proportion of committee members directly from industry with expertise covering the priority areas being supported in a particular selection round.

Eligibility

Eligibility conditions under the ARC funding schemes allow for the involvement in research projects of Partner Investigators (that is, investigators who are not Chief Investigators).

Partner Investigators are expected to:

- take significant intellectual responsibility for the planning and conduct of the project and for any strategic decisions called for in its pursuit and the communication of results
- have the experience and capacity to provide effective supervision, support and mentoring of research personnel associated with the project in their areas of expertise, and/or
- have the relevant skills and experience to effectively manage a similar scale research Project.

Under the Industrial Transformation Research Program, the involvement of Partner Investigators is mandated:

- Industrial Transformation Research Hubs: a proposal must include at least one Australian Partner Organisation and at least one affiliated Partner Investigator
- Industrial Transformation Training Centres: a proposal must include at least one Australian Partner Organisation and at least one affiliated Partner Investigator.

Box 1: Extract-Linkage Projects Instructions to Applicants for funding commencing in 2015

G6 Research Opportunity and Performance Evidence (ROPE) - Details on your career and opportunities for research over the last 10 years (This question must be answered)

Write a maximum of 5250 characters (approximately 750 words). Please detail your career and opportunities over the last 10 years. Provide and explain:

- (i) The number of years it has been since you graduated with your highest educational qualification;
- (ii) The research opportunities that you have had in the context of your employment situation (e.g. Early Career Researcher), the research component of your employment conditions, and any unemployment or part-time employment you may have had;
- (iii) If you are university based, indicate as appropriate the percentage of your current role in research-only, teaching and research, teaching-only, teaching and administration, research and administration, administration-only academic, researcher in business, program or project manager or other business role, giving any additional information (e.g. part-time status) needed to understand your situation. Give an indication of what percentage of time you have spent over the last ten years in those roles; or
If you are *industry based*, indicate as appropriate the percentage of your current role in industry, research and administration, researcher in business, program or project manager or other business role, giving any additional information (e.g. part-time status) needed to understand your situation. Give an indication of what percentage of time you have spent over the last ten years in those roles;
- (iv) Any career interruptions you have had for childbirth, carer's responsibility, misadventure, or debilitating illness;
- (v) The research mentoring and research facilities available to you; and
- (vi) Any other aspects of your career or opportunities for research that are relevant to assessment and that have not been detailed elsewhere in this Proposal (e.g. any circumstances that may have slowed down your research and publications or affected the time you have had to conduct and publish from research).

G7 Research Opportunity and Performance Evidence (ROPE) - Recent significant publications and ARC grants (since 2004) (This question must be answered)

G8 Research Opportunity and Performance Evidence (ROPE) - Ten career-best publications

G9 Research Opportunity and Performance Evidence (ROPE) - Further evidence in relation to research impact and contributions to the field over the last 10 years most relevant to this Proposal
Definition of Research Impact:

Research impact is the demonstrable contribution that research makes to the economy, society, culture, national security, public policy or services, health, the environment, or quality of life, beyond academia. Please detail further evidence in relation to research impact and contributions to the field over the last 10 years. In this section provide:

- *Research outputs other than academic publications. Examples may include patents, IP licences, other research support income, relevant consultancies, policy advice, and other professional activities.*
- *Describe your Research Impact relative to opportunity and in the context of discipline/end user benefits. Outline significant achievements and outcomes that have contributed to a tangible impact for end users.*

Opportunities to develop research block grant arrangements that retain a focus on quality and excellence while supporting greater industry and end-user engagement

It is important to recognise that with the Australian Government operating a dual support system for funding of research and research training there is an interdependent and important relationship between the competitive funding delivered by the Australian Research Council (ARC) and the Research Block Grants (RBG).

The system consists of competitive programs, where funding is distributed through merit-based, peer-determined processes; and block grants, which are allocated independently of funding for specific research projects, programs, or fellowships. As part of this system, competitive funding schemes delivered by the ARC only include support for the direct costs of research, so institutions in receipt of research funding from the ARC are heavily reliant on RBG funding to meet the indirect costs of research (i.e. overhead costs that benefit and support research, but do not directly address the approved research objectives of a grant).

Any modifications to current arrangements, particularly in relation to RBGs that are designed to support the indirect costs of research will have an effect on Australian universities' capacity to effectively undertake ARC-funded research and deliver on Australian Government expectations.

Two of the RBG schemes in particular, Research Infrastructure Block Grants (RIBG) and Sustainable Research Excellence (SRE), are designed to assist eligible higher education institutions to meet the indirect costs incurred when carrying out research projects supported by the ARC and other national competitive research granting programs. Without these schemes, the underpinning fabric and capacity of universities to undertake both basic and applied world-leading research in Australia would be compromised.

A significant proportion of ARC-funded research is already directed towards supporting research for end-user and industry needs. With over \$300 million provided annually through the ARC Linkage Program schemes (listed on the Australian Competitive Grants Register as Category One income), a substantial amount of block grant funding, including through RIBG and SRE, is already being awarded to universities on the basis of undertaking and supporting research designed in many instances to translate into commercial outcomes. More information about the ARC Linkage Program is provided under the next opportunity.

Of the RBG schemes, the Joint Research Engagement (JRE) scheme may be the most appropriate scheme to modify to ensure it supports greater industry and end-user engagement. Importantly, from an ARC perspective, JRE funding is not dependent on Category One income in deciding the allocation of its block funding, so any changes to the input factors for this scheme should not affect universities' ability to support the indirect costs of ARC-funded research.

Opportunities to leverage greater collaboration between publicly funded research agencies and industry

Omissions from the schemes highlighted in the discussion paper (page 12) are those of the ARC Linkage Program. The ARC's Linkage Program schemes aim to encourage and extend cooperative approaches to research and improve the use of research outcomes by strengthening links within Australia's innovation system and with innovation systems internationally. The Linkage Program promotes national and international research partnerships between researchers and business, industry, community organisations and other publicly funded research agencies. By supporting the development of partnerships, the ARC encourages the transfer of skills, knowledge and ideas as a basis for securing commercial and other benefits of research.

The Linkage Program was established in acknowledgement of the importance of applied research and supporting development of partnerships between researchers in universities and in end-user organisations including industry. Long-standing schemes of the Linkage Program include: *Linkage Projects*, *ARC Centres of Excellence*; *Linkage Infrastructure, Equipment and Facilities*, and *Special Research Initiatives*, while a more recent addition is the Industrial Transformation Research Program, comprising research hubs and training centres.

All Linkage Program schemes have the potential to support collaboration between publicly funded research agencies and industry:

- The *Linkage Projects* scheme, Industrial Transformation Research Program, and *ARC Centres of Excellence* scheme, provide a continuum of funding support for partnerships between researchers in universities and industry, from smaller research projects through to large research centres.
- The *Linkage Infrastructure, Equipment and Facilities* scheme provides support for collaborative infrastructure acquisition, both between universities, and between universities and other research organisations (including industry).
- The *Special Research Initiatives* scheme provides funding support for one-off research initiatives in areas of priority, with the extent of industry involvement dependent on the particular initiative. For example, one of the objectives of the Research in Bionic Vision Science and Technology Initiative was to 'provide for potential spin-off innovation, with commercial applications to be pursued through a robust commercialisation strategy'.

ARC funding schemes, particularly those in the Linkage Program, have been highly successful in engaging industry in university research. For example, the Industrial Transformation Research Program, which was established to '*encourage R&D projects that could help solve the big problems facing our industries today*'³, has been particularly successful in encouraging engagement with industry. While the scheme is a relatively new addition to the funding landscape, initial indications are that identification of priority areas has facilitated the engagement of industry organisations in those areas into which the research hubs and training centres have been awarded.

The following are considered by the ARC to be indicators of the performance of the Linkage Program in supporting industry engagement:

- the levels of participation by industry partner organisations, including the number of organisations and the total contributions (cash and in-kind) pledged by those organisations
- the proportion of 'repeat business' by industry partner organisations

³ ARC website, Industrial Transformation Research Program

- examples of the industry organisations involved (which include large companies as well as small- to medium-sized enterprises)
- the feedback received from industry organisations in final reports and relevant evaluations and reviews
- research outcomes and commercialisation outputs reported in final reports.

Examples of reporting against these indicators are provided in **Box 2**.

