NCRIS
National Research
Infrastructure for Australia
An Australian Government Initiative

# National Research Infrastructure Census

## REPORT

(2017-18)

Wallis strategic market & social research

**Report prepared for:**

**Research Policy and Programs Branch**
**Higher Education Group**
**Commonwealth Department of Education**

Wallis Market and Social Research achieved accreditation to the International Standard ISO20252 in September 2007. The Company is committed to maintaining administrative and operational procedures which comply with these accreditation requirements and to improving its performance in all aspects of the service it delivers to its customers.

Wallis is an active participant in the market research industry, with senior staff making significant contributions to the Australian Market and Social Research Society (AMSRS) and the Association of Market and Social Research Organisations (AMSRO). As such we actively pursue the ethical objectives of the industry.

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# 2017 – 2018 NCRIS Census Snapshot

Wallis undertook a census on the National Collaborative Research Infrastructure Strategy (NCRIS) projects for the financial year 2017-18. This built on a previous data from the period 2015-17. The census collected data on usage, impacts and operation of NCRIS National Research Infrastructure facilities, including both physical infrastructure and human resources. This page outlines some of the key metrics uncovered, while further detail is contained in this report.

## LEVERAGING INVESTMENT

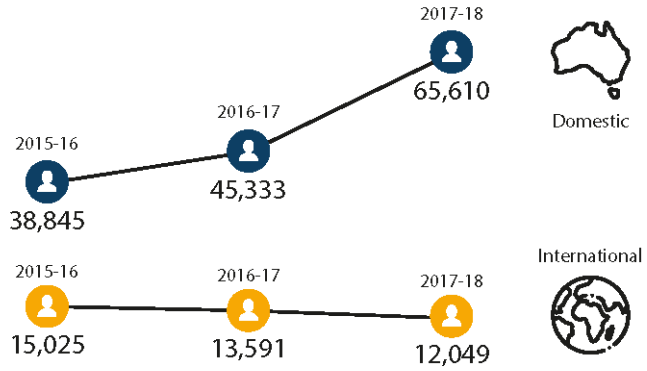
From **2015-18** every **$1.00** of government investment yields ▶ **$0.30** in cash and **$0.99** in-kind investment from other sources ▶ A total of **$1.29**

$1.00 $0.30 + $0.99 = $1.29

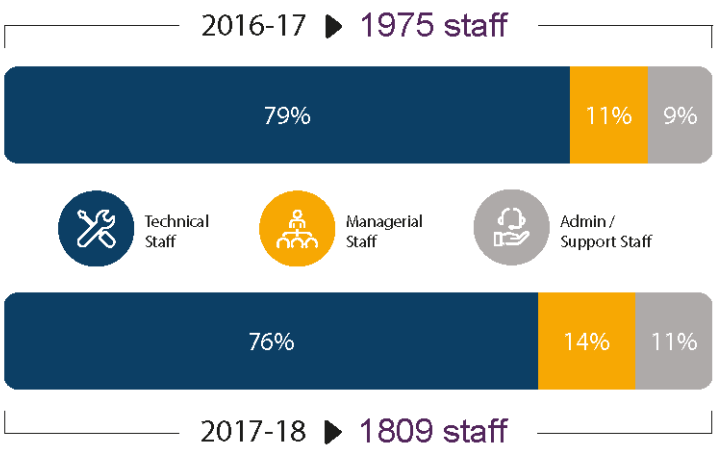
*Note that the total co-investment ratio for the 2015-17 NRI Census was $0.88 per $1.00. These census outcomes are not comparable as we have changed co-investment methology.

## RESEARCH USER NUMBERS

Excludes Government department and unaffiliated users



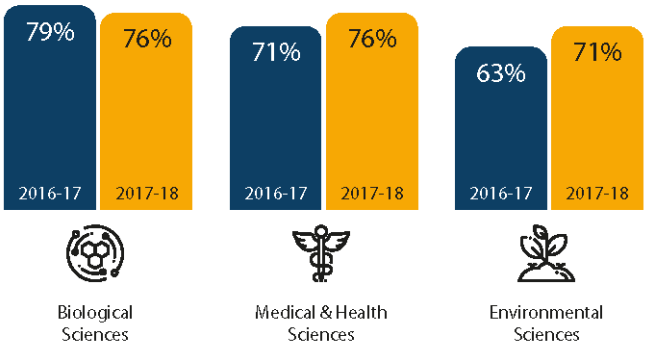

## STAFFING BY HEADCOUNT




**4 in 10** managerial positions were held by women

*16 per cent of Australia's STEM workforce are women

## FIELDS OF RESEARCH (TOP 3)

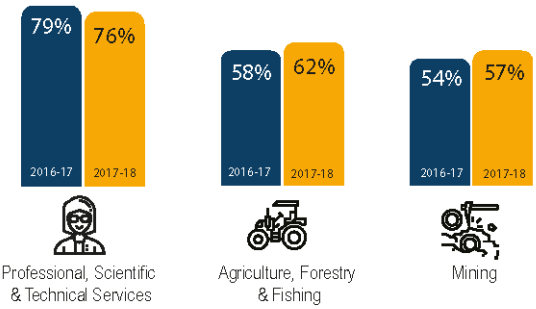



## PUBLICATIONS

**8371** publications from NCRIS-enabled research for 2017-18 ▶ **37.9%** of these in the top 10 percentile of most cited publications

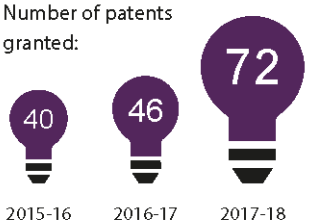
## INDUSTRIES SUPPORTED (TOP 3)

Proportion of NCRIS projects providing services to Industry




## IMPACT

Number of patents granted:




**15** Products introduced to markets in 2015-18

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# 2.0 Introduction

## 2.1 Purpose of the Project

This report presents the aggregated data from across the National Collaborative Research Infrastructure Strategy (NCRIS) projects.

The Australian Government Department of Education is tasked with providing an aggregated and detailed picture of how NCRIS funded projects support quality research that benefits Australia.

This census is an attempt to gather an overall picture of Australia's National Research Infrastructure (NRI): its scope, scale and reach. It is not an objective of this census to compare projects with one another.

## 2.2 Overview of the Census

The current NRI census, administered by Wallis, had as its reference period the 2017-18 financial year. In 2018, a census was conducted with two reference periods, 2015-16 and 2016-17. That census was also administered by Wallis, and it was the first time that Wallis had administered the NRI census. The questions in the current census are largely based on the census conducted in 2018 (see Appendix 1 for the 2017-18 NRI Census questions). As a result, projects responding to the census this year were familiar with the types of questions asked. Hence, in comparison to the previous census, projects have had considerably more time to refine the way that they collect the data required to complete the census.

The census was undertaken across the full range of NRI that was considered during the development of the 2018 Research Infrastructure Investment Plan. Given that projects vary massively in terms of size, purpose, scope and structure, it should be understood that some of the questions may not have been equally relevant to all NRI facilities and contexts, and that NRI facilities cannot always be sensibly compared on all metrics.

With regard to NCRIS projects, 21 projects were invited to participate. This was less than in 2015-17, since the National eResearch Collaboration Tools and Resources project (NeCTAR), the Australian National Data Service (ANDS), and Research Data Services (RDS) have been integrated into the Australian Research Data Commons (ARDC). Furthermore, two projects that were invited to complete the 2015-17 census are no longer part of the NCRIS network.

Some projects within the same organisation but with different NRI completed separate forms and each part of the organisation have been treated as separate projects for the purpose of this report.

A list of all NCRIS projects that were invited to conduct the census is included in Appendix 2.

## 2.3 Methodology

Wallis presented the results of the 2015-17 NRI Census at the NCRIS forum in August 2018. As part of this presentation (as well as at the wider forum), feedback was sought and received from the projects with regard to future iterations of the census.

Following this, Wallis issued a feedback survey to all the NCRIS projects. Of the eight NCRIS projects that completed the feedback survey, the majority expressed a preference to move away from an online form and towards a spreadsheet type form.

After further discussions between the department and Wallis, it was agreed that a spreadsheet document would be employed for the 2017-18 census.

The next step in the methodology was a thorough review and redraft of the census questions. The department provided the results of its internal consultations, which revealed priority areas for consideration. These were then assessed alongside the existing census instrument that had been used in the previous two reference periods (2015-2017).

Once a draft census form was agreed between Wallis and the department, Wallis then designed and created the census form to allow for completion by projects via a spreadsheet document.

This spreadsheet-based census form was initially reviewed by the department. After further refinement, it was then shared with a pilot sample of ten NCRIS projects that had volunteered to participate in the pilot stage. Feedback was received from seven of these projects. This feedback from the pilot projects was evaluated and incorporated into the final version of the census form for 2017-18.

At the commencement of fieldwork, census participants were emailed their census form along with an information pack. The information pack consisted of a Frequently Asked Questions (FAQ) document, a list of changes since 2015-17, and some other supporting documents to help respondents complete their census form.

The census forms and information packs were emailed to NRI projects on 21 February 2019, with projects requested to complete their census form by 22 March 2019[1].

Once all census forms were returned to Wallis, data was collated, sense checked, and analysed, forming the basis of this report.

[1] Several projects requested and received extensions on this data.

# 3.0 Use of National Research Infrastructure

## 3.1 Overall Users and Usage

On the census form, participants had the option of either entering their number of *users* and/or their number of *uses*. Participants were directed to decide this based on what was most relevant or appropriate to their project. The count of *users* is essentially a count of the number of researchers who have used a facility. Alternatively, a count of *uses* does not necessarily reflect how many researchers used a facility, as individual researchers will often contribute multiple *uses*. Typically, this is usually collected in relation to the use of online portal or accessing data.

Of the 21 NCRIS projects, 20 (95 per cent) of these completed the '**users**' option, and 15 (71 per cent) completed the '**uses**' option. These proportions are a little higher than the previous two years, with 67 per cent of the projects completing both options.

### Total Users – Program wide

As can be seen in Table 1, excluding 'Unaffiliated users'[2] (most of whom are accounted for by the Atlas of Living Australia (ALA) which had 230,324 Unaffiliated users), the largest users of NCRIS infrastructure are researchers from within universities, followed by users from government departments.

As can be seen in Figure 1, the number of domestic research users (excluding government department use and use by unaffiliated parties) in total across all NCRIS projects was considerably higher in 2017-18 compared to the previous two years. While domestic usage has risen noticeably, international usage has fallen somewhat, although not nearly to the same degree that domestic usage has risen.

As can be seen in Figure 2, domestic users from within universities has increased consistently and strongly since 2015-16, up by 17 per cent each year, or up by a third in total.

