

Australian Government

Australian Research Council

IMPLEMENTATION OF THE NATIONAL SCIENCE AND RESEARCH PRIORITIES UNDER THE AUSTRALIAN RESEARCH COUNCIL'S NATIONAL COMPETITIVE GRANTS PROGRAM

DISCUSSION PAPER March 2019

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Acronyms

Acronym	Details
ARC	Australian Research Council
CE	ARC Centres of Excellence
CEO	Chief Executive Officer
DP	Discovery Projects
DI	Discovery Indigenous
DECRA	Discovery Early Career Researcher Award
FoR	Field of Research
FT	Future Fellowships
FL	Australian Laureate Fellowships
HASS	humanities and social sciences
ITRH	Industrial Transformation Research Hubs
ITTC	Industrial Transformation Training Centres
LP	Linkage Projects
LIEF	Linkage Infrastructure, Equipment and Facilities
NCGP	National Competitive Grants Program
NHMRC	National Health and Medical Research Council
NSTC	National Science and Technology Council
PFAS	per- and poly-fluoroalkyl substances
R&D	research and development
STEM	science, technology, engineering and mathematics

Section 1: Introduction

Background

On 31 October 2018, the Minister for Education, the Hon Dan Tehan MP, tasked the ARC Chief Executive Officer (CEO) with reviewing the Australian Government's 2015 National Science and Research Priorities as they relate to the ARC's National Competitive Grants Program (NCGP).

The CEO is being assisted in this task by a panel of experts—the ARC Research Priorities Panel (Panel). At its first meeting on 13 March 2019, the Panel noted the scope of the review and the areas of consideration as identified in the terms of reference (see below). The Panel agreed that the research sector's views should be sought, in particular, on the appropriateness of the ARC's implementation of the National Science and Research Priorities.

This discussion paper has been developed to seek that feedback.

Terms of reference

The review of priorities for ARC research grants will be undertaken by members of the ARC Advisory Council with the addition of Mr David Learmonth, as the nominee of Dr Michele Bruniges AM (Secretary, Department of Education and Training), Dr Alan Finkel AO (Australia's Chief Scientist), and Professor Anne Kelso AO (Chief Executive Officer of the National Health and Medical Research Council).

The ARC Research Priorities Panel is chaired by the ARC CEO. The Panel will review the existing 2015 Science and Research Priorities as they relate to the NCGP administered by the ARC and provide advice to the Minister on whether and how these might require updating to ensure they support the ARC's purpose of growing knowledge and innovation for the benefit of the Australian community.

The Panel's review of the priorities in relation to the NCGP will include consideration of:

- how the existing priorities are used in the NCGP process
- whether the structure of the existing priorities appropriately supports the NCGP process
- areas in which Australia exhibits research strength, or which present opportunities to establish Australia as a world leader in research as identified by the ARC's Excellence in Research for Australia report
- areas of strategic priority that have been identified by Australia's Learned Academies
- how the ARC's use of the priorities relates to government science, research and innovation strategies, for example, as outlined in the 2017 *National Science Statement* and Innovation and Science Australia's *Australia 2030: Prosperity Through Innovation*
- how the ARC's use of the priorities compares to other Commonwealth research funding programs
- other reviews of the priorities
- stakeholder consultation and feedback.

The Panel will provide its advice to the Minister for Education by the end of July 2019.

Scope of the review

In scope

This review is focussed on the ARC's implementation of the National Science and Research Priorities and associated Practical Research Challenges under the NCGP.

Out of scope

The detail and content of the National Science and Research Priorities and associated Practical Research Challenges themselves is out of scope for this review. Policy relating to the National Science and Research Priorities is administered by the Department of Industry, Innovation and Science.

Additional information

To supplement this discussion paper, additional information is published on the consultation page of the ARC website. The additional information covers (i) the areas identified for consideration in the review terms of reference, and (ii) additional statistics relating to support for the National Science and Research Priorities under the NCGP. Further information may be provided during the consultation period.

Section 2: Context

National Science and Research Priorities

The Australian Government announced the National Science and Research Priorities (and their associated Practical Research Challenges) on 26 May 2015 (see **Attachment A**). These replaced the Strategic Research Priorities (released in 2013), which replaced the National Research Priorities (released in 2004).

There are nine cross-disciplinary National Science and Research Priorities—food, soil and water, transport, cybersecurity, energy, resources, advanced manufacturing, environmental change, and health—and 30 associated Practical Research Challenges (three or four per Priority area). At the time of their release, the Government anticipated that implementation of the priorities would result over time in "an increased proportion of Australian Government research investment allocated on a strategic basis to areas of critical need and national importance", while noting its intent that funding should not be directed to "applied, mission-based research to the exclusion of other forms of research".¹

The Department of Industry, Innovation and Science is leading a review of the National Science and Research Priorities in 2019.