Box 2: Indicators of industry engagement under the ARC Linkage Program [to be completed]

Linkage Projects scheme

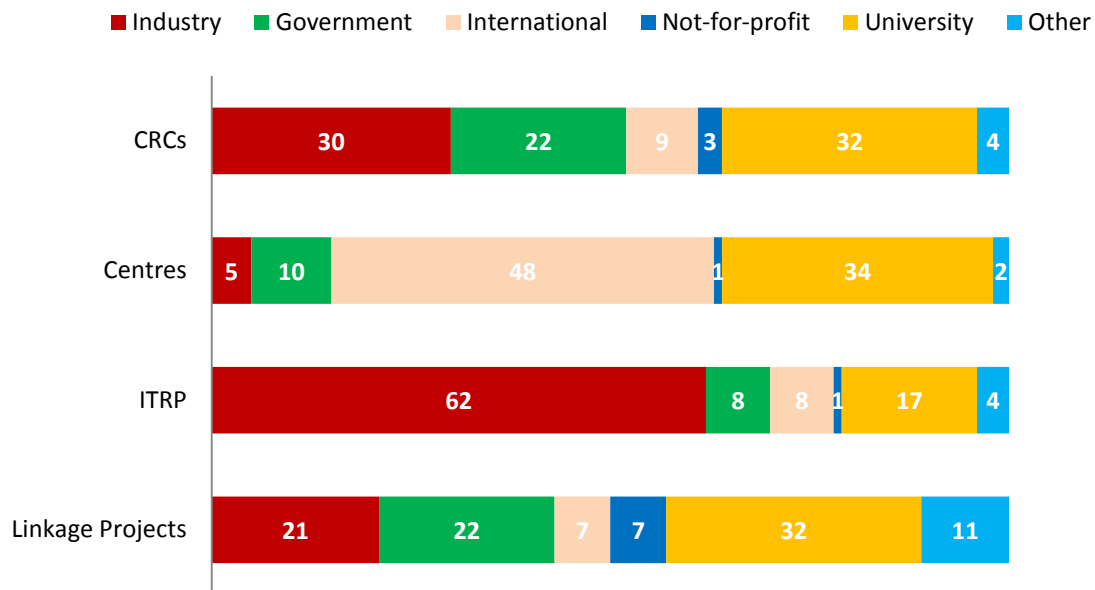
- The proportion of industry partner organisations participating on funding proposals averages 38 per cent across the years 2005 to 2014 (ranging from 35 per cent recorded in 2005 and 2010 to 43 per cent in 2013).
- The trend of total contributions (cash and in-kind) pledged by industry partner organisations was increasing until 2014 when the figure fell. The year 2014 was the second year where only one selection round of the *Linkage Projects* scheme was conducted. Industry partner organisations have, however, remained the single largest contributor to research projects funded under the scheme.
- A high number of industry partner organisations have participated on more than one grant under the Linkage Projects scheme.
- Industry partner organisations recorded as repeat participants in Linkage projects include BHP Billiton, Alcoa, Bluescope, RioTinto and CSL Limited.
- Ninety-six per cent of partner organisations that responded to the question, indicated that the research project had been beneficial or very beneficial to their organisation (final report data, Linkage projects awarded for funding commencing in the period 2002 to 2011).
- Eighty six per cent of partner organisations that responded to the question, indicated that they would be willing to participate in the scheme again (final report data, Linkage projects awarded for funding commencing in the period 2002 to 2011).
- In 2010, an independent evaluation of the *Linkage Projects* scheme concluded that the scheme was operating effectively in achieving its objectives; that there was overwhelming support for the scheme and its role in enabling interaction between sectors; and the benefits that flow as a result of the collaborative relationships were highly valued by stakeholders.
- Measuring the extent to which ARC-funded research has resulted in benefits (including commercial benefits) is a difficult undertaking. Final reports are received by the ARC within one year of a research project being completed and it is unlikely that any commercial outcomes will be realised within that timeframe. As outlined in Section 5, outcomes of research may not be realised for decades.

However, ARC final reports can provide information about initial research outcomes as well as the number of commercialisation outputs, including: invention disclosures, licences, patents, plant breeders rights and start-up companies. For example, Linkage projects, commencing between 2002 and 2010 (and for which final reports have been received), reported 183 invention disclosures, 74 licences executed, 265 patents filed and 87 start-up companies.

Industrial Transformation Research Program (ITRP)

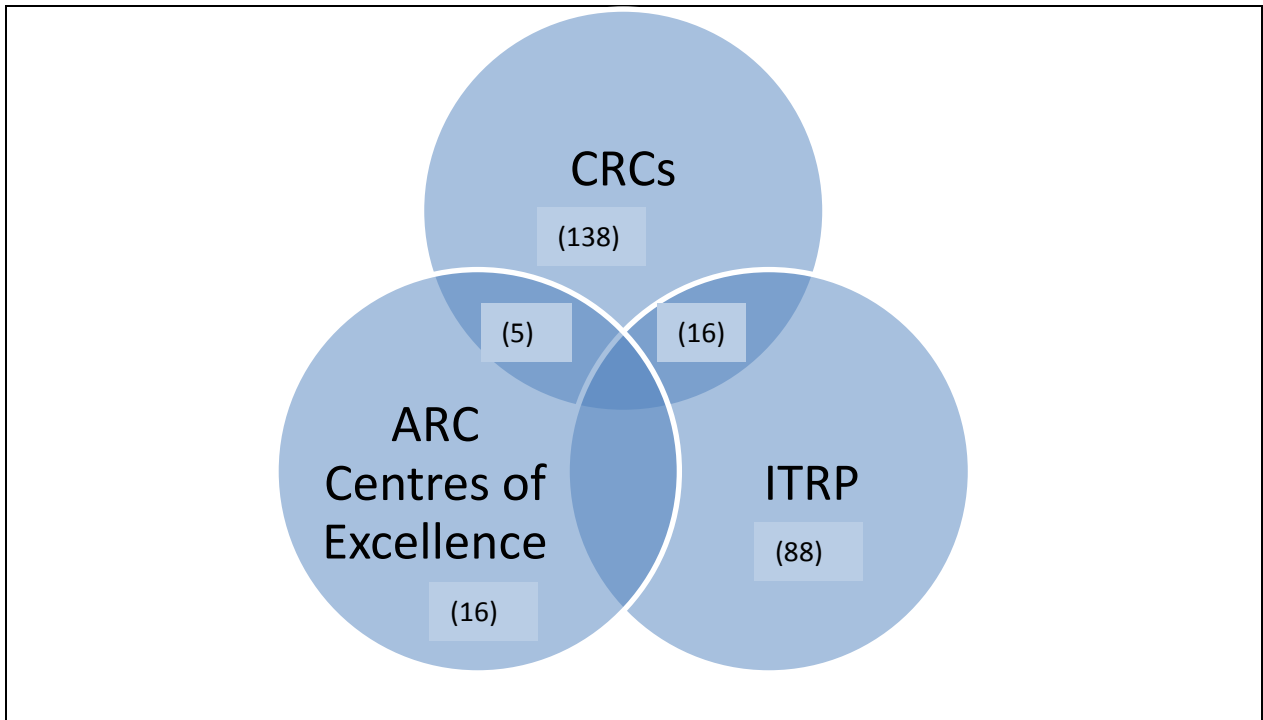
- Twenty five centres and hubs, awarded funding under the ITRP to date, have included a total of approximately 140 instances of involvement by administering and partner organisations with approximately 60 per cent of this total being partner organisations that have classified themselves as being a company or industry body (see Figure 1). The overlap of industry partners between schemes is illustrated in Figure 2.

Figure 1: Type of organisations participating in various Australian Government research grants



- (1) CRC Programme data: 'essential participants' of current CRCs as reported in the CRC Directory, July 2014-15
- (2) ARC Centres of Excellence data: Administering, collaborating and partner organisations of Centres as reported in proposals for funding commencing in 2011 and 2014
- (3) ITRP data: Administering and partner organisations involved in research hubs and training centres as reported in proposals for funding commencing 2012 to 2014
- (4) *Linkage Projects* scheme data: Administering and partner organisations involved in Linkage projects awarded for commencement in years 2010 to 2014 as reported in proposals for funding
- (5) 'International' category includes representation from all other types of organisation

Figure 2: Overlap of industry organisations



Networks established through the Linkage Program create opportunities for:

- Australian industries to have Australia’s best researchers investigate and apply cutting edge research to their problems
- universities and their researchers to interface with real world problems.

The interactions facilitated through the Linkage Program have the potential to contribute to the formation of extensive research and innovation networks as demonstrated by network mapping conducted recently by the ARC on the Linkage Projects and ITRP (see Figures 3 and 4 respectively). Networks are key enablers of interaction, both through direct linkages and indirect linkages facilitated through common participants. While the numbers of partner organisations is not a direct indicator, the maps indicated by Figures 3 and 4, are a powerful indicator that these networks, either exist or are developing as a result of the collaboration supported through Linkage Program funding.