Table 1 Total *users* for 2017-18: By source

| User Source | Domestic | International |
|---|---|---|
| Researchers from within Universities | 45,763 | 10,710 |
| Researchers from within Publicly Funded Research Agencies (PFRA) | 2,113 | 257 |
| Researchers from within Medical Research Institutes (MRI) | 1,418 | 73 |
| Researchers from International organisations | 268 | 330 |
| Researchers from industry / commercial organisations | 14,440 | 661 |
| Researchers from within other organisations (please specify) | 1,608 | 18 |
| Users from government departments (incl. local government) | 20,222 | 1,228 |
| Unaffiliated users | 174,039 | 87,463 |
| Other (specify) / (further) disaggregation unavailable | 25,307 | 22,326 |
| **Total Users** | **285,178** | **123,066** |

[2] Unaffiliated users are individuals who are NOT part of a wider organisation including for purposes such as citizen science or primary / secondary education)

Figure 1 Researchers excluding Government departments and unaffiliated users, over time

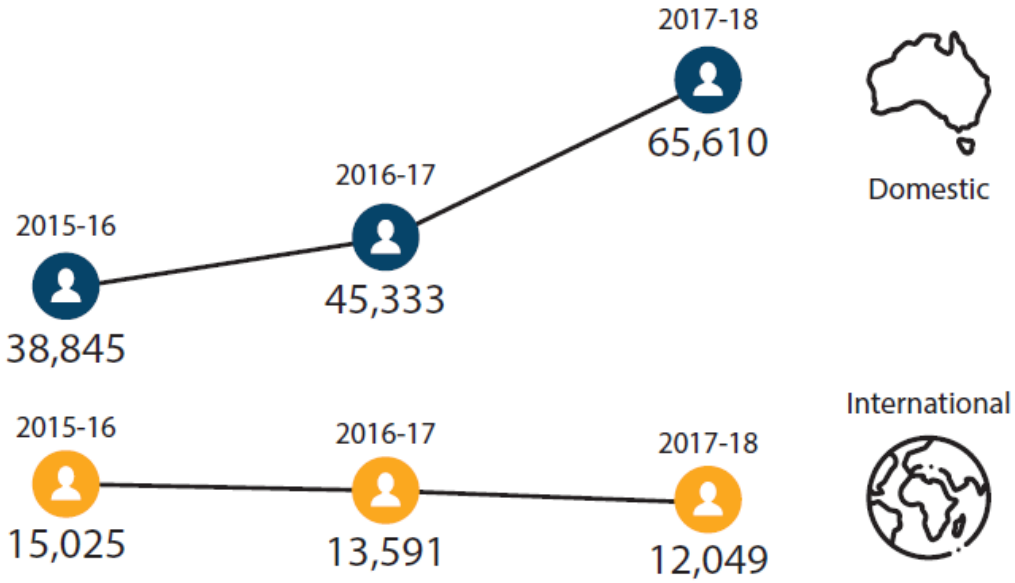
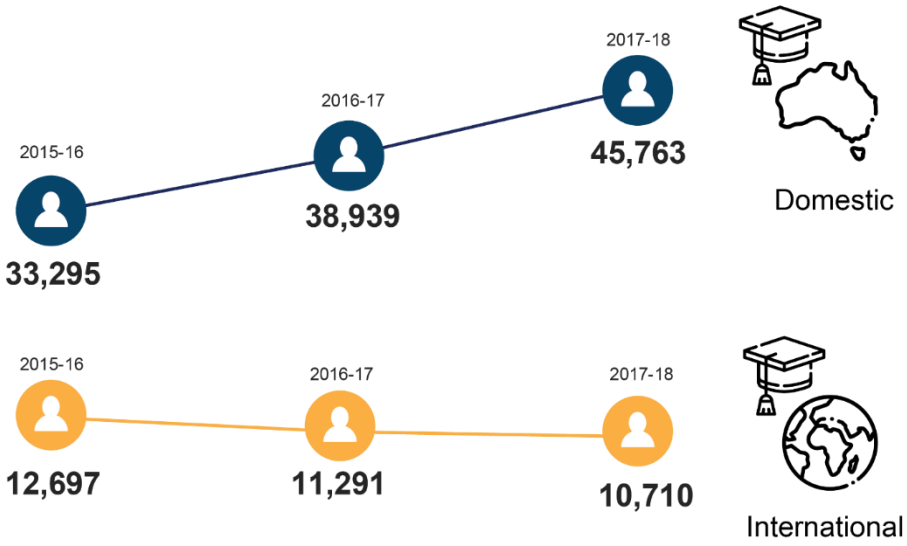



Figure 2 Researchers from within Universities over time




A similar broad pattern is identified when 'uses' (rather than users') is examined, with researchers from within universities being responsible for many uses of NCRIS facilities, although an even larger number of uses are attributed to Publicly Funded Research Agencies (PFRA). For some of the projects where 'uses' is the most logical metric, it is not possible to capture details on the individuals making such use, hence the high number of uses that are not possible to disaggregate. These disaggregated uses typically were related to computational or data services-based projects, in particular National Computational Infrastructure (NCI), which alone is responsible for nearly 337 million of the uses that could not be disaggregated. The number of uses for NCI has increased dramatically from 2016-17, but according to NCI, this is likely the result of changes they have made to how they measure uses.

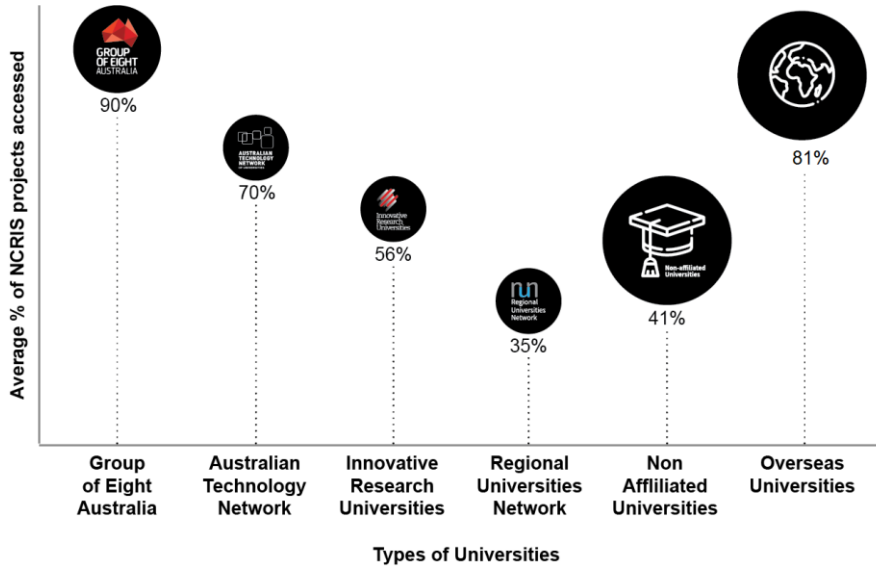
Table 2 Total *uses* for 2017-18: By source

| Use Source | Domestic | International |
|---|---|---|
| Researchers from within Universities | 4,191,318 | 117,592 |
| Researchers from within Publicly Funded Research Agencies (PFRA) | 6,527,402 | 7,408 |
| Researchers from within Medical Research Institutes (MRI) | 542,461 | 15,293 |
| Researchers from International organisations | 1 | 10,912 |
| Researchers from industry / commercial organisations | 35,412 | 6,076 |
| Researchers from within other organisations (please specify) | 19,931 | 9,991 |
| Users from government departments (incl. local government) | 3,816 | 207 |
| Unaffiliated users (i.e. individuals who are NOT part of a wider organisation including for purposes such as citizen science or primary / secondary education) | 4,145 | 1,397 |
| Other (specify) / (further) disaggregation unavailable | 337,120,722 | 8,696,909 |
| **Total Uses** | **348,445,208** | **8,865,785** |

## 3.2 Types of Users

The figure below shows how many of the NCRIS projects on average had their facilities used by various categories of universities. To illustrate, on average, approximately 19 of 21 (90 per cent) NCRIS projects provided facilities to users from any given Group of Eight university. In contrast, on average, only 35 per cent of NCRIS projects provided facilities to users from any given Regional Network University (RUN). However, it is important to note that researchers from all six RUN universities use existing NCRIS projects. There is a clear correlation, where the higher ranked an Australian university category is in terms of research impact, the greater the proportion of NCRIS facilities that universities from that category typically make use of. This pattern largely replicates what was found in 2015-2017.

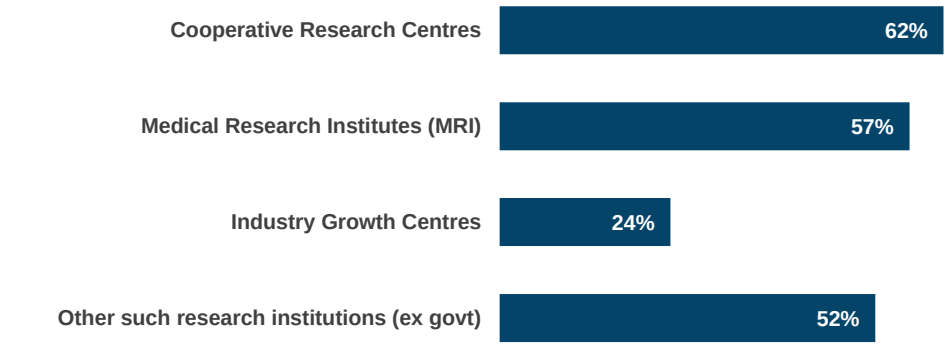
Figure 3 Average percentage of NCRIS Projects accessed by universities[3]




[3] The size of each bubble in the above chart is proportional to number of universities in the group/network, excluding overseas universities, for whom such a representation would not be practical.

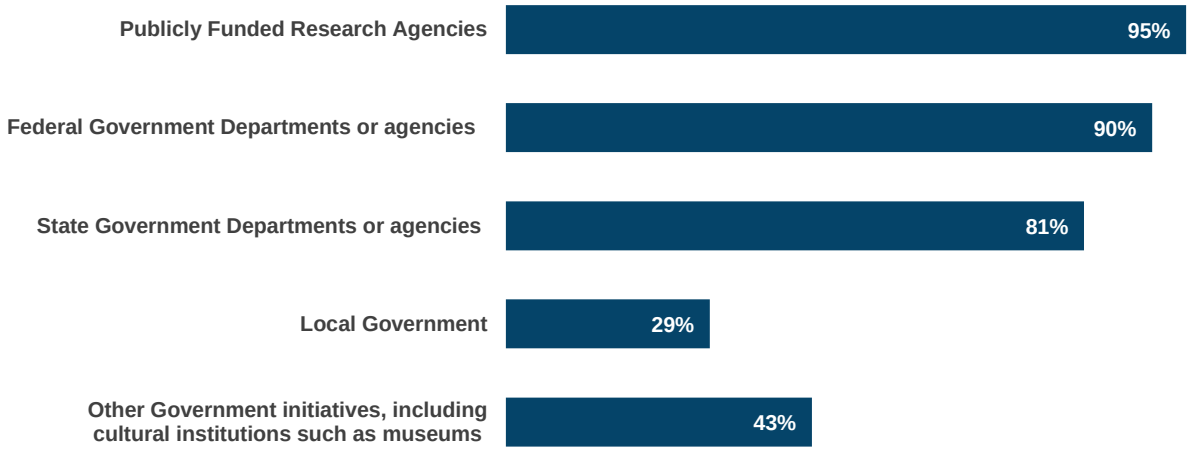
In terms of institutional users, 62 per cent of projects reported that cooperative research centres used their project's infrastructure. Similarly, 57 per cent reported that Medical Research Institutes used their project's infrastructure.

**Figure 4 Types of institutions using NCRIS infrastructure**




All but one NCRIS project reported that PFRAs used their project's infrastructure. The higher (or more central) the level of government, the greater use of NCRIS facilities.