ARC support for research

The ARC's purpose is to grow knowledge and innovation for the benefit of the Australian community through funding the highest quality research, assessing the quality, engagement and impact of research and providing advice on research matters.

To achieve its purpose, the ARC supports the highest-quality fundamental and applied research and research training through the NCGP. Under the NCGP, grants are competitively awarded to individuals, research teams and large scale centres through two Programs—the ARC Discovery Program, with a primary focus on supporting individuals and small teams—and the Linkage Program, which links university researchers to industry and other partners.

The NCGP is unique in Australia's research system (as compared to all other competitive research grants in Australia) in that it supports university research in almost all disciplines, including science, technology, engineering and mathematics (STEM), and the humanities, arts and social sciences (HASS). It does not normally fund medical and health research,² which is the responsibility of the National Health and Medical Research Council (NHMRC). Since 2013, the proportion of funding across all schemes between HASS and STEM research projects is approximately 20 per cent and 80 per cent respectively.

In countries similar to Australia, separate research funding agencies provide support across different disciplines' research. Canada, for example, has the Natural Sciences and Engineering Research Council and the Social Science and Humanities Research Council, while the United Kingdom has seven Research Councils across the breadth of research endeavour.

¹ Fact sheet: Science and Research Priorities (May 2015) (see Attachment A)

² The ARC's Medical Research policy says medical and health research includes laboratory-based studies, clinical studies and group/community-based studies that aim to understand the causes, treatment and/or prevention of human diseases and/or the maintenance of human health. The ARC does not normally fund research with these aims.

The NCGP is one of the few sources of Australian Government support for basic as well as applied research within the Australian university system³—approximately half of NCGP funding is allocated to the Socio-Economic Objective code of 'Expanding Knowledge'.⁴ Basic research is a critical ingredient of the Australian R&D system. As a critical driver for the applied research vital to maintaining Australia's competitive research advantage and high quality of life for its citizens, basic research underpins the national innovation system through the discovery of new knowledge and understanding.

NCGP funding recommendations are based on quality, as assessed through a competitive process involving rigorous peer review. The majority of ARC funding is not driven or limited by any particular research focus, subject matter or policy imperative. The main exception is the ARC Special Research Initiatives scheme, which provides funding for research in strategically important areas.

The NCGP has a budget of \$766.45 million in 2018–19⁵, which is approximately 8.0 per cent of the Australian Government's direct investment in research.

ARC support for research in Australian Government priority areas

The National Science and Research Priorities are an important component of the Australian Government's governance arrangements for Australian science and research. Since their introduction in 2015, the ARC has implemented the Priorities through all funding schemes of the NCGP (through the method outlined in Section 3) and reports annually on the proportion of total NCGP funding allocated to research in these areas. The ARC relies on applicants self-identifying the area of their research against the National Science and Research Priorities, and does not independently assess that identification.

In addition to the National Science and Research Priorities, the NCGP targets funding to support a number of thematic and structural priority areas:

- Industrial Transformation Priorities under the ARC Industrial Transformation Research Program (ITRP). The Industrial Transformation Priorities align with the Government's Industry Growth Centres and underpin the specific objective of the ITRP to support industry focused research. The current priorities, which do not apply to any other ARC grant scheme, are: Advanced Manufacturing, Cyber Security, Food and Agribusiness, Medical Technologies and Pharmaceuticals, Mining Equipment, Technology and Services, and Oil, Gas and Energy Resources.
- Various Australian Government priorities under the ARC Special Research Initiatives scheme including:
 - Research in per- and poly-fluoroalkyl substances (PFAS) remediation
 - Excellence in Antarctic science
- Research capacity building through the administration of separate schemes specifically targeted at providing fellowship support for excellent early and mid-career researchers.
- Research training in industry through the Industrial Transformation Training Centres (ITTC) scheme.
- Commonwealth Science Council priorities under the Supporting Responses to Commonwealth Science Council Priorities scheme.⁶

³ In addition to the NCGP, universities can choose to support basic research through research block grants.

⁴ Expanding Knowledge is for the categorisation of R&D which does not have an identifiable socio-economic objective. This is usually the case for pure basic research or strategic basic research.

⁵ www.industry.gov.au > Data and publications > <u>Science, Research and Innovation (SRI) Budget Tables</u>

⁶ On 28 November 2018, the Prime Minister announced that a new National Science and Technology Council (NSTC) would replace the Commonwealth Science Council as the peak science and technology advisory body to the Prime Minister and other Ministers. The NSTC held its first meeting on 25 February 2019.

Funding allocated to the National Science and Research Priorities

Since the introduction of the National Science and Research Priorities under the NCGP, the ARC has required researchers to identify whether their proposed research falls within a Priority (and which Practical Research Challenge) area.