Figure 3: Linkage Projects scheme linkages, 2011–14



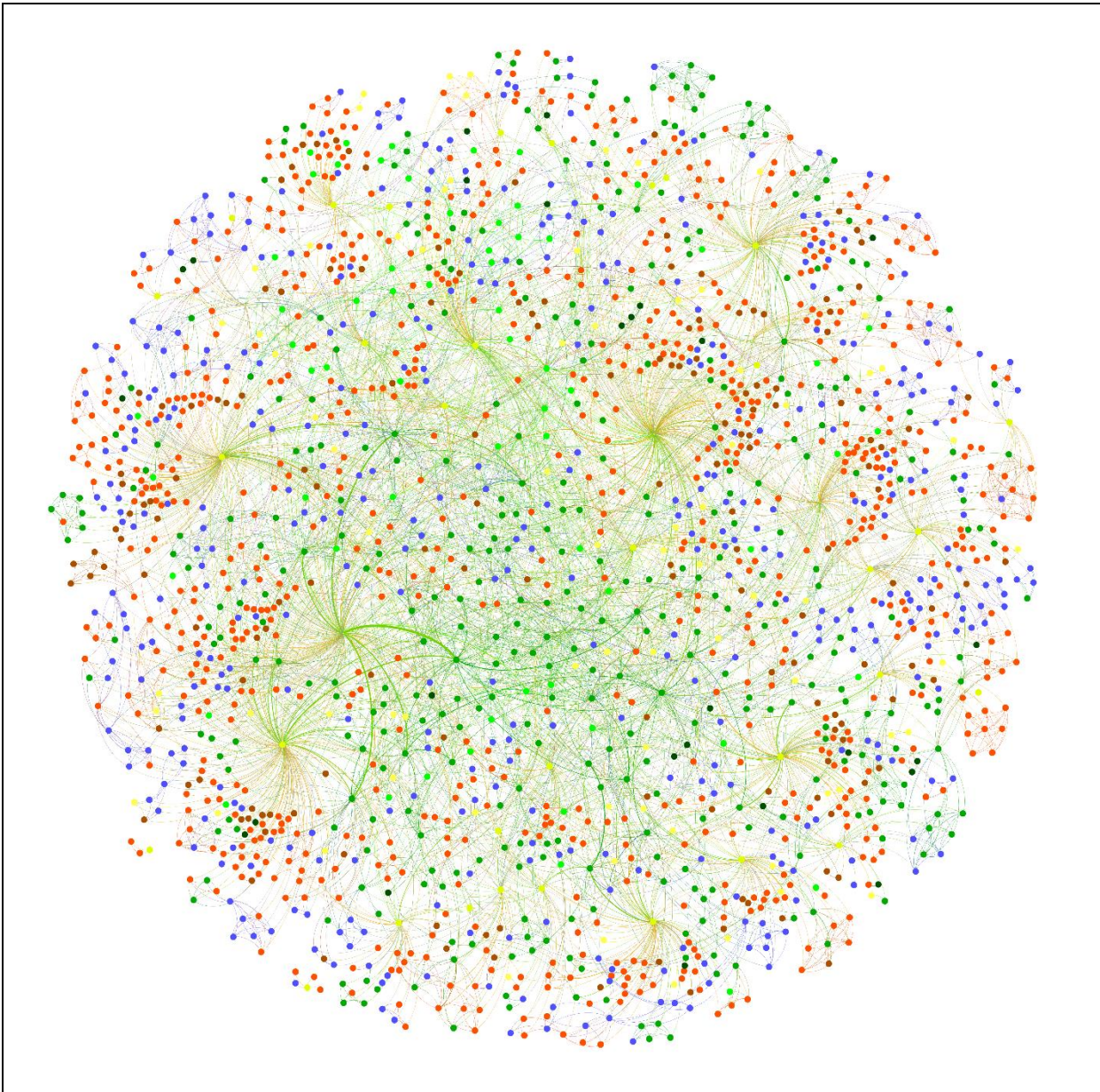
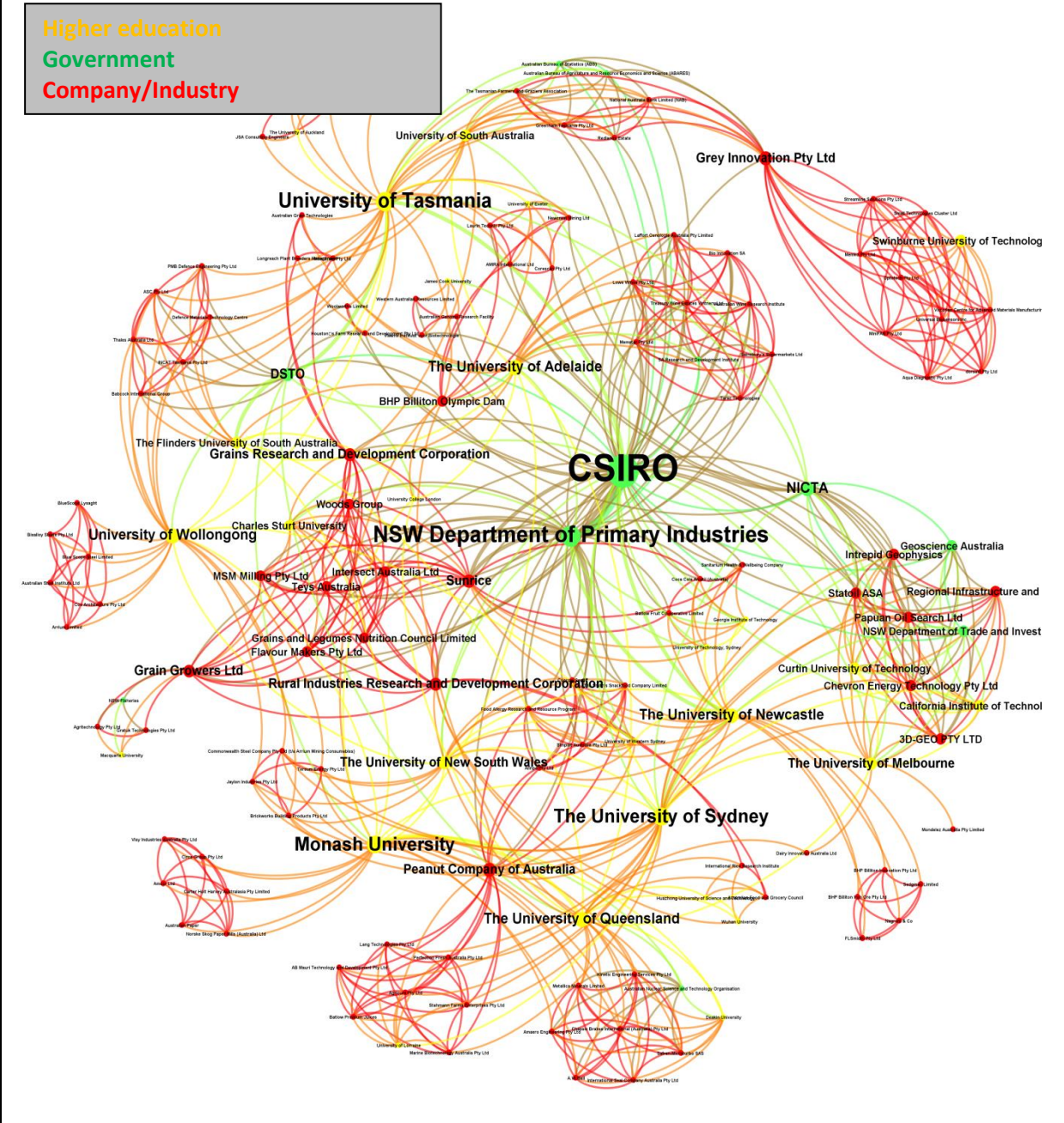


Figure 4: Industrial Transformation Research Program linkages 2012–14



Opportunities to consolidate existing programmes that focus on collaboration with industry to increase their scale and effectiveness

The aim of any changes to current arrangements should be to strengthen the matrix of Australian Government support for industry research by enabling industry to access funding support at a number of different clear entry points, depending on the scale of the research activity planned.

At the time the NCGP was established, the Government indicated that:

The Linkage element (of the NCGP) should create opportunities for complementarity and synergies with related programmes across other Commonwealth portfolios, including the Cooperative Research Centres (CRC) and R&D Start programmes, the Rural Research and Development Corporations and National Health and Medical Research Council development grants. It should also include scope to facilitate international linkages both with universities and industry⁴.

The ARC believes that it is critical that the principles of complementarity and synergy continue to underpin the structure of Australian Government support for industry research. Different sized organisations in different industry sectors have varying needs, expectations and capabilities and in this environment consolidating schemes to ‘increase scale and effectiveness’ will not necessarily deliver the best result for Australia. Rather it is important that Australia continues to provide a continuum of funding opportunities.

Australia does not have a large number of government funding schemes that provide competitive grants opportunities to support collaborative research projects between researchers in industry and those in other research organisations. The schemes that do exist, to a large extent, provide complementary modes of support. Key characteristics of this complementarity are indicated in Table 1 and include:

- discipline focus
- partnership focus
- scale of support
- governance arrangements.

Within Australia’s research funding landscape, the *Linkage Projects* scheme occupies a unique space supporting research across all disciplines. It complements small scale support also provided for:

- medical research by the National Health and Medical Research Council (NHMRC)
- rural research by Rural Research and Development Corporations
- various flagship priorities by the CSIRO.

The ITRP also occupies a unique space in the suite of available research support, providing funding for medium-scale partnerships between universities and industry.

The *ARC Centres of Excellence* scheme provides support for large-scale programs designed to feature both pure and applied research—some collaborating with industry on transformational research towards the applied research end of the spectrum, and others collaborating with universities and government organisations on innovative and frontier but more fundamental research, complementing the Cooperative Research Centres (CRC) programme.