**Figure 5 Which Government agencies used your project's infrastructure?**



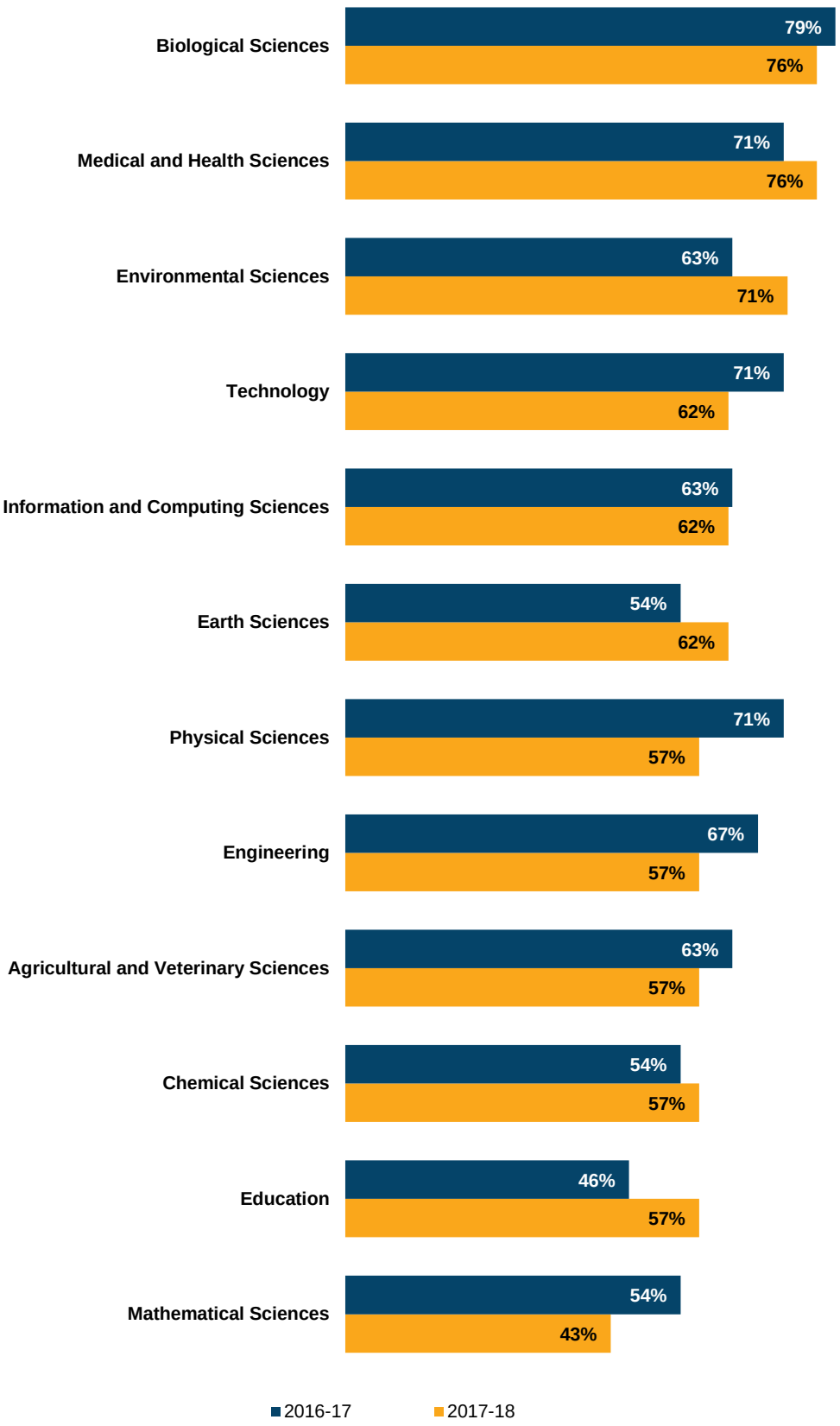

NCRIS projects also support other research projects funded through the Australian Research Council (ARC), as well as projects funded through the National Health and Medical Research Council (NHMRC). The breakdown of this can be seen in Table 3. It should be noted that the figures in Table 3 do not necessarily represent separate ARC /NHMRC funded projects, as some ARC /NHMRC funded projects are likely to be supported by more than one NCRIS project.

**Table 3 Does your project support research projects funded through any of the following schemes?**

| Proportion of NCRIS projects that support each category | | | |
|---|---|---|---|
| **Australian Research Council (ARC) schemes** | | **National Health and Medical Research Council (NHMRC) schemes** | |
| ARC Centres of Excellence | 67% | Project Grants | 24% |
| Discovery Projects | 62% | Fellowships and Scholarships | 19% |
| Future Fellowships | 48% | Program Grants | 14% |
| Industrial Transformation Research Program (Industrial Transformation Training Centres and Industrial Transformation Research Hubs) | 48% | Development Grants | 10% |
| Linkage Projects | 48% | Centres of Research Excellence | 10% |
| Linkage Infrastructure, Equipment and Facilities | 43% | Targeted Call for Research | 5% |
| Australian Laureate Fellowships | 38% | Other NHMRC Grants | 14% |
| Discovery Early Career Researcher Award (DECRA) | 38% | | |
| Special Research Initiatives | 24% | | |
| Discovery Indigenous | 10% | | |
| Linkage Learned Academies Special Projects | 5% | | |
| Supporting Responses to Commonwealth Science Council Priorities | 5% | | |
| Other ARC Grants | 14% | | |
| Any ARC funded projects | 86% | Any NHMRC funded projects | 38% |

Figure 6 displays the fields of research that are supported by over 50 per cent of NCRIS facilities. As shown below, 76 per cent of NCRIS projects are used by researchers from the Medical and Health Sciences, as well as by the Biological Sciences, making those the fields of research that make use of the highest number NCRIS facilities. Over 70 per cent of NCRIS facilities are also used by Environmental Sciences, while over 60 per cent of NCRIS projects are made use of by Earth Sciences. Fields such as Technology as well as Information and Computing Sciences also make use of the majority of NCRIS projects. While the humanities are less likely to use any given NCRIS project, it is interesting that all fields of research, even fields such as Philosophy and Religious Studies (14 per cent), nevertheless make some use of some NCRIS facilities. NCRIS project made use of by the humanities tend to be data or computing services, such as ARDC or NCI.

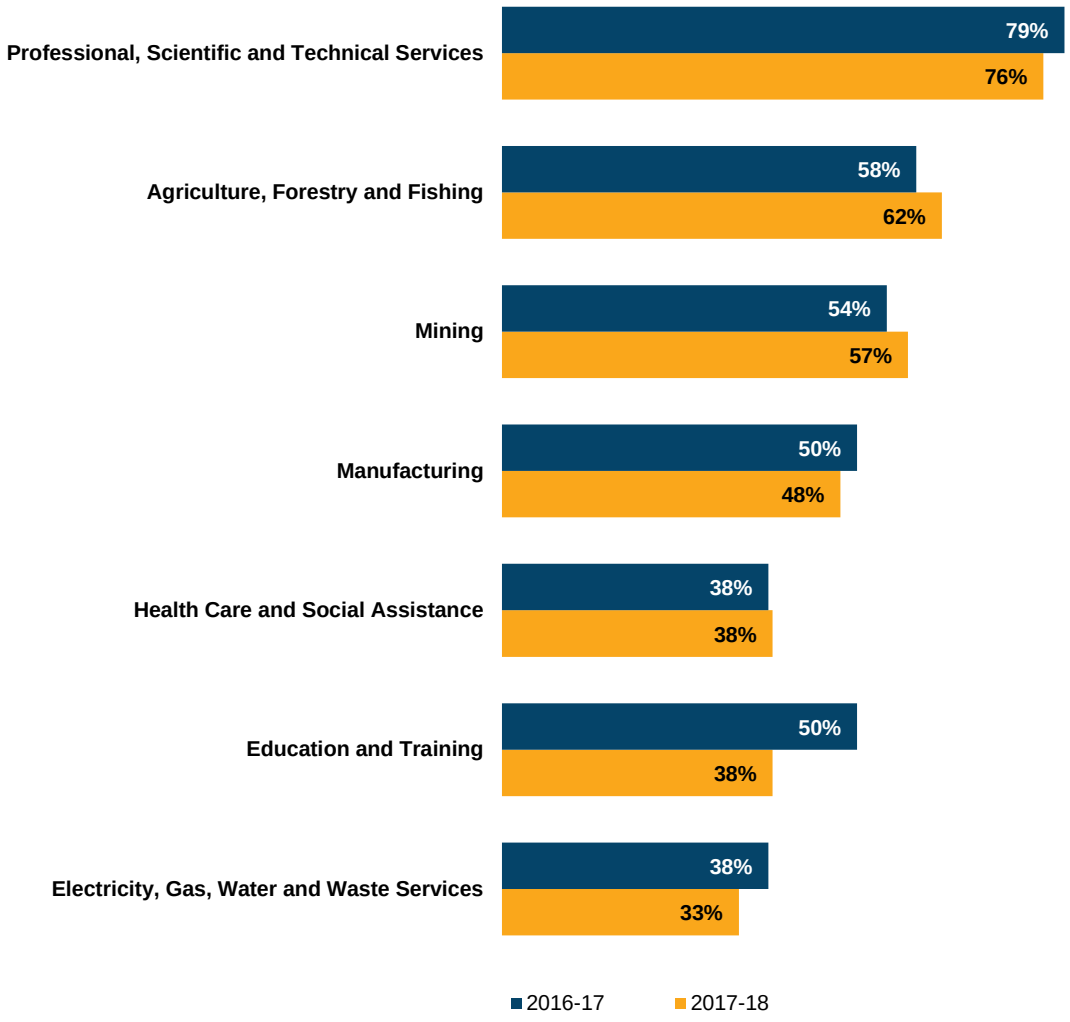
Figure 6 Proportion of facilities providing services to key fields of research[4]




[4] As responses for this item for 2015-16 were almost identical to 2016-17, 2015-16 has not been included in this figure.

As with the previous two years, the 'professional, scientific and technical services'[5] industry makes use of the highest number NCRIS facilities. Beyond this, the next most relevant industries for NCRIS facilities are the primary industries of Agriculture, Forestry, and Fishing, as well as Mining. More than half of the NCRIS facilities were provided services to these industries. In addition, approximately half of NCRIS facilities were made use of by the Manufacturing industry too. Figure 7 displays industries for which at least a third of NCRIS projects provide services to.

**Figure 7 Proportion of facilities providing services to key industries[6]**



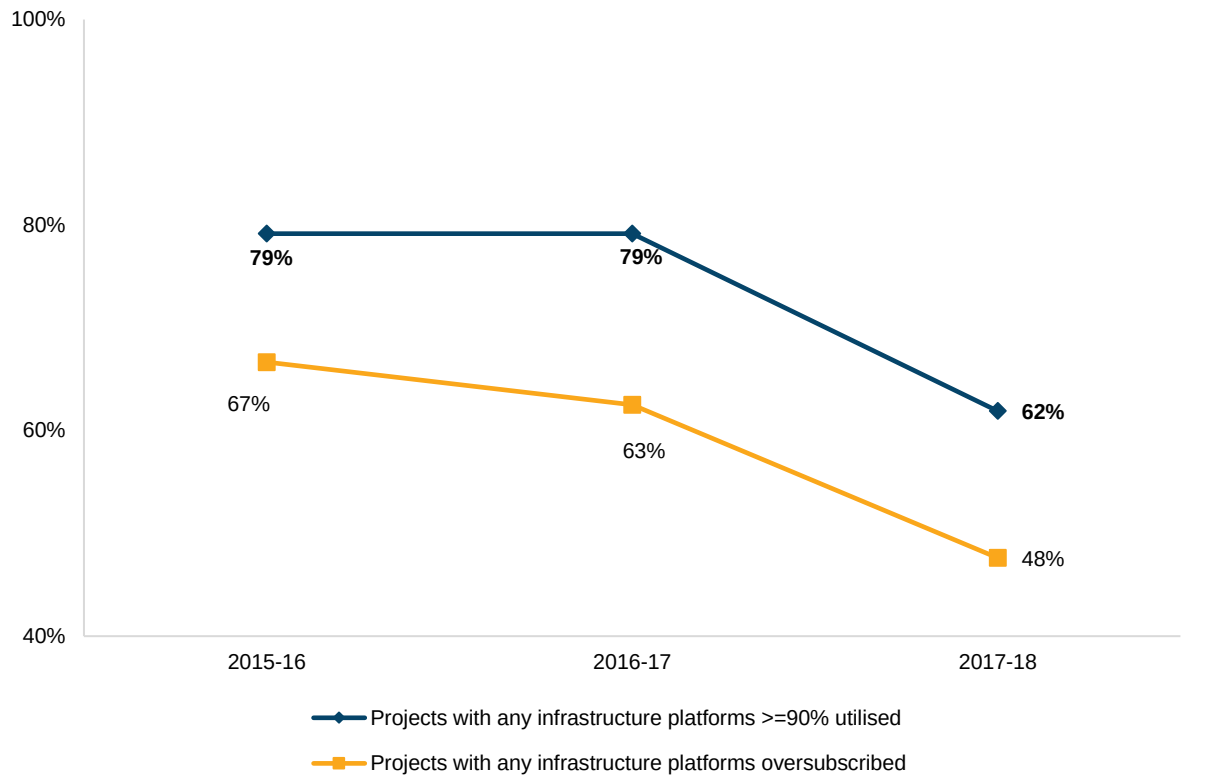

[5] Note that 'Professional, Scientific and Technical Services' industry includes scientific research, architecture, engineering, computer systems design, law, accountancy, advertising, market research, management and other consultancy, veterinary science and professional photography.
The industries listed in Figure 7 are based on the Australian and New Zealand Standard Industrial Classification (ANZIC, 2006 (Revision 2.0) Available at:
https://www.abs.gov.au/AUSSTATS/abs@.nsf/Latestproducts/8E1F8A5256947C58CA257B9500133B61?opendocument
[6] As responses for this item for 2015-16 were almost identical to 2016-17, 2015-16 has not been included.

## 3.3 Capacity and Utilisation

It can be seen in Figure 8 that the proportion of projects having at least one oversubscribed[7] infrastructure platform[7] has fallen since 2015-17. Whereas in 2015-17, almost 80 per cent of NCRIS projects had at least one technology platform at a utilisation level of 90 per cent or greater, a little over 60 per cent of NCRIS projects in 2017-18 had an infrastructure platform in that bracket of utilisation. Likewise, the proportion of oversubscribed platforms also has fallen noticeably. In 2015-17, around two-thirds of NCRIS projects had at least one oversubscribed technology platform. However, in 2017-18, less than half of NCRIS projects had an oversubscribed infrastructure platform.