In the period since the introduction of the Priorities, approximately 70 per of total funding to research is in areas which applicants have identified as being linked to the National Science and Research Priorities (ranging from 60 per cent under the Discovery Program to 94 per cent under the Linkage Program). One hundred per cent of funding under a number of individual schemes has been allocated to research that applicants have identified as being linked to the National Science and Research Priorities (see **Figure 1**).

The largest proportion of the funding allocated to research linked to the National Science and Research Priorities has gone to research in the Priority area of Advanced Manufacturing, followed by Environmental Change and Health (see **Figure 2**). This result is consistent across the total NCGP, and Discovery and Linkage Programs.

In general, HASS projects are much less likely to be identified as falling within a National Science and Research Priority than are STEM projects (where HASS and STEM projects are identified by Field of Research code). Mapping between the National Science and Research Priorities and Fields of Research (FoRs) is provided in the additional statistics in **Attachment B**.



Figure 1: Proportion of total funding allocated to research in the National Science and Research Priorities, by scheme (2015-19)



Figure 2: Proportion of total NCGP funding, by Program and National Science and Research Priority (2015-2019)

Section 3: Specific issues for consideration

Stakeholder comments are sought about the ARC's implementation of the National Science and Research Priorities within the context of the broader Australian research system.

ARC implementation of the National Science and Research Priorities

The National Science and Research Priorities were introduced into ARC grant guidelines (then funding rules) as new guidelines were prepared following the Australian Government's 2015 announcement of the Priorities.

As with previous Government research priorities, the ARC does not specifically direct funding to research in the National Science and Research Priorities. Instead:

- where appropriate, reference to the Priority areas is made within the grant scheme objectives
- applicants are asked to indicate whether their proposed research aligns with the Priorities and associated Practical Research Challenges
- assessors are asked to consider whether the research has the potential to contribute to the Priorities (as part of a broader consideration of the selection criterion of 'Project quality and innovation').

Reflecting the Government's advice that the Priorities were not intended to be exhaustive or exclusive, the 'Project quality and innovation' criterion also allows applicants to reference other aspects of the proposal, including the innovative nature of the proposal, the problem being addressed, the advancement of knowledge and international collaboration.

Further details of the references to the National Science and Research Priorities in ARC grant documentation are provided in **Attachment C**.

At the time of introducing the Priorities into grant guidelines, the ARC anticipated that implementation of the new Priority areas may result in more research applications in the areas of the Practical Research Challenges, but given the broad nature of the Priority areas, the level of research funded within each broad discipline category (that is, 2-digit FoR) was not expected to change. It is too early to determine whether this has been the case.

Questions

The Review Panel is interested in your views on the ARC's implementation of the National Science and Research Priorities under the NCGP.

You can provide general commentary or answer the specific questions listed below. In responding to the questions below, please provide a reason for your view.

- 1. The ARC does not target a specific proportion of funding to research in the National Science and Research Priorities—the ARC leaves it to individual applicants to determine whether to undertake research in the areas outlined in the National Science and Research Priority areas. The ARC also does not allocate a dedicated score for alignment with the National Science and Research Priority areas—it is one of the components of the selection criterion Project Quality and Innovation.
 - (a) Is this approach appropriate in the context of the ARC's role in Australia's research system (as detailed in Section 2)?
 - (b) Are there other methods of funding research in the National Science and Research Priorities that the ARC should consider?
- 2. Under current arrangements, approximately 70 per cent of total funding allocated each year is allocated to research which applicants identify as being linked to the National Science and Research Priorities, with the proportion varying by year and by scheme.
 - (a) Is the current level of alignment of ARC funding with the National Science and Research Priorities appropriate, and in line with the Government's objective of increasing Australia's capacity for research in these areas?
 - (b) What would the potential benefits and costs for the Australian R&D system be if allocation of ARC funding against the National Science and Research Priorities was aligned differently?
- 3. Are there other challenges or areas of priority that you consider require focus in ARC funding (by being included in NCGP research priorities) to (i) achieve the ARC's purpose of growing knowledge and innovation for the benefit of the Australian community; (ii) support an appropriate balance of research in across disciplines within the ARC's funding remit; and (iii) complement and maximise the benefits from overall existing government support for research.

Your understanding of the National Science and Research Priorities

As indicated above, researchers on ARC grant applications are asked to self-identify the National Science and Research Priority and Practical Research Challenge relevant to their research project (where a Priority applies). The ARC does not check the relevance of the researcher's identification.

Questions

The Review Panel is interested in your understanding of the National Science and Research Priorities and associated Practical Research Challenges.

- 4. What is your understanding of the implementation of the National Science and Research Priorities under the NCGP?
- 5. What is your understanding of the implementation of the National Science and Research Priorities in relation to Australia's broader research system?