⁴ Knowledge and Innovation, A policy statement on research and research training, 1999

The models of funding offered by both the *ARC Centres of Excellence* scheme and CRC Programme are critical to ongoing industrial growth and development in Australia. The needs of industry vary from sector to sector, so while new developments in some areas, for example, biotechnology, are generally intimately linked to advances in science, in other areas, for example, manufacturing, this is much less so. This suggests that the respective centres are each the appropriate model for some sectors but not others. Ideally, the nature of the research and research training conducted within the two types of centres should be quite different: the research conducted within CRCs being applied, relatively low risk and oriented towards incremental innovation and improvements in productivity; and the research conducted within ARC Centres of Excellence being longer term and higher risk.

Currently CRCs are either industry-driven or science-driven in their approach to research—a renewed focus on industry relevant research has the potential to contribute to enhancing Australian industry productivity and competitiveness as well as business investment in research and development.

The CRC Programme was originally established to ‘encourage greater research collaboration between higher education institutions and industry and to support high quality research which has the potential for economic and social benefit to Australia’⁵. There have been a number of iterations of program objectives since the commencement of the programme, most recently involving a reinstatement of public good (social and environmental benefits).

The ARC believes that refocusing the CRC Programme on its original industry objective would help to produce more immediate industrial benefits. However, it is important that any narrowing of the focus does not diminish the capacity of the Commonwealth to support, in a consistent way, a number of broader activities of clear national benefit.

⁵ *National Report on Australia’s Higher Education Sector*, Commonwealth of Australia, 1993 (page 261)

Table 1: Competitive funding schemes supporting industry partnerships

Scheme	Scale	Scheme focus	Targeted linkage	Discipline focus	Governance	Funding basis
ARC Linkage Projects	Small	Research and research training	University – Government, Not-for-profit, Industry	All disciplines	Universities	Coinvestment
ARC Industrial Transformation Research Program	Medium	Research and research training	University – industry (primarily); also other end-users	Industry priorities	Universities	Coinvestment
ARC Centres of Excellence	Large	Research and research training	University – Government, Not-for-profit, Industry	All disciplines	Universities	Coinvestment
Cooperative Research Centres	Large	Research, research training and commercialisation	University, Government, Not-for-profit, Industry	All disciplines	Legal entities	Coinvestment
NHMRC Development Grants	Small	Research at the early proof-of-principles or pre-seed stage	University – Health and medical research companies	Health and medical	Universities	Encouraged to source a funding partner, but not essential
Rural Research and Development Corporations (various)	Small	Research	University, Government, Not-for-profit, Industry	Rural	Any individual or organisation with ABN and international research providers	Various
CSIRO Flagship Collaboration Fund Projects	Small	Research	Publicly-funded research agencies (PFRAs) – industry	Flagship priorities	PFRAs both in Australia and overseas (including universities, CRCs, other Australian PFRAs and not-for-profit research institutions; must include university	Coinvestment
CSIRO Flagship Collaboration Fund Clusters	Medium	Research	Publicly-funded research agencies (PFRAs) – industry	Flagship priorities	PFRAs both in Australia and overseas (including universities, CRCs, other Australian PFRAs and not-for-profit research institutions; must include university	Coinvestment

Table 1: Competitive funding schemes supporting industry partnerships (con't)

Scheme	Scale	Scheme focus	Targeted linkage	Discipline focus	Governance	Funding basis
Entrepreneurship program (Accelerating commercialisation)	Small-Medium	Commercialisation	Businesses and research institutions	Novel intellectual property	Non tax-exempt; an individual, researcher, partnership or unincorporated trustee who agrees to form a non tax-exempt eligible corporation before signing a funding agreement; or a Commercialisation Office or Eligible Partner Entity.	Coinvestment
Industry Growth Centres	Large	Delivery of commercial outcomes (market, value chain or technology issues)	Industry – other research organisations, universities	Identified areas of competitive strength	Industry led; non-profit	Coinvestment

Section 2: Supporting research infrastructure

The Government will take steps to ensure that research infrastructure facilitates increased collaboration between researchers and industry. To achieve this outcome the Government is seeking to:

- strengthen the existing focus of the National Collaborative Research Infrastructure Strategy (NCRIS) on outreach to researchers and industry;
- undertake a reassessment of existing research infrastructure provision and requirements, in line with the recommendations of the National Commission of Audit; and
- develop a roadmap for long-term research infrastructure investment, in consultation with the research sector and industry.

Undertake a reassessment of existing research infrastructure provisions and requirements

Government support for research infrastructure is essential to ARC-funded research and to the research sector more broadly. Ongoing investment in research infrastructure is critical to strengthening Australia's position as a leader in research excellence. Varied commitments to long-term funding in this space have impacted the sector's ability to focus on and develop areas of national importance, providing an additional barrier to increasing competitiveness.

The ARC plays an important role in funding research infrastructure through its *Linkage Infrastructure, Equipment and Facilities* (LIEF) scheme. The LIEF scheme is a component of the ARC's Linkage Program, which is specifically designed to strengthen connections between universities, researchers and industry. The LIEF scheme has proven to be an effective scheme for collaboration, creating linkages both within the higher education sector and between academia and industry partners.

The LIEF scheme and its predecessor, Research Infrastructure – Equipment and Facilities (RIEF), have played a significant role for almost two decades in offering strong incentives to higher education and other organisations to collaborate in establishing and providing shared access, regionally and nationally, to small- to-medium scale research infrastructure. Funding is awarded through a competitive peer review process for one year, or in the case of coordinated access to major national/international research facilities or consortia, up to five years.

The LIEF scheme serves a complementary role to that of other Commonwealth infrastructure programs, such as Research Infrastructure Block Grants (RIBG), Sustainable Research Excellence (SRE), and the National Collaborative Research Infrastructure Strategy (NCRIS). RIBG and SRE objectives include meeting project-related infrastructure costs associated with Australian competitive grants; NCRIS provides and supports major research infrastructure via a strategic and collaborative approach; whereas the LIEF scheme funds the collaborative establishment, access to and use of small- to mid-scale research infrastructure.

The most recent round of the LIEF scheme (for funding commencing in 2014) demonstrates the benefits of collaboration between universities and industry, with contributions from collaborating organisations representing \$2.02 for every dollar funded by the ARC. Proposals approved for funding contained an average of 4.2 collaborating organisations, with

the largest intended collaboration comprising 18 organisations. Most collaborating organisations recorded under the LIEF scheme are from the university sector.

The ARC is supportive of Government steps to ensure that research infrastructure facilitates increased collaboration between researchers and industry, however wishes to emphasise that current sector requirements extend beyond what is supported through NCRIS, and these should be considered as part of any review. At present, a funding void exists between infrastructure funding provided by the LIEF scheme and that which is supported by the NCRIS. This gap largely represents medium-scale infrastructure in the \$2 to \$10 million space. Should the Government decide to allocate additional funding to medium-scale research infrastructure, the ARC would be well placed to administer funding, either through the expansion of the LIEF scheme, or the establishment of a separate funding scheme.

Section 3: Providing better access to research

The Government will put in place arrangements to provide industry and other end-users with better access to research. To achieve this outcome the Government is seeking to:

- strengthen intellectual property (IP) guidelines for researchers;
- examine the potential to link research funding to the dissemination of IP;
- establish an online point of access to commercially-relevant research for business; and
- develop a whole-of-government policy to open up access for business and the community to publicly funded research.

These proposals will be supported by the release of an IP toolkit which will provide guidance to simplify discussions relating to IP between researchers and industry.

Examine the potential to link research funding to the dissemination of IP

The ARC recognises the importance of maximising the benefits arising from research activity and emphasises the importance of effective management of intellectual property (IP) in its scheme funding rules and funding agreements.

As a funding body, rather than a body which conducts research, the ARC position on IP arising from ARC-supported research is that ownership and management of IP is the responsibility of the organisation which administers the ARC grant (in some cases in conjunction with other collaborating organisations).

Under funding agreements between Administering Organisations and the ARC, organisations must adhere to an IP policy which has as one of its aims the maximisation of benefits arising from research. Unless otherwise approved by the ARC, the policy must comply with the *National Principles of Intellectual Property Management for Publicly Funded Research* (reference). Those principles require that organisations and researchers are aware of IP issues and have policies and practices in place to effectively manage and exploit IP.

Where the ARC funds research collaborations between researchers in the higher-education sector and other organisations in the public or private sectors (typically under the ARC Linkage Program), the ARC also requires up-front agreement between the parties involved regarding the IP arrangements that apply to the outcomes or results generated by the project. Again, unless otherwise approved by the ARC, the arrangements must comply with the *National Principles of Intellectual Property Management for Publicly Funded Research*.

In 2010, the ARC commissioned an evaluation of the *Linkage Projects* scheme. The findings of that evaluation identified, on the basis of feedback from stakeholders, that contractual and intellectual property requirements was an area that could be improved. It was suggested that it may be useful to provide case studies or good practice guidelines. This would be a complex undertaking for the ARC given the differences in organisational culture and values and that many organisations have existing policies already in place. However, the Government's planned release of an IP toolkit could help address the issues identified in the evaluation of the *Linkage Projects* scheme.