The projects with the most infrastructure platforms at an utilisation rate of 90 per cent or greater were AuScope and the Australian National Fabrication Facility (ANFF), each with eight platforms with at least a 90 per cent utilisation rate (out of a total of 20 for AuScope and 27 for ANFF). Following these projects, Australian Plant Phenomics Facility (APPF) also had six platforms (out of a total of 17) with at least a 90 per cent utilisation rate. The project with the highest number of oversubscribed infrastructure platforms was Astronomy Research Infrastructure (9), more than the next two highest combined, Bioplatforms Australia (BPA) (4) and NCI (3)[8].

**Figure 8 Utilisation and oversubscription of infrastructure[9] platforms**




[7] Oversubscription is where user demand for an Infrastructure Platform exceeds the capacity. For example, if an Infrastructure Platform has a capacity of 100 users per month, but there is on average a demand of 120 users per month, the service is 20 per cent oversubscribed.
[8] On average NCRIS facilities have nine Infrastructure Platforms, with individual numbers per project ranging from one to 37.
[9] In 2015-17, the census form referred to technology platforms, whereas in 2017-18, the census referred to infrastructure platforms, this may have accounted for some of the difference.

# 4.0 Impact of National Research Infrastructure

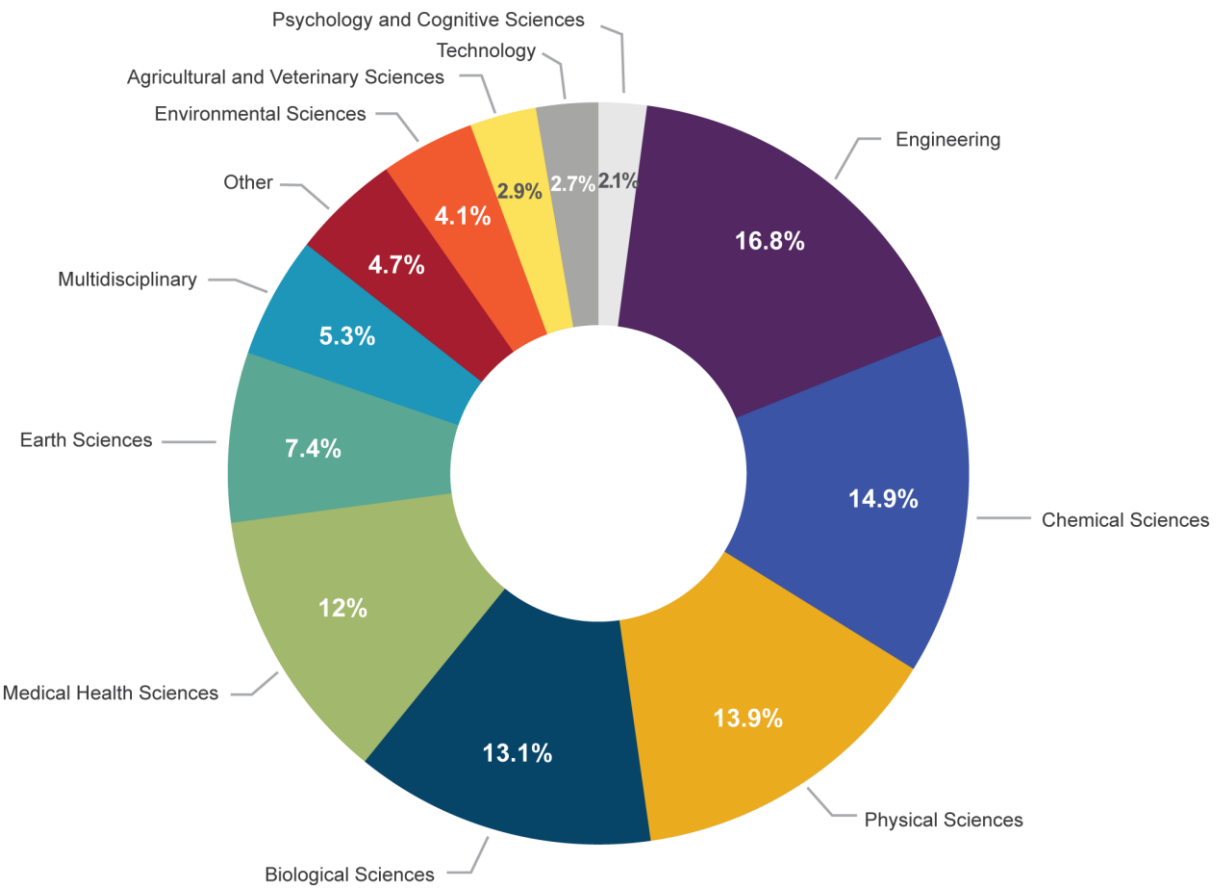
## 4.1 Academic Impact: Publications and Citations

The NRI census captured details from 20 of the projects on academic publications that had been created from research that made use of NCRIS infrastructure. The lists of publications were examined by the Department, through the online tool SciVal[10] to access research performance, and the key findings are outlined in this section.[11]

The analysis revealed that there were 8,371 publications enabled by NCRIS projects in 2017-18.

For the publications provided by NCRIS projects in 2017-18, the Fields of Research (FoR) chart below shows Engineering was the most common field, followed by Chemical Sciences and Physical Sciences. The 'Other' section of the chart includes groups such as Computer Software, Library and Information Studies, Curriculum and Pedagogy, Archaeology, and Artificial Intelligence and Image Processing.

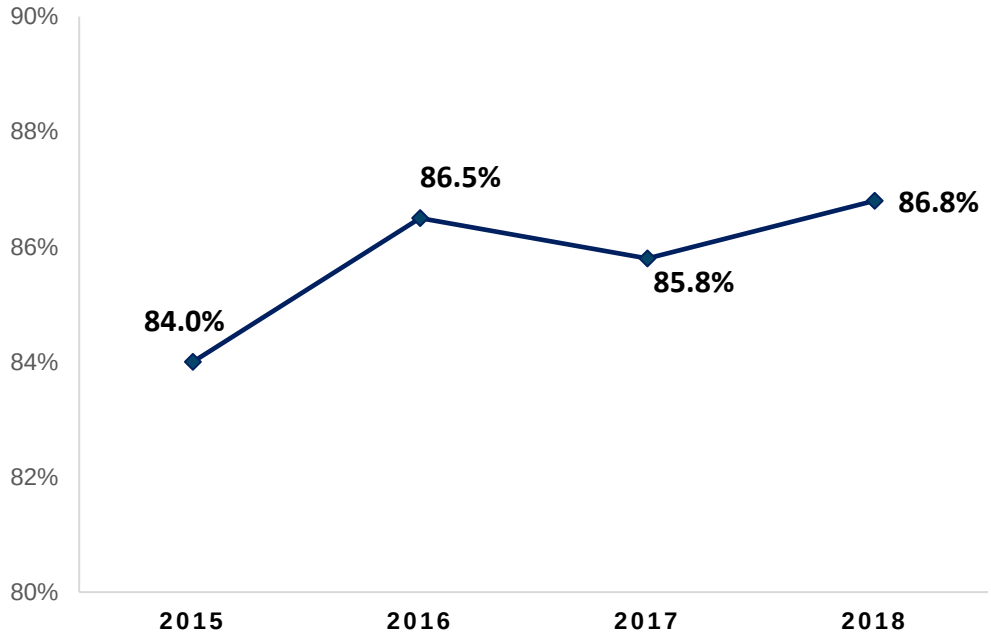
**Figure 9 Fields of Research Codes for 2017-18 NCRIS enabled publications**




[10] SciVal can be accessed through the following link: https://www.scival.com/
[11] Please note that SciVal regularly updates citation information. As such, results from citation metrics are likely to be different from the results from the previous NCRIS census report.

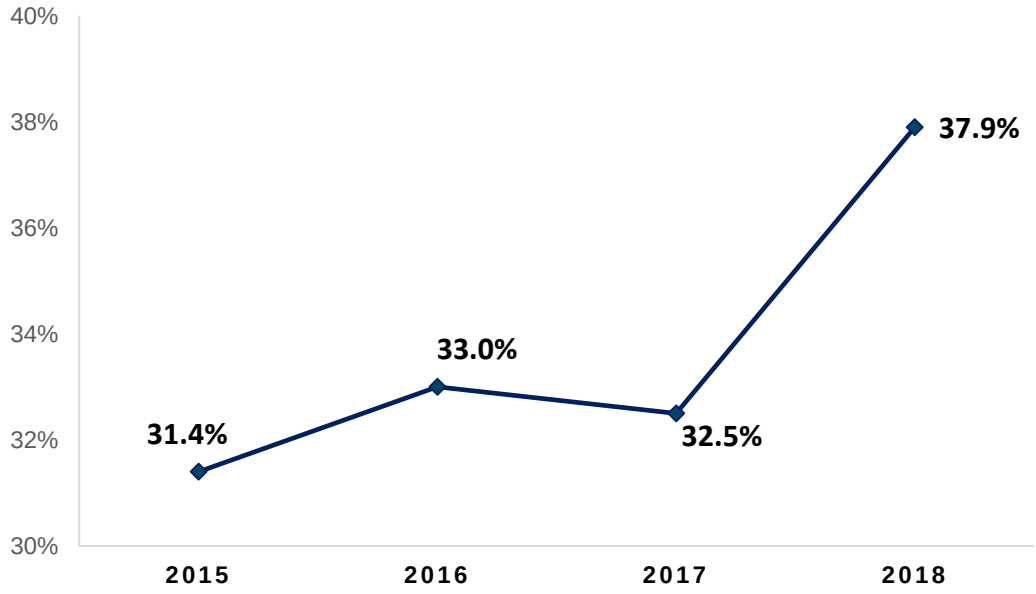
Aggregating publications enabled by NCRIS projects from both the 2015-17 and 2017-18 NRI Census collections, showed that from 2016 onwards over 85 per cent of articles are within the top 25 per cent of the world's journals. The substantial proportion of publications in these top journals can be used to demonstrate that research enabled by NCRIS is rated as world standard or above.

**Figure 10 Outputs in top 25 percentile of journals**




Publications created utilising NCRIS infrastructure tend to perform strongly in terms of citations. More than one third of publications for 2015-2018 that used NCRIS facilities to conduct their research were in the top 10 percentile of most cited publications.

**Figure 11 Outputs in top citation percentiles (top 10%), by year**



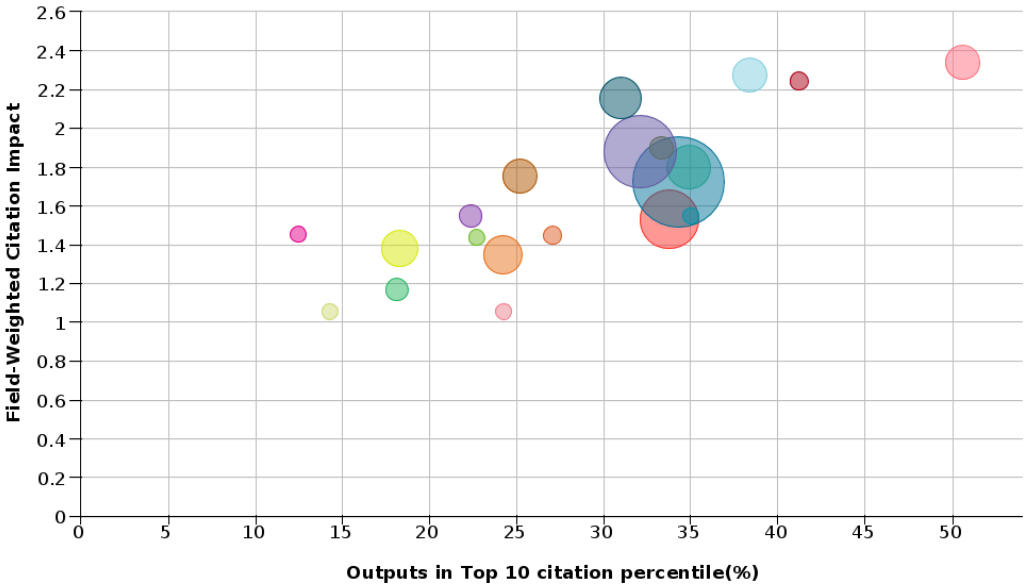
The Field-Weighted Citation Impact (FWCI) is the ratio of citations received relative to the expected world average for the subject field, publication type and publication year. A FWCI score of more than 1.00 indicates that the entity's publications have been cited more than would be expected based on the world average for similar publications.