Section 4: Review process and timeline

Process

The Minister has asked the Research Priorities Panel to report by the end of July 2019.

Public consultation will be held until 16 May 2019 to collect stakeholder views on the questions posed in the Discussion Paper.

Submissions must be received by 11.59 pm Thursday 16 May 2019 to be considered by the Panel in its formulation of advice to the Minister.

Submissions in response to this Discussion Paper will open on Thursday 4 April 2019 here.

Submissions should be Microsoft Word or machine-readable PDF files. Submissions may be made public unless accompanied by a request that they not be made public. Submission information may be shared with other Australian Government organisations for the purpose of the review.

In addition to public consultation, targeted consultations with individuals may be undertaken depending on the nature of the feedback received.

Questions about the review should be directed to:

ARC-NSRPReview@arc.gov.au

Timeline

Month	Activity
March/April	Consultation
May	Compilation of consultation results; preparation of draft advice
June	Consideration of draft advice
July	Provision of advice to Minister

Attachment A: Fact Sheet—National Science and Research Priorities⁷ (May 2015)

Introduction

The Government has established a set of Science and Research Priorities, and corresponding Practical Research Challenges, designed to increase investment in areas of immediate and critical importance to Australia and its place in the world.

Australia depends on science and research to increase productivity, achieve sustainable economic growth, create jobs, and improve national well-being. Australian science also contributes to the global stock of knowledge across a broad range of areas.

Like other countries our capacity to support research is finite. With diverse investments in research across multiple agencies and many processes, we must ensure that we build our capacity to pursue research of particular importance to us as a nation.

Our Industry Innovation and Competitiveness Agenda states that we will align Australia's research priorities with our comparative advantages and our *Boosting the Commercial Returns from Research* paper calls for national science and research priorities and corresponding practical challenges.

Led by the [then] Chief Scientist, Professor Ian Chubb AC, the Priorities and associated Practical Challenges were developed in consultation with researchers, industry leaders and government representatives.

In its [April 2015] meeting, the Commonwealth Science Council considered the Priorities and recommended that they be adopted by the Government immediately. The Science and Research Priorities and associated Practical Challenges will ensure that appropriate levels of public funding are allocated to research that addresses the most immediate problems facing the nation. They are neither exclusive; nor are they exhaustive.

The implementation of priorities is expected, over time, to result in an increased proportion of Australian Government research investment allocated on a strategic basis to areas critical need and national importance. This does not mean that funding should be directed to applied, mission-based research to the exclusion of other forms of research. Even in the priority areas, a significant amount of the research will need to be early-stage, basic research.

Addressing the Priorities and Practical Research Challenges will require effort from across the full spectrum of research disciplines, including the physical and life sciences, engineering, information and communications technology and the humanities and social sciences. It will also require a coordinated approach from all Government departments and agencies.

Cross-cutting issues related to the priorities present challenges in their own right and will be addressed through a whole-of-government strategic approach. These include big data, research infrastructure, workforce and international collaboration.

The Science and Research Priorities and Practical Research Challenges will be reviewed every two years to allow for new initiatives to take effect and to ensure that issues being addressed are still the most pressing for the nation.

⁷ www.industry.gov.au > Data and publications > <u>Science and Research Priorities</u>

Food

Australian research and ingenuity has led to well-developed agricultural and fishery industries that contribute nutritious food to domestic and global markets. If Australia is to respond to increasing global demand for both plant and animal-based food, we will need to develop internationally competitive, sustainable, profitable, high intensity and high production capacity in new and existing food products, and in new and existing regions of Australia. We will face constrained soil and water resources, shifts in climate, and changes in the environment, and the emergence of new pests and invasive species, that could lead to increased difficulties in meeting expectations.

Research will aim to optimise food and fibre production and processing, enhance food safety and minimise waste. Research will also be critical to preserve our hard won reputation for clean, safe and sustainable production.

Departments and agencies should give priority to research that will lead to:

- knowledge of global and domestic demand, supply chains and the identification of country specific preferences for food Australia can produce
- knowledge of the social, economic and other barriers to achieving access to healthy Australian foods
- enhanced food production through:
- novel technologies, such as sensors, robotics, real-time data systems and traceability, all integrated into the full production chain
- better management and use of waste and water; increased food quality, safety, stability and shelf life
- protection of food sources through enhanced biosecurity
- genetic composition of food sources appropriate for present and emerging Australian conditions.

Soil and Water

Australia's soil, vegetation, biodiversity and water along with its marine resources are national strategic assets that should be highly valued and effectively managed. These assets are fundamentally interconnected components of our ecosystems, but the ways they interact and respond to change remain poorly understood.