Establish access to commercially-relevant research for business

Excellence in Research for Australia

ERA has the capacity to provide information for research users (including industry) to identify opportunities for developing university research for economic or societal benefit. Each round of ERA includes a comprehensive data set that covers university research output across a six-year period. It also includes collections of a number of other measures for universities including research income and esteem measures.

The ERA ratings are provided at a fine-grained level that develops a detailed map of where Australian university strengths lie across many disciplines and sub-disciplines (ratings are provided at the two-digit and four-digit Australian and New Zealand Standard Research Classification (ANZSRC) Fields of Research (FoR) classifications for each university). These results are published in the ERA national reports, which are made available on the ARC website following each ERA round, and provide valuable information for research users to identify opportunities for collaboration with universities.

Develop a whole-of-government policy to open up access to publicly funded research

In recent years, a global trend towards greater access to the outputs of publicly funded research has emerged. International developments, as well as those occurring within Australia led by the ARC and NHMRC, have placed open access firmly on the agenda of research funding agencies. It is now widely recognised that greater access to publicly funded research outputs provides a solid foundation for increasing return on investment.

The ARC is committed to maximising the benefits of ARC-funded research, by encouraging and facilitating greater access to research outcomes through schemes under the NCGP. The ARC expects NCGP research outputs to be disseminated as broadly as possible to allow access by other researchers and the wider community, including industry. The ARC Open Access Policy, effective since 1 January 2013, requires that any publications arising from an ARC supported research project be deposited into an open access institutional repository within a 12 month period from the date of publication.

The ARC is also taking steps to encourage cultural change within the research community in regard to the sharing and access of data arising from publicly funded research. In line with responsibilities outlined in the Australian Code for Responsible Conduct of Research (2007) and international best practice, the ARC has, from 2007, encouraged researchers to deposit data arising from research projects in publicly accessible repositories.

In February 2014, the ARC introduced new data management requirements applicable to schemes under the Discovery Program, requiring researchers to outline how they plan to manage research data generated through ARC-funded research as part of the application process for funding. The requirements are now also applicable to the *Linkage Projects*, *Industrial Transformation Research Hubs* and *Industrial Transformation Training Centres* schemes.

While not mandating open access to research data, the ARC encourages researchers to consider the ways in which they can best manage, store, disseminate and re-use data in a way that is consistent with disciplinary best practice.

Any work in relation to developing a whole-of-government policy to open up access for business and the community to publicly funded research should recognise the existing frameworks already in place through the two largest public funders of research in Australia—the ARC and the NHMRC.

Section 4: Increasing industry-relevant research training

The Government will take steps to ensure that the research workforce is equipped to work with industry and bring their ideas to market. To achieve this outcome the Government is looking to provide greater opportunities for industry relevant research training, provision of industry and business relevant skills, and recognition of PhD candidates with existing industry experience. These issues will be a focus of a review of research training arrangements which will be informed by consultation with the research sector and industry.

Provide greater opportunities for industry relevant research training

The ARC welcomes the proposal to conduct a review of research training arrangements within Australia. There are a range of broader issues that could be addressed in such a review, reflecting worldwide reforms of PhD training and requirements.

ARC support

Support for research training is a primary objective under both the Discovery and Linkage Programs of the NCGP:

- Discovery Program Objective: Build Australia's research capacity through support for research training and career opportunities for the best Australian and international researchers.
- Linkage Program Objective: Build Australia's research and innovation capacity through support for research training and career opportunities that enable Australian and international researchers and research students to work with industry and other end-users.

Within the Linkage Program, a number of individual funding schemes also contain targeted scheme objectives and goals relevant to research training:

- encourage growth of a national pool of world-class researchers to meet the needs of the broader Australian innovation system [*Linkage Projects* scheme]
- foster opportunities for Higher Degree by Research (HDR) candidates and postdoctoral fellows to pursue industrial training and to enhance competitive research in collaboration between universities and organisations outside the Australian higher education sector [*Industrial Transformation Training Centres* scheme]
- provide high-quality postgraduate and postdoctoral training environments for the next generation of researchers [*ARC Centres of Excellence* scheme].

Stipends for Higher Degree by Research candidates are supported as a budget item under most Linkage Program schemes, including *Linkage Projects*. Under the *Industry Transformation Training Centres* scheme, there is provision to provide funding for at least ten postgraduate research students with:

- stipends funded for up to three and half years
- each candidacy involving a mandatory one-year placement within a partner organisation outside the higher education sector during the life of the project
- a requirement for the use of competitive national and international recruitment processes to attract the highest quality candidates.

In its 2013–14 annual report, the ARC reported that 1.6 Higher Degree by Research (HDR) students had been involved (either funded or supported) in each Linkage project that was awarded funding commencing in 2009⁶.

Selection reports for the *Industrial Transformation Training Centres* scheme show that, under the eleven centres funded since the scheme was introduced in 2013, it has engaged more than 100 PhD students and over 30 early career researchers with industry-relevant research training targeted to achieving real world benefits .

In evaluations of the *Linkage Projects* scheme, a range of research training benefits have been identified by both industry and academics including:

- academic researchers understanding the issues faced by industry and informing students through teaching and supervision
- realisation of the benefits of collaboration and understanding of the strengths of each partner
- industry gaining a better understanding of academic research and upgrading their skills
- attracting PhD students to projects particularly in areas of industry interest
- training and skill development particularly in broader and industry based fields
- creation of recruitment and employment opportunities.

It should be noted that industry relevant research training is a very complex area. Previous iterations of the *Linkage Projects* scheme included separate components for postgraduate students (Australian Postgraduates Awards Industry (APAI)) and postdoctoral fellows (Australian Postdoctoral Fellows Industry (APDI)), as well as for Linkage Industry Fellowships (which enabled temporary transfers for researchers between organisations involved in the Linkage project).

APAI were very successful components of the *Linkage Projects* scheme, with over 3000 stipends awarded between 2002 and 2010. The primary reason for its removal as an identified component of the scheme was to provide additional flexibility for both administering organisations and the ARC in the administration of these awards.

APDIs and Linkage Industry Fellowships were much smaller components of the scheme, with approximately 330 APDIs awarded over the period 2002 to 2012 and 17 Linkage Industry Fellowships awarded over the period 2003 to 2012. In the evaluation of the *Linkage Projects* scheme, respondents cited various reasons why eligible applicants did not seek Linkage Industry Fellowships. These included: concerns about career interruption (including interruption to research programs); the perception that the fellowships may not be significant for obtaining employment or achieving promotion; difficulty accommodating other work responsibilities (including teaching and supervision); and differentials in salary between academic positions and positions in industry.

Assessment of proposals under the *ARC Centres of Excellence* scheme includes the potential:

- contribution of the Centre to research training at the Honours, postgraduate and postdoctoral level

⁶ Research personnel data; final reports submitted to the ARC as at 30 June 2014

- value of education programs in professional and technical training and outreach programs in engagement
- links with Australian researchers in universities, other research organisations and strategic agencies working in, and applying the outcomes of, the proposed research
- of the Centre to develop and enhance international linkages that will benefit the research, training and knowledge transfer programs.

Centres of Excellence are effectively creating collaborative, high quality training environments engaging with national and international organisations across the research sector. In 2013 annual reports submitted to the ARC by centres awarded funding commencing in 2011, for example, the 13 centres reported:

- involvement of an average of 26 collaborating institutions per centre
- graduation of approximately 100 PhD and 40 Masters students
- enrolment of over 600 PhD and 60 Masters students
- involvement of over 350 early career researchers
- the conduct of approximately 200 training programs and teaching packages.

International developments

Overseas funding agencies are providing funding as part of PhD programs to support generic skills training. For example, Research Councils UK supports 'Vitae' an organisation providing researchers, including HDR students, with professional and career development information. UK Research Council students attend Vitae events including personal development, team-working and business methods and are required to complete a minimum quota of generic skills training each year in addition to receiving funding for generalised training.

The National Science Foundation (US) has introduced the Research Traineeship Program. Its goal is to develop models for STEM graduate training that ensure that graduate students develop the skills, knowledge, and competencies needed to pursue a range of research and research-related careers within and outside academe.

The Linkage Program and Discovery Program scheme funding rules currently preclude using ARC funding to support costs not directly related to research or a project, including professional development courses. Support has been expressed for the ARC to allow funding under NCGP schemes to support generic skills training for both research training and for early career researchers.

Section 5: Measurement of outcomes

The Government will work with the research sector and industry to improve assessment of the research system, including improved metrics on engagement and knowledge transfer with industry, as well as research outcomes and impact.

Assessment of the Australian research system

ERA

Excellence in Research for Australia (ERA) collects a wide variety of indicators for evaluating research quality and research application and esteem measures. The research outputs (such as books, journal articles, conference papers and other non-traditional research outputs) submitted for ERA provide a comprehensive collection of Australian university research across a six year reference period. Committees of experts use this information to determine ERA ratings for the unit of evaluation (UoE, i.e. the discipline area within a university).

ERA is well established as Australia’s system for evaluating university research quality. However, the ARC continues to work with a wide range of stakeholders on refining the methodology as well as exploring the evaluation and assessment of different aspects of the research system in an appropriate and cost effective manner.