The FWCI score for NCRIS enabled publications has increased over time from 1.87 for 2015 publications to 1.98 for 2018 publications. A score of approximately 2.00 suggests that the average publication emerging from NCRIS supported research has been cited more than twice as many times as would be expected for a similar publication in general. Also, between 2015-18, Australia's[12] FWCI increased over time from 1.58 for 2015 publications to 1.61 for 2018 publications. Thus, if we benchmark NCRIS enabled publications with Australia's aggregate publications for FWCI in 2015-18, NCRIS enabled publications have a higher FWCI score than the overall Australian aggregate of publications.

**Figure 12 Field-weighted citation impact, by year**


The chart below shows the FWCI of each[13] of the projects supplying publications data in 2017-18 on the vertical axis, with the proportion of outputs in the top-10 citation percentile along the horizontal axis. The size of each bubble is proportional to the scholarly output (i.e. the number of publications) of each project. While the project names have been anonymised, the message is nonetheless positive. All projects reported FWCI above 1.0, as well has having on average over 25 per cent or more of outputs rating in the top 10 citation percentile.

**Figure 13 NCRIS Projects publication outputs: relative scores on Field-Weighted Citation Impact and top-10 citation percentile**




[12] Australia's publications in this context is based on the publications dataset from the Scopus Universe. https://www.scopus.com/

[13] The chart does not include all NCRIS projects who completed the study. Some projects did not collect publications data.

Exploring collaboration, the year-on-year figures provide pleasing results. The proportion of publications exhibiting international collaborations in co-authorship has peaked in 2016 at approximately 56 per cent, but the result in 2018 (53 per cent) is still higher than it was in 2015 (approximately 52 per cent). It is important to note that as shown in section 5, many projects are wishing to expand their levels of international collaboration. A commercialisation impact of NCRIS enabled publications can be determined through academic-corporate collaborations. This metric is the extent that publications are co-authored across the academic, corporate and industrial sectors, which in general has been increasing for NCRIS enabled publications. As a benchmark, the overall NCRIS Academic-Corporate Collaboration proportion for 2015-18 publications is 3.6 per cent, which is higher than the overall figure for Australia (2.4 per cent) for that publication year range.

Figure 14 NCRIS-enabled publications: International Collaboration for 2015-18

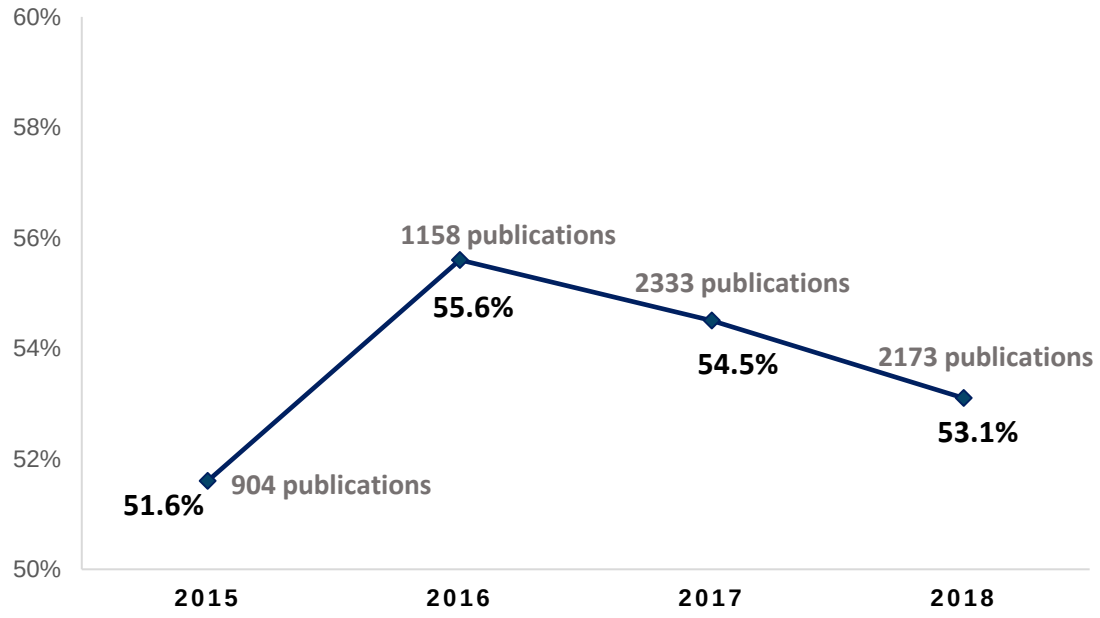
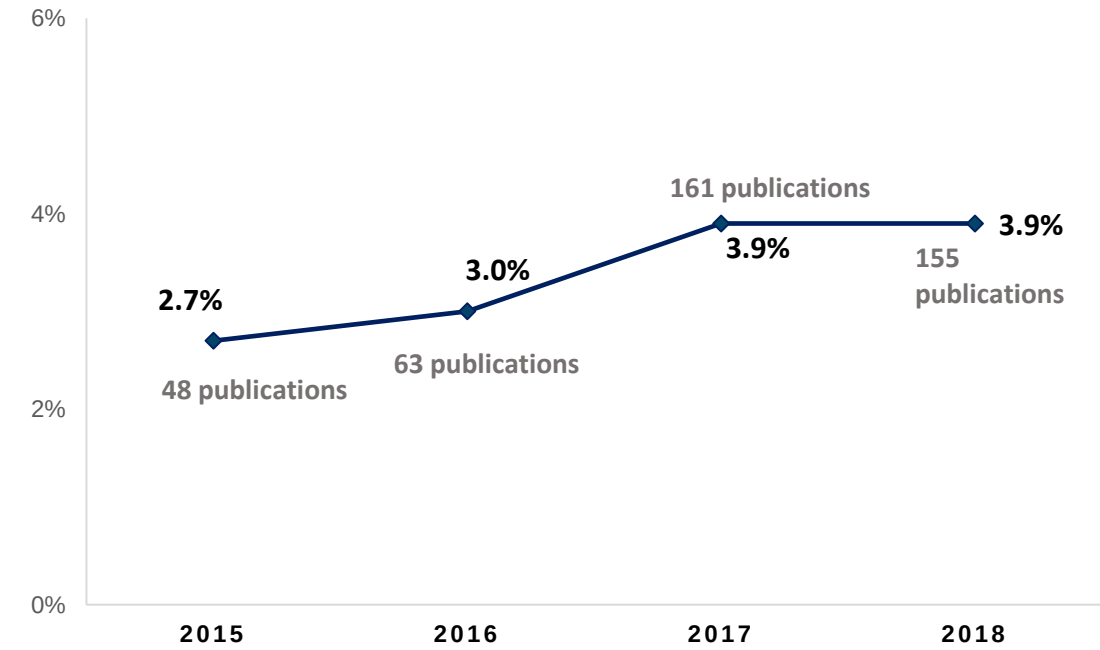



Figure 15 NCRIS-enabled publications: Academic Corporate Collaboration for 2015-18

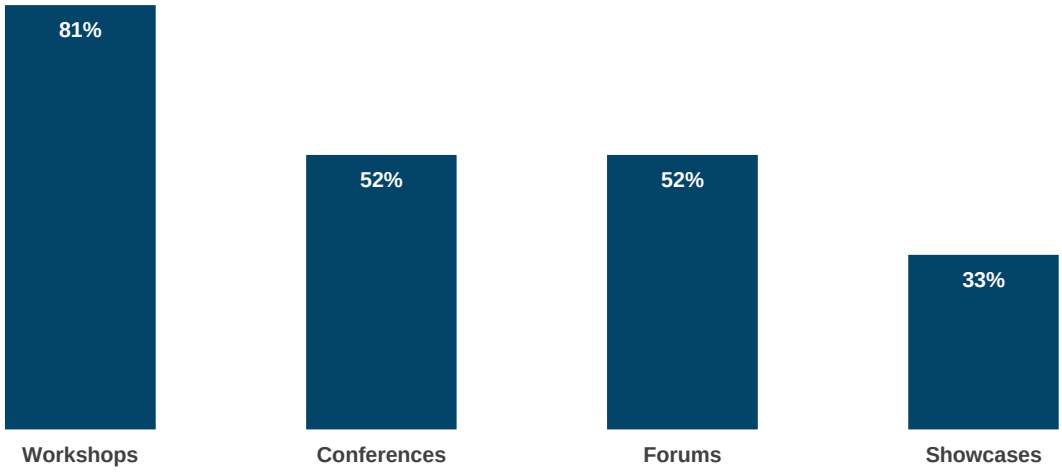


## 4.2 Promotional Activities

Nineteen of the 21 projects responded that they had produced or had published some promotional articles or materials during the reference period. An examination of the census responses shows that newsletters are issued by many of the NCRIS projects, as are annual reports, and that promotional materials can include multi-media content (e.g. videos online).

All 21 NCRIS projects had played a key participation role in promotional events. All but two of the 21 NCRIS projects had hosted or organised at least one promotional event in 2017-18. The proportion of NCRIS projects hosting or organising the various categories of promotional events can be seen in Figure 16.

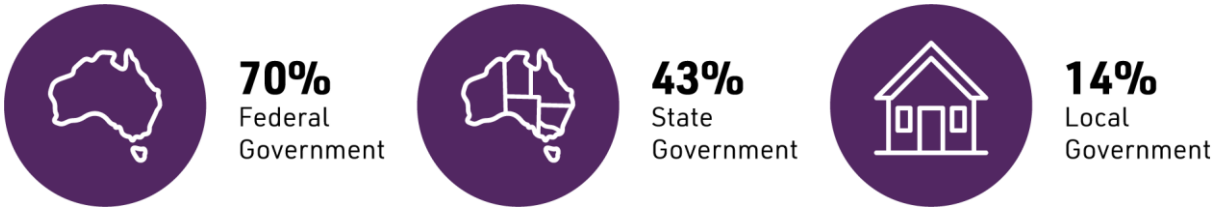
**Figure 16 Has the facility hosted/organised any promotional events?**




## 4.3 Enabling Government policies and programs

NCRIS projects are involved in a wide variety of policy areas. Over 70 per cent of projects provided critical or operational services/functionality to enable Federal Government policies and program delivery. A lower proportion of projects enabled program delivery by State Governments (43 per cent) and Local Governments (14 per cent).

**Figure 17 Proportion of projects providing critical support to federal, state, and local governments**




The raw data includes many examples of the above, and the variety of initiatives underway makes them somewhat difficult to further classify.

To illustrate, the example in Table 4 shows the many ways that BPA enables government policy development and program delivery.

Table 4 Bioplatforms Australia Roles in enabling government policy and program delivery

| Please outline any key government priorities that are supported by the facility, and outline the nature of the support… | | |
|---|---|---|
| **Description** | **Relevant government portfolio** | **Level of Government** |
| Assessment services for import consideration | Australian Quarantine and Inspection Service | Federal |
| Training and method development for assessment of biosimilars | Therapeutic Goods Administration | Federal |
| Risk characterisation, human performance | Defence Science and Technology | Federal |
| Environmental impact, threatened species breeding | Department of Environment | Federal |
| Genomics developments for use in pathology | Department of Health | Federal |
| Development of risk assessment mechanisms for importation of plants | Biosecurity Australia | Federal |
| Environmental impact, threatened species breeding | Department of Environment | State |
| Feral Species Analysis | Department of Primary Industries | State |
| Operationalising and workforce development for Genomics adoption | Department of Health | State |
| Biosecurity assessment | Museums, Zoos, and Gardens | State |

The following examples are illustrative of how NCRIS projects support government priorities.