Research should therefore focus on critical assets such as the Great Barrier Reef, Northern Australia, key agricultural regions, aquifers and urban catchments, and build capacity for improved accuracy and precision in predicting change. Research will lead to better decision-making strategies in the context of potentially conflicting demands between development, the environment and landscape management.

Departments and agencies should give priority to research that will lead to:

- new and integrated national observing systems, technologies and modelling frameworks across the soil-atmosphere-water-marine systems
- better understanding of sustainable limits for productive use of soil, freshwater, river flows and water rights, terrestrial and marine ecosystems
- minimising damage to, and developing solutions for restoration and remediation of, soil, fresh and potable water, urban catchments and marine systems.

Transport

As the world increasingly diversifies its energy sources new markets are emerging for alternative fuels. Australia has the potential to develop new industries and to contribute to improved fuel security and to support the design and delivery of infrastructure that responds to Australia's urban, regional and remote communities, and changing demographics.

Research will be critical to developing low cost, reliable, resilient and efficient transport systems that meet the needs of businesses and enable sustainable mobility, while lowering carbon emissions and other pollution.

Departments and agencies should give priority to research that will lead to:

- low emission fuels and technologies for domestic and global markets
- improved logistics, modelling and regulation: urban design, autonomous vehicles, electrified transport, sensor technologies, real time data and spatial analysis
- effective pricing, operation, and resource allocation.

Cybersecurity

Australia's cyber infrastructure underpins the entire knowledge economy, including government, business, defence, police, and emergency services. But our cyber infrastructure is vulnerable to exploitation by malicious actors and is subject to damage caused by non-malicious events such as natural disasters, equipment failure, human error and other accidents. It is essential that the security and resilience of this key infrastructure is assured.

Research in cyber security including quantum technologies will position Australia as a leader in fast moving and emerging areas such as distributed network management, machine learning, and intelligent and secure data management and retention.

Departments and agencies should give priority to research that will lead to:

- highly-secure and resilient communications and data acquisition, storage, retention and analysis for government, defence, business, transport systems, emergency and health services
- secure, trustworthy and fault-tolerant technologies for software applications, mobile devices, cloud computing and critical infrastructure
- new technologies and approaches to support the nation's cybersecurity: discovery and understanding of vulnerabilities, threats and their impacts, enabling improved risk-based decision making, resilience and effective responses to cyber intrusions and attacks
- understanding the scale of the cyber security challenge for Australia, including the social factors informing individual, organisational, and national attitudes towards cyber security.

Energy

Australia has abundant energy resources, but we need to improve efficiency of use, reduce emissions and to integrate energy from any source into the electricity grid.

A desirable energy future is one with a diversity of sources and suppliers that progressively reduces carbon emissions and that is economically attractive for consumers and other stakeholders.

Research will lead to the development of reliable, low-cost, sustainable energy supplies that are resilient to sudden shocks, as well as decadal trends in demand and climate, and to technologies that use energy more efficiently.

Departments and agencies should give priority to research that will lead to:

- low emission energy production from fossil fuels and other sources
- new clean energy sources and storage technologies that are efficient, cost-effective and reliable
- Australian electricity grids that can readily integrate and more efficiently transmit energy from all sources including low- and zero-carbon sources.

Resources

Australia's resource sector is a significant contributor to the economy. By prioritising the sustainable extraction of our resources and by adding value where we have competitive advantage, we will optimise long-term economic, social and environmental benefit to the community.

Research will lead to a fundamental understanding of the structure, composition, and processes governing the formation and distribution of resources in Australia. This knowledge will support the exploration, the potential discovery of major new sources, production, distribution of the traditional resources such as strategic metals and minerals, coal and gas and those in increasing demand such as rare earth elements and groundwater.

Departments and agencies should give priority to research that will lead to:

- a fundamental understanding of the physical state of the Australian crust, its resource endowment and recovery
- knowledge of environmental issues associated with resource extraction
- lowering the risk to sedimentary basins and marine environments due to resource extraction
- technologies to optimise yield through effective and efficient resource extraction, processing and waste management.

Advanced manufacturing

Australian competitiveness needs innovative industries that are focused, agile, high value-add, transformative and fully integrated into global supply chains. In the competitive global market Australia should aim to dominate in selected product categories, where we have particular advantage.

Research will be critical in developing and supporting existing industries while enabling the development of a new and advanced manufacturing sector.

Departments and agencies should give priority to research that will lead to:

- knowledge of Australia's comparative advantages, constraints and capacity to meet current and emerging global and domestic demand
- cross-cutting technologies that will de-risk, scale up, and add value to Australian manufactured products
- specialised, high value-add areas such as high-performance materials, composites, alloys and polymers.