The ERA rating scale is from 1 to 5 as follows:

Rating	Descriptor
5	The Unit of Evaluation profile is characterised by evidence of outstanding performance well above world standard presented by the suite of indicators used for evaluation.
4	The Unit of Evaluation profile is characterised by evidence of performance above world standard presented by the suite of indicators used for evaluation.
3	The Unit of Evaluation profile is characterised by evidence of average performance at world standard presented by the suite of indicators used for evaluation.
2	The Unit of Evaluation profile is characterised by evidence of performance below world standard presented by the suite of indicators used for evaluation.
1	The Unit of Evaluation profile is characterised by evidence of performance well below world standard presented by the suite of indicators used for evaluation.
NA	Not assessed due to low volume. The number of research outputs does not meet the volume threshold standard for evaluation in ERA.

National reports listing the ratings for discipline areas at each of Australia’s 41 universities as well as extensive summary data were published in 2010 and 2012 following the evaluation process.

Possible Measures of Research Outcomes

There are two broad approaches to measure research outcomes:

- case study approaches which aim to identify and explain the broad social, economic and industry based impacts of research projects
- metric based approaches, which focus on more limited and quantifiable measures of knowledge transfer and engagement.

National Evaluation of Research Impact and Outcomes Through Case Studies

Unlike the measurement of research quality, the policy mechanisms for measuring and evaluating the impact and outcomes research is less developed. There are a number of challenges for evaluating the research impact (including a comprehensive use of case studies) on a national level including the difficulties associated with:

- long time-lags between research and the associated impacts
- the attribution of given outcomes to specific research projects
- external factors and external actors (such as businesses) outside of the control of researchers and the research sector.

The OECD, for example, has summarised the difficulties for measuring the ‘transfer and impact’ of university research as follows:

A general trend in the last few decades has been an increasing focus on measuring commercialisation and potential use of research outcomes and [higher education institution’s] intellectual property. Such focus tends, however, to neglect the need to assess less tangible but equally important impacts. In this sense four main problems have been pointed out ... First, the effects of research often emerge long after the research has been completed. Second, a given innovation may draw upon many research projects and a given research project may affect many innovations. Third, because the beneficiaries of research may not be the people or organisations that perform the research, it may not be obvious where to look for effects. And fourth, in a given project portfolio, the distribution of impacts is typically highly skewed, as a small number of “blockbuster” projects may account for most effects, while others only advance knowledge in a general way (OECD, 2011⁷).

The Productivity Commission raised concerns in 2007 about the use of case studies to evaluate research impact. In particular, the report noted that selected case studies, even if done well, may not be appropriate indicators of the benefits of public support for a research program because:

If measurement focuses on those projects with the highest returns it gives a misleading picture of program impacts. Most [research] programs could be expected to have a share of ‘failures’ or low/negative return projects ex post (Productivity Commission, 2007, p. 326⁸).

The issues of time-lags and the attribution of underlying research are significant. For example, the time-lag can be in the order of decades and beyond the life of a researcher, project or organisation. It has been estimated that the average time for translating research in the biomedical and health sciences into societal benefit is 17 years (Slote Morris, et al., 2011⁹). The historical contexts of research and research impact can be very different and

⁷ OECD, 2001. Actor Brief: Higher Education Institutes (HEIs). sl.:OECD

⁸ Productivity Commission, 2007. Public Support for Science and Innovation, Canberra

⁹ Slote Morris, Z., Wooding, S. & Grant, J., 2011. The answer is 17 years, what is the question: understanding time lags in translational research. *Journal of the Royal Society of Medicine*, 104(12), pp. 510-520

raise questions about whether it is appropriate for rewards of research to be given to organisations or researchers that conducted research in preceding decades (Morgan Jones, et al., 2013, p. 5¹⁰).

In addition, the challenge of attributing a particular outcome to underlying research is difficult and affected by a number of issues. For example, the Productivity Commission noted that: *achieved outcomes depend not only on the effects of immediate public support [of research], but also on such influences as the existing 'stock' of relevant R&D (domestic and/or foreign), the competitive environment, and institutional and regulatory factors...*

Indeed, some forms of outcomes may not be apparent to external observers, being internalised within the individuals, firms or institutions receiving public support. This does not mean that such outcomes are not valuable — they can form the building blocks to future gains for particular groups or for the community generally — but just that they cannot be reliably measured or estimated.

Given this attribution difficulty, there can be incentives for recipients of funding to ascribe changed outcomes almost 'automatically' to the support program, thus falling for what is described by the OECD as the 'project fallacy'... However, this leads to inaccurate and misleading performance measurement and assessment (Productivity Commission, 2007, p. 323).¹¹

Similarly, there are many external factors outside of universities that may determine the impacts and outcomes of research. As one United Kingdom based report conclude, this has significant policy implications for evaluating the research impact:

... in attempting to assess the impact of publicly funded research, one needs to bear in mind that the exploitation of publicly funded research often depends on private sector capacities and investments, factors outside the control of the publicly funded researchers. Consequently, the task is less about assessing the impact of publicly funded research per se, and more about understanding and managing connections between public and private sector in a system of knowledge production and innovation (Hughes & Martin, 2012¹²).

These challenges for measuring research impact and outcomes, and the consequences for policy-making, create a significant barrier to implementing a measure, at least in the short term. The international practice for measuring research impact is immature and therefore there is limited evidence about the advantages and/or perverse and unintended outcomes that may result from this kind of assessment. The REF 2014 in the UK is due to report results in December 2014. The REF impact measure is attached to significant funding, and will provide some guidance that may be drawn upon in the future.

Measuring Knowledge Transfer

While the measurements of the broader social and economic impacts of research provide significant challenges, more easily identifiable financial and commercial measures may be collected and presented as useable and understandable metrics. Examples such as research commercialisation, patenting, registered designs and plant breeders' rights are already collected as part of ERA. Other government data collections, including the Department of Industry's *National Survey of Research Commercialisation*, collect metrics on

¹⁰ Morgan Jones, M. et al., 2013. *Assessing Research Impact: An international review of the Excellence in Innovation for Australia Trial*, Cambridge: RAND Corporation.

¹¹ For the relevant reference to the OECD see p. 323 of the Productivity Commission report.

¹² Hughes, A. & Martin, B.R., 2012. *Enhancing Impact: The Value of Public Sector R&D*, s.l.: Council for Industry and Higher Education and UK-Innovation Research Centre.

intellectual property licencing values, start-up companies and contract research and consultancy activity. Such existing measures present a clear starting point for measuring knowledge transfer and there may be significant value by more effectively using this data alongside the ERA data of research quality.

However, care must be taken to ensure that the development and implementation of such research measures drives meaningful collaboration and research outcomes by avoiding the simplistic proxies of knowledge transfer, which if used inappropriately can drive perverse behaviours in the sector. As a recent report that analysed the benefits of research in the United Kingdom noted:

Over-emphasis by policy-makers on the more readily measurable or more immediate forms of impact (e.g. patents) may be counterproductive to research impact in the long term (Hughes & Martin, 2012, p. xii¹³).

Furthermore, the same report notes a survey of UK-US firms which looked at the value that businesses report from different types of collaboration:

The UK-US survey in addition asked the responding firms to indicate the types of university-industry interactions contributing to their innovation activities. In both countries, informal contacts were the most important contribution, followed by recruitment at first degree or Masters level, publications and conferences. This is consistent with the results for the UK emerging from the study by Bruneel et al. (2009). Some differences between the countries do emerge, especially in terms of the relatively more intensive use of, and value placed upon, internships in the US compared to the UK. It is important to note that patenting and licencing appear low down the list of business perceptions with regard to university interactions contributing to innovation. The UK-US survey also probed specifically into mechanisms for the acquisition of new technology involving universities rather than innovation-related activities more generally. Once again, in both countries publications and informal contacts were top of the list, whilst licencing was low down in terms of frequency and the value placed upon it (Hughes & Martin, 2012, p. 37¹⁴).

If a suite of appropriate knowledge transfer measures is developed it is likely to shape the behaviour in the university sector in a positive way. In this regard, lessons may be learnt from the approach taken to develop the ERA evaluation methodology, which includes a wide variety of indicators that are sensitive to different disciplines while at the same time are broadly comparable and verifiable across disciplines.

Other activities

The ARC's support of high quality research across all disciplines through the NCGP has provided important and long lasting benefits for Australia and its innovation system. Its policies towards international collaboration, open access, open data and support for researchers across all career stages, are ensuring that ARC supported research continues to provide the widest possible benefits to Australia and facilitate the development of this research by industry, government and other stakeholders in the innovation system.

However, there is an increasing focus on showcasing or measuring the societal benefits from research, and a need for better coordination in reporting and promoting the impact of these research outcomes.

¹³ Hughes, A. & Martin, B.R., 2012. Enhancing Impact: The Value of Public Sector R&D, s.l.: Council for Industry and Higher Education and UK-Innovation Research Centre.