### Population Health Research Network (PHRN)

***Health:***

> *National Innovation and Science Agenda: The PHRN links and facilitates access to government data for researchers to conduct innovative research.*

> *Australian Government Public Data Policy Statement: The PHRN facilitates collaboration between the government and research sectors to extend the value of public data for the benefit of the Australian public.*

> *Australian Government Science and Research Priorities – Health: The PHRN is improving access to and links between datasets as well as better coordination of data infrastructure.*

### Australian Nuclear Science and Technology Organisation (ANSTO) Nuclear Science Facilities

> *The Australian Centre of Neutron Scattering provides supporting capabilities industries closely aligned with the Defence White Paper, such as ship building, maintenance and repair, as well as the new frontier manufacturing of aerospace components.*

### Pawsey Supercomputing Centre

***Food:***

> *Weeds cost Australian grain growers $3.3 billion per year and cause annual yield losses of 2.7 million tonnes. Currently, the most efficient method of weed control available is to use a blanket application of herbicides, but this wastes resources and cultivates herbicide-resistant weeds.*

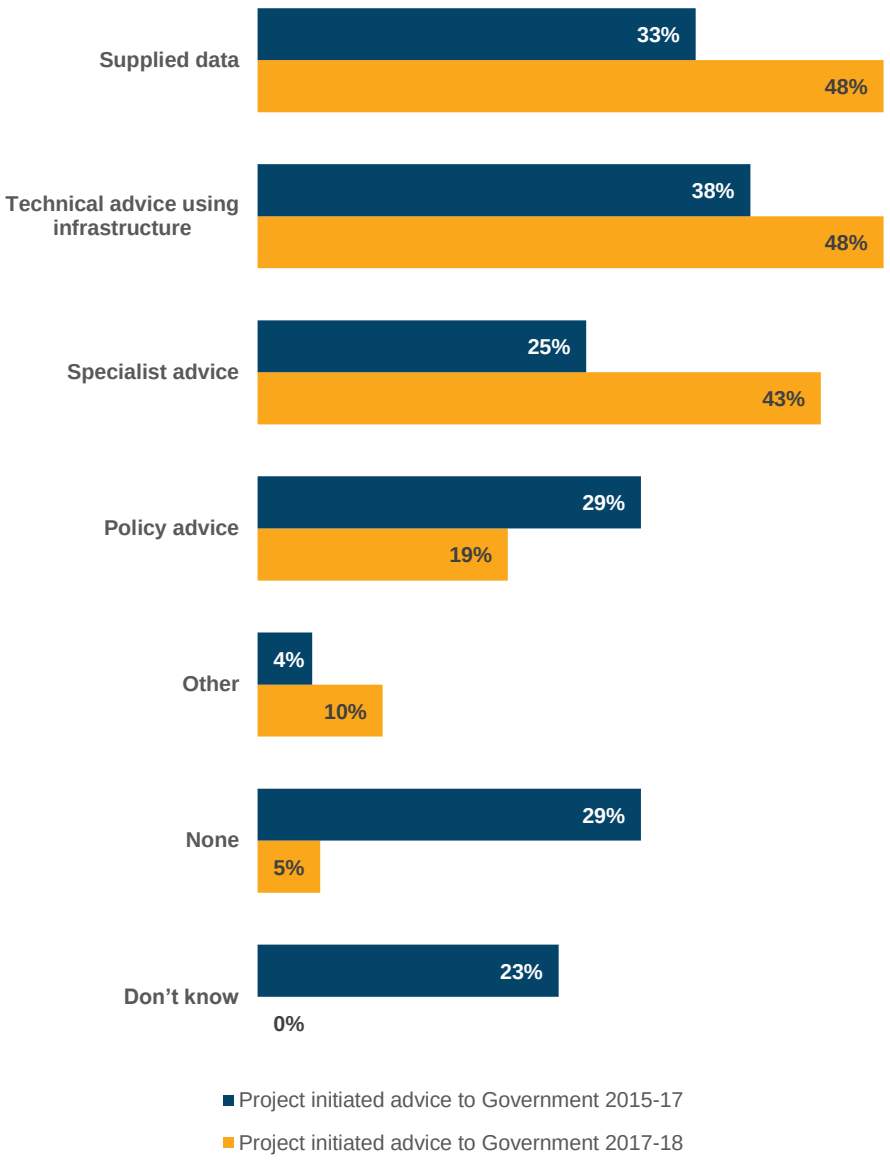
> *Edith Cowan University's Electron Science Research Institute (ESRI), alongside industry partners at the Grains Research and Development Corporation (GRDC) and Photonic Detection Systems (PDS), are developing technology that will allow grain growers to apply herbicides more selectively and efficiently. Using the power of Pawsey's world-class facilities, the ESRI team have made significant progress towards their goal of creating a commercially viable variable-rate herbicide applicator. They are currently in the process of optimising their system, with the hope that they will be able to test a fully functional prototype in the field in April 2018.*

> *Using reflected spectral data from lasers and spatial information from cameras mounted on tractor booms, their technology will use artificial intelligence to discriminate between the crop and weeds such as ryegrass, wild radish, and wild oats, and will spray herbicide only where it is cost-effective to do so.*

As can be seen in Figure 19, more than half of NCRIS projects have been called upon by the government to supply data as well as some other form of advice in order to inform government decision making. This demonstrates that government departments and agencies recognise the expertise of NCRIS personnel.

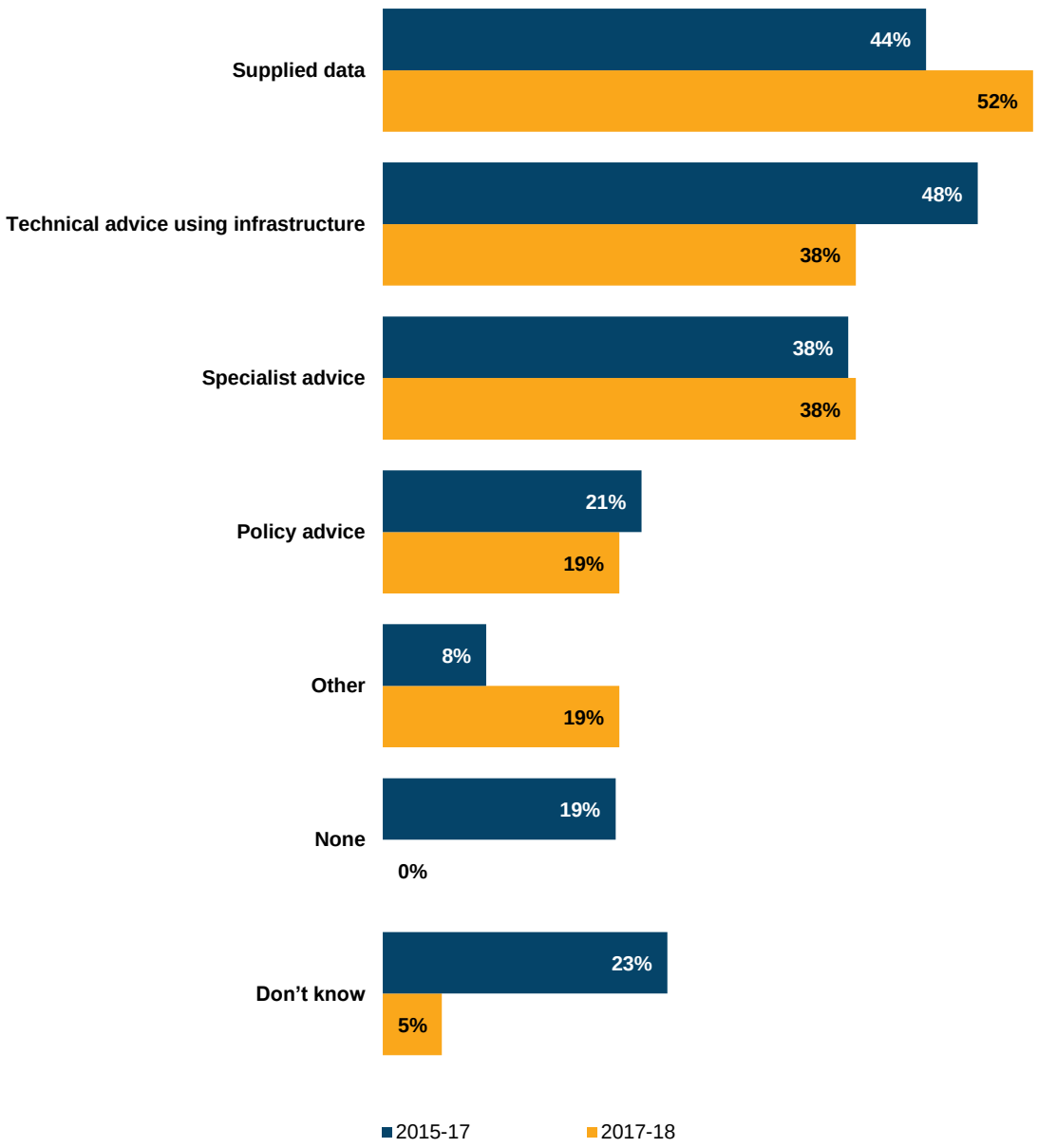
In comparison to 2015-17, the proportion of NCRIS projects that supplied various categories of advice requested from the government are relatively stable. However, in 2017-18, a noticeably higher proportion of projects **initiated** the supply of advice to the government compared to 2015-17, as seen in Figure 18. For example, in terms of initiating the supply of data, there has been an increase from 33 per cent to 48 per cent. In terms of initiating technical advice, there has been an increase from 38 per cent to 48 per cent. Finally, in terms of initiating specialist advice, there has been an increase from 25 per cent to 43 per cent.

Figure 18 Project initiated advice to Government[14]




[14] For items charted, frequencies for 2015-16 and 2016-17 were essentially identical, except for the "none" category. Therefore, these two reference periods have been averaged and displayed as 2015-17.

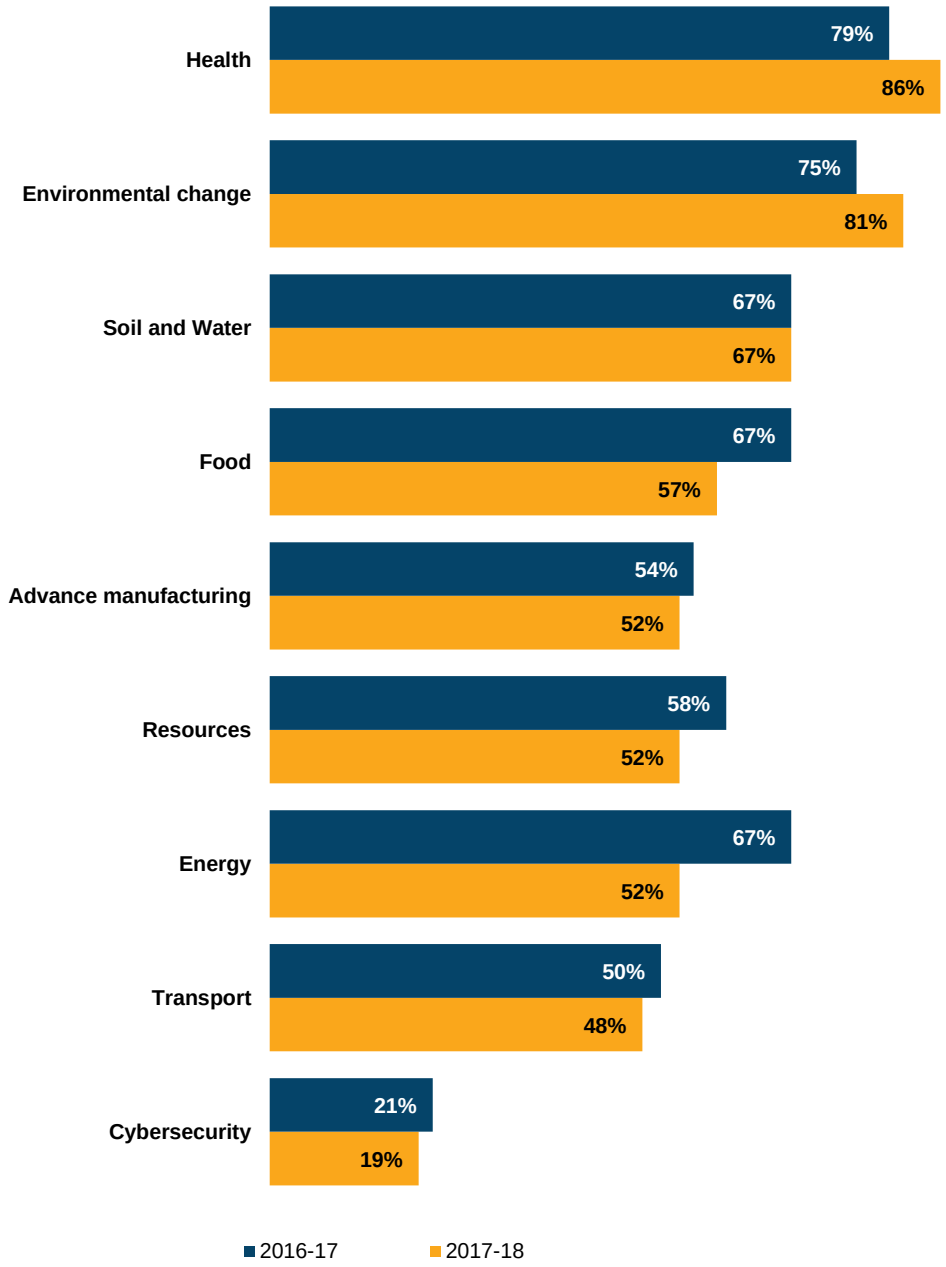
Figure 19 Advice specifically requested from the project by government[15]




In terms of the Australian Government's Science and Research priorities, 18 of 21 (86 per cent) NCRIS projects adressed the priority area of Health in 2017-18, while 17 (81 per cent) addressed the priority area of Environmental change. As can be seen in Figure 20, at the other end of the scale, there were four projects that addressed the area of cyber security. With the exception of Energy, differences between 2016-17 and 2017-18 are relatively small.