Environmental Change

There are many factors that influence the environment. They range from global climate change to the environmental consequences of local actions; all are significant. These factors affect terrestrial, marine, rural and urban systems in Australia and within our region. While continuing to study environmental and climate science in Australia, and connecting to global research, we must learn to mitigate and adapt to local and regional effects.

Research will build Australia's capacity to respond to environmental change. It will require the integration of research outcomes from biological, physical, social and economic systems.

Departments and agencies should give priority to research that will lead to:

- improved accuracy and precision in predicting and measuring the impact of environmental changes caused by climate and local factors
- resilient urban, rural and regional infrastructure
- options for responding and adapting to the impacts of environmental change on biological systems, urban and rural communities and industry.

Health

Australia's health needs must be addressed at both the individual and population level, and must recognise that health or "wellness" is not simply the absence of disease or infirmity. Good health requires the development of treatments, solutions and preventative strategies to improve physical and mental well-being.

Research will be essential to building healthy and resilient communities throughout Australia. It will capitalize on Australia's strengths in science and technology to generate wider economic benefits through improved knowledge translation and commercialisation, and partnerships with industry.

Departments and agencies should give priority to research that will lead to:

- better models of health care and services that improve outcomes, reduce disparities for disadvantaged and vulnerable groups, increase efficiency and provide greater value for a given expenditure
- improved prediction, identification, tracking, prevention and management of emerging local and regional health threats
- better health outcomes for Indigenous people, with strategies for both urban and regional communities
- effective technologies for individuals to manage their own health care, for example, using mobile apps, remote monitoring and online.

Attachment B: Additional statistics

Table 1: Proportion of total applications in National Science and Research Priority areas, by scheme and year (2016 to 2019)

Program	Scheme	2016	2017	2018	2019
Discovery	ARC Future Fellowships	60%	60%	63%	still underway
Discovery	Australian Laureate Fellowships	60%	62%	68%	still underway
Discovery	Discovery Early Career Researcher Award	n/a	66%	63%	60%
Discovery	Discovery Indigenous	n/a	74%	71%	74%
Discovery	Discovery Projects	n/a	62%	61%	59%
Discovery	Total	n/a	63%	62%	59%
Linkage	ARC Centres of Excellence	n/a	89%	n/a	n/a
Linkage	Industrial Transformation Research Hubs	n/a	100%	100%	still underway
Linkage	Industrial Transformation Training Centres	100%	100%	100%	still underway
Linkage	Learned Academies Special Projects	n/a	70%	n/a	n/a
Linkage	Linkage Infrastructure, Equipment and Facilities	0%	84%	81%	82%
Linkage	Linkage Projects	84%	81%	80%	still underway
Linkage	Special Research Initiatives	n/a	n/a	100%	still underway
Linkage	Supporting Responses to Commonwealth Science Council Priorities	n/a	100%	n/a	n/a
Linkage	Total	n/a	83%	84%	82%
NCGP	Total	n/a	65%	63%	60%

Program	Scheme	2016	2017	2018	2019
Discovery	ARC Future Fellowships	56%	49%	56%	Still underway
Discovery	Australian Laureate Fellowships	81%	71%	75%	Still underway
Discovery	Discovery Early Career Researcher Award	n/a	62%	58%	55%
Discovery	Discovery Indigenous	n/a	82%	69%	83%
Discovery	Discovery Projects	n/a	59%	56%	57%
Discovery	Total	n/a	59%	57%	57%
Linkage	ARC Centres of Excellence	n/a	100%	n/a	n/a
Linkage	Industrial Transformation Research Hubs	n/a	100%	100%	Still underway
Linkage	Industrial Transformation Training Centres	100%	100%	100%	Still underway
Linkage	Learned Academies Special Projects	n/a	40%	n/a	Still underway
Linkage	Linkage Infrastructure, Equipment and Facilities	0%	85%	74%	75%
Linkage	Linkage Projects	83%	85%	78%	Still underway
Linkage	Special Research Initiatives	n/a	n/a	100%	Still underway
Linkage	Supporting Responses to Commonwealth Science Council Priorities	n/a	100%	n/a	Still underway
Linkage	Total	n/a	86%	80%	75%
NCGP	Total	n/a	64%	59%	57%

Table 2: Proportion of total funded projects in National Science and Research Priority areas, by scheme and year (2016 to 2019)