¹⁴ *ibid*

In this regard, the ARC has taken an active role in collaborating with other Publicly Funded Research Agencies (PFRAs) to develop a common understanding of approaches, terminology and reporting of research impact.¹⁵ Since August 2012, the working group has met a number of times and focussed its attention on issues including:

- understanding current arrangements for planning, monitoring and evaluating research impact within the above mentioned agencies
- demonstrating to key stakeholders (government, industry and community) the return on investment from Australian research activities (both retrospective and prospective)
- establishing a common understanding of the latest developments, nationally and internationally in research impact assessment
- establishing a set of overarching principles and a common understanding of language that underpins the measurement of research impact, and achieves a common use of terminology
- identifying possible common data requirements that can be used to verify research impact outcomes
- considering new data as measures of impact
- identifying cost effective and efficient methodologies for reporting
- Sharing experiences in communication strategies to promote research impact to key stakeholders.¹⁶

As a result, the working group has developed Impact Measurement Principles and Operational Principles for implementing and reporting research impact (these are provided on the ARC website at the address in footnote 17). More recently the working group has focussed on developing a common understanding of the framework of research performance measurement as illustrated by the example provided below.

Inputs	Activities	Outputs	Outcomes	Benefits
Research income	Research work and training	Publications	Commercial products, licences, revenue. Companies – spin offs, start-ups, joint ventures. Job creation	Economic, health, social, cultural, environmental, national security, quality of life, public policy or services

¹⁵ The agencies involved in the working group are: Australian Institute of Aboriginal and Torres Strait Islanders Studies, Australian Institute of Marine Science, Australian Nuclear Science and Technology Organisation, Australian Research Council, Commonwealth Scientific and Industrial Research Organisation, Defence Science and Technology Organisation, National Health and Medical Research Council and National Measurement Institute.

¹⁶ See www.arc.gov.au > General Information > Research Impact

Section 6: Capitalising on the Medical Research Future Fund

The Government will ensure that the new Medical Research Future Fund supports collaboration between researchers and industry and drives the uptake of Australian medical research.

Ensure that the new Medical Research Future Fund supports collaboration between researchers and industry

The ARC plays a role in the funding of health and medical research in Australia. Since 2011, more than \$287 million of ARC funding has been committed to health and medical research projects. This represents around nine per cent of all ARC funding approved by Government over this period. In most cases, these are early stage projects—in the areas such as bioengineering, applied behavioural research, and the natural sciences—where an understanding of fundamental scientific processes is required to establish whether future health or medical applications are feasible.

The ARC also funds health and medical research, either in concert with the NHMRC or directly, to address specific Australian Government priorities. For example, the Government has recently prioritised ARC funding towards boosting Dementia research (\$26 million over three years from 2014–15), the Australian Institute of Tropical Health and Medicine at James Cook University (\$42 million over four years from 2014–15), and research to help find a cure for Type 1 Juvenile Diabetes (\$35 million over five years from 2013–14).

The ARC's support for health and medical research in Australia needs to be recognised in future disbursements of earnings from the Medical Research Future Fund. Without this, an imbalance between support for basic and applied health and medical research is likely to emerge over time. Consideration should also be given to the breadth of research fields supported as discoveries made in many non-medical areas ultimately lead to improved health outcomes for Australians.

The role of the Australian Research Council in translating research into outcomes

Background

The discussion paper, *Boosting the commercial returns from research*, reports that countries that successfully translate their research into commercial outcomes tend to exhibit the following four factors in their research and innovation systems:

- research excellence
- targeted research effort
- cooperation between research and industry
- entrepreneurship.

Success factors

Research excellence

National Competitive Grants Program

- Funding under the National Competitive Grants Program (NCGP) is awarded via a competitive process underpinned by rigorous peer review assessment to support the highest-quality researchers and research projects across all disciplines¹⁷. Research excellence and the ability to deliver research outcomes are key features of the ARC selection processes.
- Proposals submitted to the ARC are considered by members of the ARC College of Experts or Selection Advisory Committees. Committee members are experts of international standing drawn from the Australian research community: from higher education, industry and public sector research organisations. Informed by detailed assessments undertaken by Australian and international peer reviewers, these committees are responsible for advising the Chief Executive Officer of the ARC who in turn makes funding recommendations to the Minister.

Excellence in Research for Australia

- Through ERA, the ARC evaluates research quality within Australia's higher education institutions and gives government, industry, business and the wider community assurance of the excellence of research conducted. It also provides a national stocktake, by research discipline areas, of research strength against international benchmarks.
- ERA outcomes locate specific areas of research strength, identify opportunities to develop research capacity and allow for comparisons of research efforts over time. These features make ERA data an ideal tool for aligning research strengths with university, industry, regional and national priorities to maximise the benefits of public investment in research.

¹⁷ The ARC may fund health and medical research, either in concert with the National Health and Medical Research Council (NHMRC) or directly, to address specific Australian Government health and medical research priorities, however, the ARC does not normally fund health and medical research through its competitive funding schemes. More information is contained in the *ARC Medical Research Policy* (www.arc.gov.au > Information for Applicants > ARC Medical Research Policy).

Targeted research effort

National Competitive Grants Program

- Under the NCGP, as part of addressing the Significance and Innovation selection criterion, researchers are asked, if relevant, to address how their proposed research project will address the Australian Government's Strategic Research Priorities (previously National Research Priorities).
- The Industrial Transformation Research Program funds centres and hubs in agreed innovation transformation priority areas. Priority areas identified to date include: manufacturing; food and agriculture; oil and gas, including petroleum; mining and mining services; and medical devices and biotechnology.
- The ARC also periodically establishes targeted funding initiatives under the *Special Research Initiatives* scheme. In the past the ARC has conducted selection rounds for initiatives involving research into bionic vision, the science of learning, policing and security and stem cell science.

Cooperation between research and industry

National Competitive Grants Program

- The ARC seeks to encourage and extend cooperative approaches to research by strengthening links within Australia's innovation system and with innovation systems internationally.
- Cooperation between research and industry is pursued through both the Discovery and Linkage elements of the ARC's NCGP. Both the *Discovery Projects* and *Linkage Projects* schemes, for example, are designed to facilitate collaboration within investigator-initiated research, providing support for researchers to establish partnerships with partner investigators (in both *Discovery Projects* and *Linkage Projects* schemes) and partner organisations (in the case of *Linkage Projects* scheme).
- Details of the various mechanisms employed under the NCGP are provided in **Attachment A.1**.

Excellence in Research for Australia

- ERA outcomes locate specific areas of research strength, potentially informing industry decisions about possible research partnerships.

Entrepreneurship

National Competitive Grants Program

- All funding schemes include Innovation as part of the selection criteria.
 - Under the *Discovery Projects* scheme, for example, researchers are asked to address the questions: are the project aims and concepts original and innovative, representing the leading edge of research in the field? Will new methods, technologies, theories or ideas be developed? How does the research program enhance innovation in Australia?
 - The *Industrial Transformation Training Centres*, *Industrial Transformation Research Hubs* and *Linkage Projects* schemes specifically state that they do not support projects where one or more of the Partner Organisations is seeking expert

external assistance not available within their own organisation in order to develop specific applications or outcomes which involve little innovation or low risk.

Mechanisms employed under the NCGP to support cooperation between research and industry

Overview

Through the NCGP the ARC provides incentives for Australia's most talented researchers to work in partnership with leading researchers throughout the national innovation system and internationally, and to form alliances with Australian industry. The incentives are delivered through both the Discovery and Linkage Programs of the NCGP and include:

- use of selection criteria that support participation by researchers with diverse career histories, the development of strong partnerships between different research sectors, and the conduct of innovative research
- use of eligibility criteria that enable the involvement of researchers from various sectors as partner investigators in ARC-funded research projects
- use of funding models that require organisations eligible to administer ARC funding to partner with organisations from other sectors, including industry, government and non-profit. The partner organisations are required to make cash and/or in-kind contributions to the conduct of the research.

Discovery Program

The Discovery Program supports the growth of Australia's research and innovation capacity, which generates new knowledge resulting in the development of new technologies, products and ideas, the creation of jobs, economic growth and an enhanced quality of life in Australia.

The Discovery Program aims to deliver outcomes of benefit to Australia and build Australia's research capacity through support for: a. excellent, internationally competitive research by individuals and teams; b. research training and career opportunities for the best Australian and international researchers; c. international collaboration, and d. research in priority areas.

Two Discovery Program funding schemes—Future Fellowships and Australian Laureate Fellowships—refer specifically to the involvement of industry and other end-user organisations. While the *Discovery Projects* scheme does not refer specifically to industry involvement, it does fund excellent research by individual researchers and teams of researchers; and a proportion of this innovative research involves analysis of industry and business practices across a range of industries such as mining, manufacturing, finance and nanotechnology.

Future Fellowships

Aim

The *Future Fellowships* scheme is aimed at supporting the highest-quality mid-career researchers. The objectives of the *Future Fellowships* scheme are to:

- attract and retain outstanding mid-career researchers
- build collaboration across industry and/or research organisations and/or disciplines
- support research in national priorities that will result in economic, environmental, social, health and/or cultural benefits for Australia
- strengthen Australia's research capacity by supporting innovative, internationally competitive research.