[15] For items charted, frequencies for 2015-16 and 2016-17 were essentially identical, except for the "none" category. Therefore, these two reference periods have been averaged and displayed as 2015-17.

Figure 20 Which of the Australian Government's Science and Research priorities did your project address? [16]




[16] The reference periods 2015-16 and 2016-17 were essentially identical on these measures and so 2015-16 is not charted here.

## 4.4 Commercial Impacts

Table 5 displays at a total NCRIS program level how many IP/commercialisation activities occurred during the reference periods as a result of infrastructure provided by the facility. The large increase in total commercialisation activities is mostly accounted for by the increase in Creative Commons-style licences.

The total number of Creative Commons-style licences increased in 2017-18 from a relatively small amount the previous year. However, 2500 of these were from the Terrestrial Ecosystem Research Network (TERN), since all TERN datasets are published under creative commons, and there are currently at least 2500 data collections which are under creative commons licences.

Likewise, although it appears that there is a lot of copyrighted material, it should be understood that 90 per cent of the total came from a single project, Microscopy Australia.

With regard to clinical trials, over 90 per cent of these were from Therapeutic Innovation Australia (TIA), which is to be expected given TIA's specialisation in clinical trial services.

Patents are a key category of commercialisation, and they have grown in 2017-18. Of the 72 patents in 2017-18, 29 of these were from TIA. This is a noticeable increase over TIA's patent count in 2015-16 (9) and 2016-17 (10). The other projects with significant patent counts were BPA (13), Microscopy Australia (12), and the ANFF (10).

**Table 5 Number of commercialisation outputs, by year**

| | 2015-16 | 2016-17 | 2017-18 | Proportion of projects with outputs in each category for 2017-18 |
|---|---|---|---|---|
| Creative Commons-style licences | 65 | 111 | 2693 | 33% |
| Copyrighted Material | 1108 | 1104 | 1112 | 29% |
| Clinical trials | 157 | 265 | 240 | 24% |
| Patents | 40 | 46 | 72 | 33% |
| Process improvements | 14 | 13 | 61 | 24% |
| Proof of concept | 105 | 112 | 55 | 24% |
| Licences | 44 | 34 | 39 | 24% |
| Invention Disclosures | 8 | 4 | 15 | 14% |
| Products introduced to market | 4 | 4 | 7 | 10% |
| New enterprises / spin-offs | 4 | 3 | 6 | 10% |
| Plant Breeders' rights | 0 | 0 | 0 | 0% |
| Other | 2 | 6 | 32 | 24% |
| **TOTAL** | **1551** | **1699** | **4332** | |

Some of the other benefits mentioned by projects included trademark filings, the issuing of open source software licenses, and licensing data for use. For example, APPF noted that:

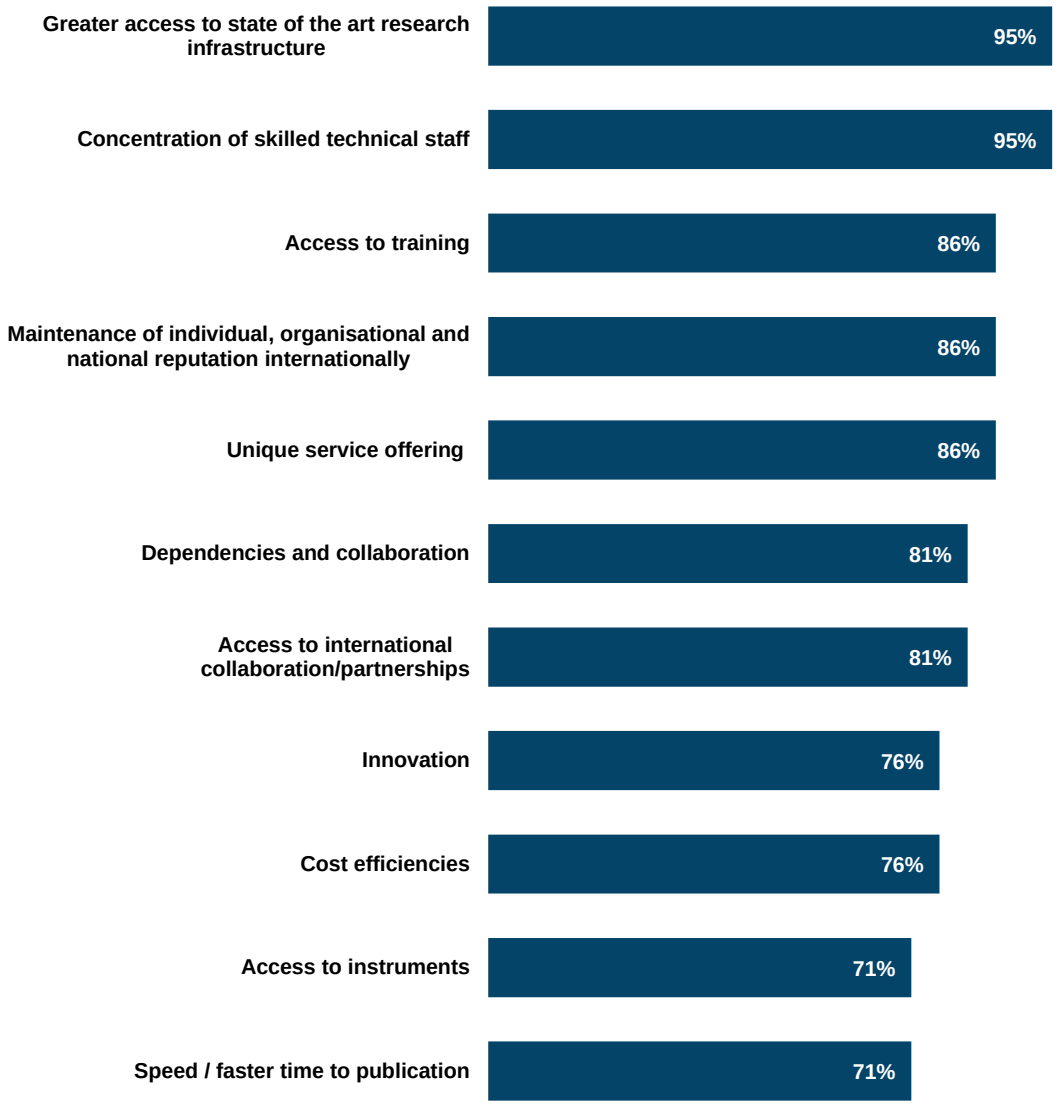
> *Trademark filings, Open source software licences. The phenoSMART trademark has been filed internationally and altered scope of services and has been registered in Australia; phenoMobile is registered in several key international markets and Australia.*

## 4.5 Overall Impact: Key Advantages

Over 90 per cent of NCRIS projects responded that concentration of skilled technical staff as well as greater access to state-of-the-art research infrastructure were key advantages that they offered their users. This can be seen in responses were very similar to the 2015-17 census, and hence only the current reference period is displayed.

Figure 21, where responses were very similar to the 2015-17 census, and hence only the current reference period is displayed.

**Figure 21 What are the key advantages the project offers users?**



The measurement of impact was extremely diverse across projects. Some projects used simple metrics such as user/usage metrics. Some projects used publication counts or metrics to measure their impact. Many projects had a much more complex, qualitative, and/or elaborate approach to evaluating their impact.

As an example, TERN had this to say about measuring its impact in 2017-18:

> *The impact of TERN is measured through user stories about the success to both researchers and decision makers of the way integrated, multi-scale data are making a difference to the way environmental change is being monitored and managed.*

Another example of measurement of impact for 2017-18 comes from NCI:

> *Support for research of excellence, assessed via:*
>
> - *ARC/NH&MRC metrics—number and value of grants*
> - *Publications, numbers and impact factors*
> - *Direct collaborative relationships with centres of excellence (ARC/NH&MRC)*
> - *Receipt of ongoing support from the ARC via a $1 million p.a. ARC LIEF Grant (2012-15, 2016-18) and award of a further increased grant commencing 2019.*
>
> *Support for research and innovation of national significance:*
>
> - *Supporting national program scale research through engagement with national science agencies (principally BoM, CSIRO, GA)*
> - *Funded contracts to support major national initiatives, e.g., hosting of national/international earth observation data collections*
> - *Significant dependencies of government on advanced computational services*
>
> *Recognition of leadership in the development of data-intensive computational services:*
>
> - *International benchmarking; recognition through awards to projects in which NCI is an integral partner (e.g., Digital Earth Australia)*

# 5.0 Collaboration

## 5.1 Domestic collaboration

Most projects had a variety of domestic collaborative arrangements. Invitations to speak at domestic conferences, forums, and meetings were reasonably well distributed amongst the various NCRIS projects. The largest share was from the PHRN (83), which made up about a fifth of the total. The high number of informal collaborative arrangements with industry organisations was mostly accounted for by Australian Animal Health Laboratory (AAHL) (244). In terms of the high number of formal collaborative arrangements with research organisations, the APPF (98) and the PHRN (70) together made up over 70 per cent of these arrangements. Regarding formal collaborative arrangements with industry organisations, Microscopy Australia (104) made up over 80 per cent of these. Finally, with informal collaborative arrangements with research organisations, ANSTO Nuclear Science Facilities (55) contributed 50 per cent of these.

**Table 6 Program-Wide Domestic Collaborative Arrangements in Place**

| Domestic collaborative arrangements | 2017-18 |
|---|---|
| Invitations to speak at domestic conferences, forums, meetings | 402 |
| Other informal collaborative arrangements with industry organisations | 261 |
| Other formal collaborative arrangements with research organisations | 235 |
| Other formal collaborative arrangements with industry organisations | 127 |
| Other informal collaborative arrangements with research organisations | 111 |
| Representation on expert working groups, reviews, key committees, etc. | 81 |
| Other formal collaborative arrangements with research infrastructure providers | 28 |
| Memoranda of Understanding (MOUs) | 17 |
| Other informal collaborative arrangements with research infrastructure providers | 17 |
| Awards, commendations, used as exemplar | 9 |
| Other | 1 |

## 5.2 International collaboration

Invitations to speak at international conferences was the most common international activity. This was relatively well distributed across the various NCRIS projects. The largest share was from BPA (43) which was a little over a fifth of the total amount. ALA (20) made up about a quarter of representations on expert working groups etc., while APPF (30) made up over 40 per cent of informal collaborative arrangements with research organisations. Finally, the Integrated Marine Observing System (IMOS) (14) made up about a quarter of formal collaborative arrangements with research infrastructure providers.

**Table 7 Program-Wide International Activities in Place**

| International collaborative arrangements | 2017-18 |
|---|---|
| **Invitations to speak at international conferences, forums, meetings** | 191 |
| **Representation on expert working groups, reviews, key committees, etc.** | 71 |
| **Other informal** collaborative arrangements with research organisations | 69 |
| **Other formal** collaborative arrangements with research infrastructure providers | 57 |
| **International research infrastructure facility bodies that the project was involved with** | 51 |
| **Other informal** collaborative arrangements with research infrastructure providers | 43 |
| **Memoranda of Understanding (MOUs)** | 41 |
| **Visits from international bodies seeking advice** | 41 |
| **Other formal** collaborative arrangements with research organisations | 29 |
| **Other informal** collaborative arrangements with industry organisations | 17 |
| **Other formal** collaborative arrangements with industry organisations | 13 |
| **Awards, commendations, used as exemplar** | 7 |
| **Other** | 27 |

As seen in the figure below, the vast majority of projects are involved with global research infrastructure.