Program	Scheme	2016	2017	2018	2019
Discovery	ARC Future Fellowships	57%	49%	55%	Still underway
Discovery	Australian Laureate Fellowships	81%	72%	73%	Still underway
Discovery	Discovery Early Career Researcher Award	n/a	62%	59%	55%
Discovery	Discovery Indigenous	n/a	77%	72%	84%
Discovery	Discovery Projects	n/a	61%	57%	59%
Discovery	Total	n/a	60%	59%	59%
Linkage	ARC Centres of Excellence	n/a	100%	n/a	Still underway
Linkage	Industrial Transformation Research Hubs	n/a	100%	100%	Still underway
Linkage	Industrial Transformation Training Centres	100%	100%	100%	Still underway
Linkage	Learned Academies Special Projects	n/a	40%	n/a	Still underway
Linkage	Linkage Infrastructure, Equipment and Facilities	n/a	86%	80%	83%
Linkage	Linkage Projects	83%	88%	76%	Still underway
Linkage	Special Research Initiatives	n/a	n/a	100%	Still underway
Linkage	Supporting Responses to Commonwealth Science Council Priorities	n/a	n/a	100%	Still underway
Linkage	Total	n/a	97%	89%	83%
NCGP	Total	n/a	78%	65%	60%

 Table 3: Proportion of total funding in National Science and Research Priority areas, by scheme and year (2016 to 2019)

Table 4: Proportion of total funding in National Science and Research Priority areas, by Program and National Science and Research Priority area (2015 to 2019)

National Science and Research Priority	Discovery Program	Linkage Program	Total NCGP
Advanced manufacturing	15%	45%	26%
Cybersecurity	3%	1%	2%
Energy	6%	4%	5%
Environmental change	14%	16%	14%
Food	4%	5%	4%
Health	11%	14%	12%
Resources	3%	3%	3%
Soil and water	2%	4%	3%
Transport	2%	3%	2%
No Priority	40%	6%	29%
Total	100%	100%	100%

Table 5: NCGP, number of funded projects, by National Science and Research Priority area and 2-digit Field of Research (2017 to 2019, by project commencement year)

Primary FoR2D	No NSRP	Advanced manu-	Cyber- security	Energy	Environ- Mental	Food	Health	Resources	Soil and	Trans- port	Grand Total	Pct with no NSRP
		facturing			change				water			
01 Mathematical Sciences	109	7	4	4	9	1	14	4	1	3	156	70%
02 Physical Sciences	115	78	10	11	2	0	2	0	0	0	218	53%
03 Chemical Sciences	41	97	0	21	5	1	17	2	5	1	190	22%
04 Earth Sciences	23	0	1	0	60	0	1	31	20	0	136	17%
05 Environmental Sciences	3	0	0	2	71	1	1	0	10	0	88	3%
06 Biological Sciences	225	15	0	4	131	64	42	1	12	0	494	46%
07 Agricultural and Veterinary Sciences	2	0	0	0	1	26	3	0	0	0	32	6%
08 Information and Computing Sciences	42	19	58	2	6	6	26	1	1	21	182	23%
09 Engineering	33	214	6	113	37	4	26	43	37	32	545	6%
10 Technology	13	71	7	13	3	4	10	0	3	3	127	10%
11 Medical and Health Sciences	54	2	0	0	1	1	55	0	0	2	115	47%
12 Built Environment and Design	7	1	0	1	10	0	5	1	0	3	28	25%
13 Education	50	1	0	0	1	0	10	0	0	0	62	81%
14 Economics	50	11	0	1	5	1	8	0	1	1	78	64%
15 Commerce, Management, Tourism and Services	21	1	0	1	1	0	1	0	0	5	30	70%
16 Studies in Human Society	117	5	4	4	30	7	57	0	1	4	229	51%
17 Psychology and Cognitive Sciences	105	0	0	1	0	0	41	0	0	2	149	70%
18 Law and Legal Studies	30	1	0	1	6	2	10	1	1	0	52	58%
19 Studies in Creative Arts and Writing	22	1	0	0	1	0	5	0	0	0	29	76%
20 Language, Communication and Culture	60	1	3	0	5	0	12	0	0	0	81	74%
21 History and Archaeology	81	0	0	0	15	0	11	1	1	0	109	74%
22 Philosophy and Religious Studies	38	0	3	0	1	1	9	1	0	0	53	72%
Grand Total	1241	525	96	179	401	119	366	86	93	77	3183	39%
Proportion	39%	16%	3%	6%	13%	4%	11%	3%	3%	2%	100%	

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Table 6: ARC funding by National Science and Research Priority Practical Research Challenge (2015-2019)

Note 1 - Funding was first divided by the number of Practical Research Challenges on each project, then aggregated by year, and scheme Note 2 - Data is from Minister announced projects and applications as of 18/03/2019