Relevant mechanisms

Under the *Future Fellowships* scheme selection criteria, candidates are invited to indicate how they intend to build collaboration across industry and/or research organisations and/or with other disciplines.

A candidate may also propose to undertake research at an organisation other than the administering organisation while holding a Future Fellowship—this organisation must be listed as a host organisation within the proposal. Host organisations are collaborating organisations that are not eligible organisations (e.g. industry). The funding rules state that the fellow may conduct research at the host organisation(s), provided that it is in the best interests of the research and its outcomes, and is of national benefit to Australia, for a period or periods of up to twelve (12) months in total, over the life of the Future Fellowship.

Australian Laureate Fellowships

Aim

The *Australian Laureate Fellowships* scheme is aimed at:

- attracting and retaining outstanding researchers and research leaders of international reputation
- strengthening Australia’s international research standing and increasing world-class research capability in Australia
- providing an excellent research training environment and exemplary mentorship to nurture early-career researchers
- expanding Australia’s knowledge base by supporting ground-breaking, internationally competitive research
- forging strong links among researchers, the international research community and/or industry
- supporting research that will result in economic, environmental, social and cultural benefits for Australia.

Relevant mechanisms

Under the *Australian Laureate Fellowships* scheme selection criteria, candidates are invited to indicate how their proposed research will build new international research collaboration or links between research and industry.

Linkage Program

The Linkage Program supports the growth of research partnerships between university-based researchers and researchers in other sectors in Australia and overseas that generate new knowledge, technologies and innovations.

The Linkage Program aims to deliver outcomes of benefit to Australia and build Australia’s research and innovation capacity through support for: a. collaborative research between university-based researchers and researchers in other sectors; b. research training and career opportunities that enable Australian and international researchers and research students to work with industry and other end-users; and c. research in priority areas.

The main Linkage Program schemes are: *Linkage Projects*; ITRP (comprising *Industrial Transformation Research Hubs* and *Industrial Transformation Training Centres*), *ARC*

Centres of Excellence; Linkage Infrastructure, Equipment and Facilities and Special Research Initiatives.

Linkage Projects

Aim

A scheme of this nature is a long-standing element of the ARC's research funding responsibilities, with the ARC Collaborative Grants Programme first established in the early 1990s to 'support high quality research of social and economic benefit to Australia and to encourage research collaboration between universities and industry'¹⁸. This programme was subsequently replaced by the *Strategic Partnerships with Industry – Research and Training* scheme in 1997, before the *Linkage Projects* scheme was established as part of the new NCGP in 2001.

The objectives of the *Linkage Projects* scheme are to:

- support the initiation and/or development of long-term strategic research alliances between higher education organisations and other organisations, including industry and end-users, in order to apply advanced knowledge to problems and/or to provide opportunities to obtain national economic, social or cultural benefits
- build the scale and focus of research in the Strategic Research Priorities
- provide opportunities for researchers to pursue internationally competitive research in collaboration with organisations outside the higher education sector, targeting those who have demonstrated a clear commitment to high-quality research
- encourage growth of a national pool of world-class researchers to meet the needs of the broader Australian innovation system.

Relevant mechanisms

Proposals under the *Linkage Projects* scheme must involve at least one partner organisation. The partner organisation must make a contribution in cash and/or in-kind to the project and the total of the cash and in-kind contributions of the partner organisation(s) must at least match the total funding requested from the ARC. All organisations, other than those eligible to administer ARC funds, are eligible to be partner organisations under the *Linkage Projects* scheme, including government, business and non-profit organisations. Scheme selection criteria include the value of the proposed research to end-users, as well as the commitment of the partner organisations.

Industrial Transformation Research Program

Aim

The ITRP was established in 2012 to provide a suite of funding schemes attractive to both university-based researchers and industries. The Government committed \$236 million to the program focussed on developing new research partnerships and the expansion of existing partnerships in key areas of national importance.

The ITRP is aimed at:

- focusing on research areas that are vital for Australia's future economic prosperity—such as engineering, materials science and nanotechnology, communications, chemical engineering and biotechnology

¹⁸ *University and Industry Research Partnerships in Australia, 1999* (page 14)

- supporting Industrial PhD students and researchers to gain ‘hands-on’, practical skills and experience in these important areas
- fostering important partnerships between business and universities.

To achieve this, the Program funds research hubs and training centres with the *Industrial Transformation Research Hubs* (ITRH) scheme aimed at encouraging R&D projects that could help solve the big problems facing our industries today and the *Industrial Transformation Training Centres* (ITTC) scheme fostering close partnerships between university-based researchers and the industry members who will use the research outcomes.

Relevant mechanisms

Under the ITRH, each proposal must demonstrate that the total of the cash and in-kind contributions of the partner organisation(s) to the hub at least match the total funding requested from the ARC.

Under the ITTC, each proposal must demonstrate that the total cash and in-kind contributions of the partner organisation(s) to the training centre are sufficient to support the research projects of the Higher Degree by Research candidates and postdoctoral fellows in the training centre.

Research Centres: ARC Centres of Excellence

Aim

The *ARC Centres of Excellence* scheme supports prestigious foci of expertise through which high-quality researchers collaboratively maintain and develop Australia's international standing in research areas of national priority. Centres involve significant collaboration which allows the complementary research resources of universities, publicly funded research organisations, other research bodies, governments and businesses to be concentrated to support outstanding research.

The objectives for the *ARC Centres of Excellence* scheme are to:

- undertake highly innovative and potentially transformational research that aims to achieve international standing in the fields of research envisaged and leads to a significant advancement of capabilities and knowledge
- link existing Australian research strengths and build critical mass with new capacity for interdisciplinary, collaborative approaches to address the most challenging and significant research problems
- develop relationships and build new networks with major national and international centres and research programs to help strengthen research, achieve global competitiveness and gain recognition for Australian research
- build Australia's human capacity in a range of research areas by attracting and retaining, from within Australia and abroad, researchers of high international standing as well as the most promising research students
- provide high-quality postgraduate and postdoctoral training environments for the next generation of researchers
- offer Australian researchers opportunities to work on large-scale problems over longer periods of time
- establish centres of such repute in the wider community that they will serve as points of interaction among higher education institutions, governments, industry and the private sector generally.

Relevant mechanisms

Under the *ARC Centres of Excellence* scheme, proposals involving one or more partner organisations must demonstrate a significant contribution of cash, in-kind contributions and/or other material resources from the partner organisation(s), having regard to the total cost of the centre and the relative contribution of each partner investigator.

The *ARC Centres of Excellence* scheme encourages collaboration between university researchers at the administering and collaborating organisations and researchers and end-users at partner organisations, both within Australia and internationally. ‘Outcomes and linkages’ represent 20 per cent of the proposal selection criteria and include (among others) consideration of:

- the participation of end-users and partners in strategic research planning and centre governance
- the extent to which the proposed research is likely to expand Australia’s knowledge base and research capability and to enhance Australia’s international reputation and competitiveness
- the adequacy of plans and strategies for translation of research outcomes including: knowledge transfer, knowledge application, and if applicable, technology transfer, including fostering a culture of innovation and outcomes focus
- the planned links with Australian researchers in universities, other research organisations and strategic agencies working in, and applying the outcomes of, the proposed research.

Linkage Infrastructure, Equipment and Facilities

Aim

The *Linkage Infrastructure, Equipment and Facilities* (LIEF) scheme provides funding for research infrastructure, equipment and facilities to eligible organisations. The scheme enables higher education researchers to participate in cooperative initiatives so that expensive infrastructure, equipment and facilities can be shared between higher education organisations and also with industry. The scheme also fosters collaboration through its support of the cooperative use of international or national research facilities.

The objectives of the scheme are to:

- encourage eligible organisations to develop collaborative arrangements with other eligible organisations, higher education institutions and/or their partner organisations to develop and support research infrastructure
- support large-scale national or international cooperative initiatives thereby allowing expensive research infrastructure to be shared and/or accessed
- support areas of existing and/or emerging research strength
- support and develop research infrastructure for the broader research community.

Relevant mechanisms

The LIEF scheme encourages participation by collaborating organisations from all research sectors, including industry. The maximum level of funding provided by the ARC for a project under LIEF is up to 75 per cent of the total direct cost of the infrastructure with collaborating organisations required to contribute the remaining funding.

Special Research Initiatives

Aim

The objective of the *Special Research Initiatives* (SRI) scheme is to support high-quality research which will assist in advancing Australia's research excellence to be globally competitive and deliver benefits to the community. This extends, but is not limited, to supporting research-related activities which will respond to emerging opportunities or changing priorities.

The SRI scheme provides funding to:

- support cooperative activities amongst researchers
- cooperative development of national and international linkages
- cooperative development of innovative research areas
- activities aimed at building the scale and focus of research and research training
- other activities that the ARC judges to be consistent with the scheme's objectives.

Applications for SRI funding may be submitted only when invited by the ARC by means of a call for proposal(s) for funding.

Relevant mechanisms

Relevant mechanisms (e.g. partner organisation requirements, selection criteria) are included as appropriate in initiatives funded under the *Special Research Initiatives* scheme.