National Science and Research Priority	Practical Research Challenges	Funding
Advanced manufacturing	Cross-cutting technologies that will de-risk, scale up, and add value to Australian manufactured products.	\$154,424,565
Advanced manufacturing	Knowledge of Australia's comparative advantages, constraints and capacity to meet current and emerging global and domestic demand.	\$88,092,154
Advanced manufacturing	Specialised, high value-add areas such as high-performance materials, composites, alloys and polymers.	\$279,260,425
Cybersecurity	Highly-secure and resilient communications and data acquisition, storage, retention and analysis for government, defence, business, transport systems, emergency and health services.	\$9,018,461
Cybersecurity	New technologies and approaches to support the nation's cybersecurity: discovery and understanding of vulnerabilities, threats and their impacts, enabling improved risk-based decision making, resilience and effective responses to cyber intrusions and attacks.	\$16,068,264
Cybersecurity	Secure, trustworthy and fault-tolerant technologies for software applications, mobile services, cloud computing and critical infrastructure.	\$13,057,034
Cybersecurity	Understanding the scale of the cyber security challenge for Australia, including the social factors informing individual, organisational, and national attitudes towards cyber security.	\$3,501,332
Energy	Australian electricity grids that can readily integrate and more efficiently transmit energy from all sources including low- and zero-carbon sources.	\$13,332,782
Energy	Low emission energy production from fossil fuels and other sources.	\$20,056,958
Energy	New clean energy sources and storage technologies that are efficient, cost-effective and reliable.	\$71,630,175
Environmental change	Improved accuracy and precision in predicting and measuring the impact of environmental changes caused by climate and local factors.	\$172,646,742
Environmental change	Options for responding and adapting to the impacts of environmental change on biological systems, urban and rural communities and industry.	\$98,577,149
Environmental change	Resilient urban, rural and regional infrastructure.	\$22,489,228
Food	Enhanced food production	\$72,055,808
Food	Knowledge of global and domestic demand, supply chains and the identification of country specific preferences for food Australia can produce.	\$3,297,075
Food	Knowledge of the social, economic and other barriers to achieving access to healthy Australian foods.	\$6,341,485
Health	Better health outcomes for Indigenous people, with strategies for both urban and regional communities.	\$28,919,025
Health	Better models of health care and services that improve outcomes, reduce disparities for disadvantaged and vulnerable groups, increase efficiency and provide greater value for a given expenditure.	\$93,423,055
Health	Effective technologies for individuals to manage their own health care, for example, using mobile apps, remote monitoring and online access to therapies.	\$19,417,668
Health	Improved prediction, identification, tracking, prevention and management of emerging local and regional health threats.	\$108,554,310

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National Science and Research Priority	Practical Research Challenges	Funding
Resources	A fundamental understanding of the physical state of the Australian crust, its resource endowment and recovery.	\$19,302,171
Resources	Knowledge of environmental issues associated with resource extraction.	\$4,950,762
Resources	Lowering the risk to sedimentary basins and marine environments due to resource extraction.	\$1,386,109
Resources	Technologies to optimise yield through effective and efficient resource extraction, processing and waste management.	\$32,916,295
Soil and water	Better understanding of sustainable limits for productive use of soil, freshwater, river flows and water rights, terrestrial and marine ecosystems.	\$9,812,003
Soil and water	Minimising damage to, and developing solutions for restoration and remediation of, soil, fresh and potable water, urban catchments and marine systems.	\$29,461,475
Soil and water	New and integrated national observing systems, technologies and modelling frameworks across the soil-atmosphere-water-marine systems.	\$13,728,162
Transport	Effective pricing, operation, and resource allocation.	\$10,173,877
Transport	Improved logistics, modelling and regulation: urban design, autonomous vehicles, electrified transport, sensor technologies, real time data and spatial analysis.	\$31,871,508
Transport	Low emission fuels and technologies for domestic and global markets.	\$7,628,991
Total		\$1,455,395,052
Total funding for SRP-identif	ied scheme rounds	\$2,036,349,795

Attachment C: References in ARC grant documentation

Instructions to Applicants

The Instructions to Applicants include the following text:



Does this application fall within one of the Science and Research Priorities? (This question must be answered)

This is a 'Yes' or 'No' question.

Select 'Yes' to indicate if the application falls within a Science and Research Priority area. If You select 'Yes' You will be required to select one of the Science and Research Priority areas from the drop down list. You will then need to select one or more Practical Research Challenges from the drop down list. Each Science and Research Priority area has a number of associated Practical Research Challenges.

Select 'No' if not applicable. If You select 'No' the Science and Research Priorities will remain greyed out.

Note: RMS will allow only one of the Science and Research Priorities to be selected. Choose the most appropriate one from the list. The application may, however, indicate more than one Challenge within the chosen Science and Research Priority. Information regarding the <u>Science and Research Priorities</u> is available via a link on the <u>science.gov.au</u> website.

Grant Guidelines objectives

The objectives of most schemes under the NCGP refer to supporting research in the Science and Research Priorities.

Grant Guidelines assessment criteria

The 'potential for the research to contribute to the Australian Government's Science and Research Priorities' is included in most NCGP schemes as one component of the Key Criterion 'Project Quality and Innovation' (except under the Industrial Transformation Research Program).