As an example of the benefits from these global arrangements, the National Imaging Facility (NIF) stated that:

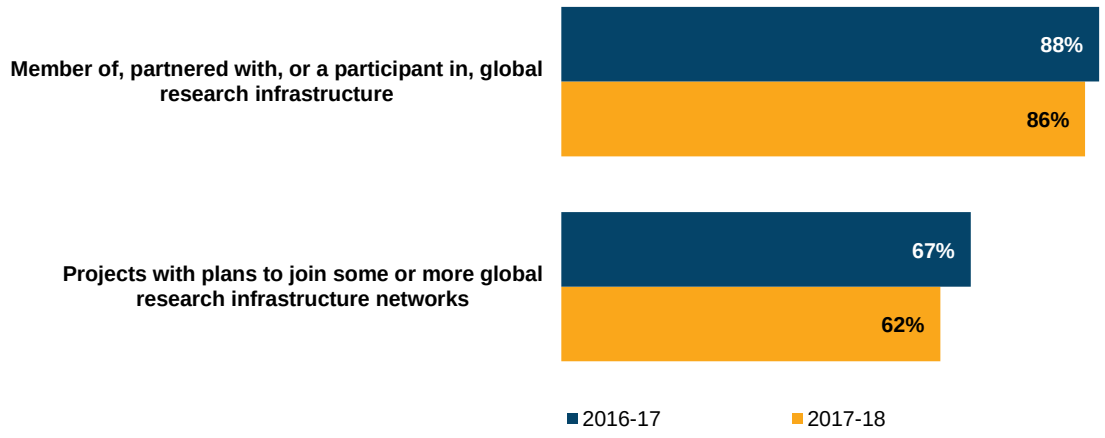
> *National Imaging Facility has a Memorandum of Understanding (MoU) with the EuroBioImaging that recognises the desire of both research infrastructures to enter a mutually beneficial alliance in supporting the advancement of scientific research. NIF is also a partner in Global BioImaging (GBI) Project, funded by the European Commission's Horizon 2020 Programme until end of 2018. Although the funding for GBI ended at the end of 2018, the partners have committed to the ongoing activities of the project.*

As another example, The Heavy Ion Accelerator (HIA) stated that:

> *We have a Memorandum of Understanding with the largest Heavy Ion Accelerator facility in Europe, the GSI/FAIR laboratory, funded internationally, but based in Germany. This is to work on research collaborations and technical developments of mutual interest, including superheavy element synthesis and superconducting accelerator development.*

Additionally, the majority of NCRIS projects plan to **increase** their involvement in global research and/or international collaboration in the future, as can be seen in Figure 22.

**Figure 22 Partnership in global research infrastructure, and plans for the future**[17]




Projects tend to find that participation in global or international research infrastructure enables them to adopt best practice as well as international standards.

For example, NIF stated that:

> *The purposes of future international memberships include, but are not limited to, development and adoption of best-practice procedures, development of next-generation technologies, and harmonising standards and protocols.*

[17] Note that this question was not asked specifically for 2015-16, so previous responses have been charted as 2016-17.

# 6.0 User Charges and Funding

## 6.1 Users and user charges

It can be seen in Table 8 that, with the exception of one NCRIS facility which charges most users full cost, it is only industry users, and to a lesser extent government users, who are sometimes charged full cost for accessing NCRIS facilities. Even so, it is still under half of applicable NCRIS facilities that charge industry users full cost. Notably, 50 per cent of meritorious researchers were charged no costs to access NCRIS facilities (based on merit selection or open access). Generally, academic researchers were charged either the marginal cost or no cost at all.

For some NCRIS projects, user interactions are such that a charging policy is not applicable. These projects have not been included in the formulation of the below table.

Table 8 Charging Structure, by User Types[18]

| User | No costs (based on merit selection) | No costs (based on open access) | Marginal Cost | Full Cost | Other arrangement |
|---|---|---|---|---|---|
| Meritorious researcher | 30% | 20% | 25% | 5% | 20% |
| Early-career researcher | 24% | 19% | 33% | 5% | 19% |
| Other academic researchers | 19% | 19% | 38% | 5% | 19% |
| Industry | 10% | 14% | 10% | 43% | 24% |
| Government | 6% | 28% | 22% | 17% | 28% |

The total NCRIS revenue from user-charging can be seen in Table 9. It is evident that the median is much lower than the mean for every reference period. This indicates that the distribution of project revenue is positively skewed, with a small number of higher revenue earners accounting for a relatively large proportion of the total revenue. The highest revenue earners for 2017-18 were BPA, AAHL, TIA, and NCI. These four projects accounted for nearly 80 per cent of the total revenue.

Table 9 Program Wide User Charges Revenue[19]

| Project revenue from User Charges | 2014-15 FY | 2015-16 FY | 2016-17 FY | 2017-18 FY |
|---|---|---|---|---|
| **Sum** | $64,706,513 | $84,575,346 | $104,609,455 | $71,228,981.06 |
| **Mean** | $3,806,265 | $4,975,020 | $6,153,497 | $5,087,784.36 |
| **Median** | $582,000 | $1,234,606 | $841,940 | $1,624,097.00 |

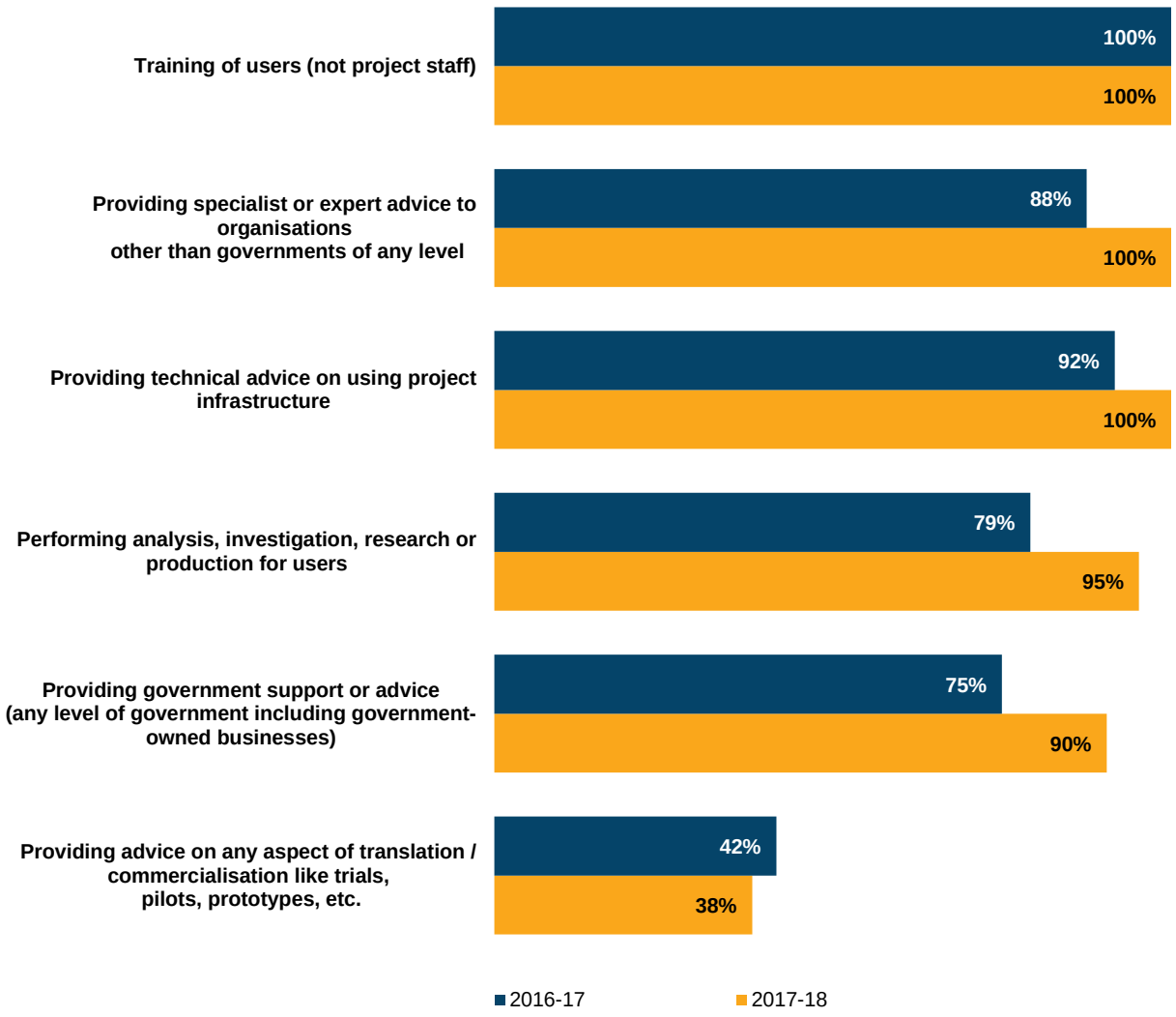
Although the total revenue has declined 32 per cent since 2016-17, it should be noted that the median revenue has increased by 93 per cent in that same timeframe. The fall in total revenue can be understood by looking at some changes with three of the four largest revenue earners. One of the largest revenue earners reported a reduced revenue compared to last year because they were still to finalise terms with one of their major clients, and hence a large portion of expected revenue had not yet been collected/reported. Another of the largest revenue earners has changed its reporting method so that a large portion of what was previously reported as revenue is now reported as collaborator co-investment. Finally, one of the largest revenue earners has substantially reduced its user charges resulting in lower revenue for that project.

[18] Table has been re-percentaged to exclude 'not-applicable' responses. Row percentages might not sum to 100 per cent due to rounding.
[19] The mean and median for this table includes only the NCRIS projects who reported receiving user-charging revenue in a given reference period. The table also incorporates figures from the 2014-15 census.

## 6.2 User training

All NCRIS projects provided user training to researchers, as well as advice on using their infrastructure. The chart below indicates NCRIS projects that were very strong in terms of training and assisting researchers to make the most out of their infrastructure. Support is not only offered at the initial data collection phase, but also 'value added' services as seen in Figure 23. For most of these user services, the proportion of projects offering these services has increased since 2016-17.

**Figure 23 Types of user service or support offered?** [20]




[20] The reference periods 2015-16 and 2016-17 were essentially identical on these measures and so 2015-16 is not charted here.

## 6.3 Co-investment

While Co-investment is not a condition of NCRIS program funding, the Commonwealth Government encourages collaboration and co-investment among universities, state and territory governments, PFRAs, independent and private sector research organisations, industry, and philanthropy. Co-investment includes cash contributions, as well as in-kind contributions. In-kind co-investment typically takes the form of, but not limited to: staffing on cost, rent/space, legal support, HR support, or a portion share of capital and operating expenses to leverage on the partnership.

The number of NCRIS projects that receive both cash co-investment as well as in-kind co-investment has increased since 2015-17, as shown in Table 10. Furthermore, all NCRIS projects now receive some form of co-investment, which was not the case in 2015-17.

Table 10 Proportion of NCRIS Projects receiving cash and in-kind co-investment

| | 2015-16 | 2016-17 | 2017-18 |
|---|---|---|---|
| **Cash and In-Kind co-investment** | 63% | 71% | 86% |
| **Cash co-investment only** | 4% | 8% | 10% |
| **In-kind co-investment only** | 17% | 8% | 5% |

It can be seen in Table 11 that the mean is much higher than the median. This indicates that the distribution of co-investment is positively skewed, with a large proportion of the total co-investment in NCRIS projects being accounted for by a relatively small number of projects.

Table 11 Program-wide Cash and In-kind contributions for 2017-18

| Co-investment from 2017 to 2018 | | | |
|---|---|---|---|
| | **Cash** | **In-kind** | **Total Co-investment** |
| **Sum** | $57,030,113 | $198,457,950 | $255,488,063 |
| **Mean** | $2,851,506 | $9,450,379 | $12,166,098 |
| **Median** | $1,252,129 | $5,083,246 | $7,074,746 |

In Table 12, it is apparent that both cash and in-kind co-investment have declined significantly since 2016-17. Some of this reduction is due to how projects are reporting co-investment. At least a couple of projects that are amongst the largest in terms of receiving cash co-investment have changed the way they report co-investment. This resulted in funds that would previously have been reported as co-investment reported otherwise.

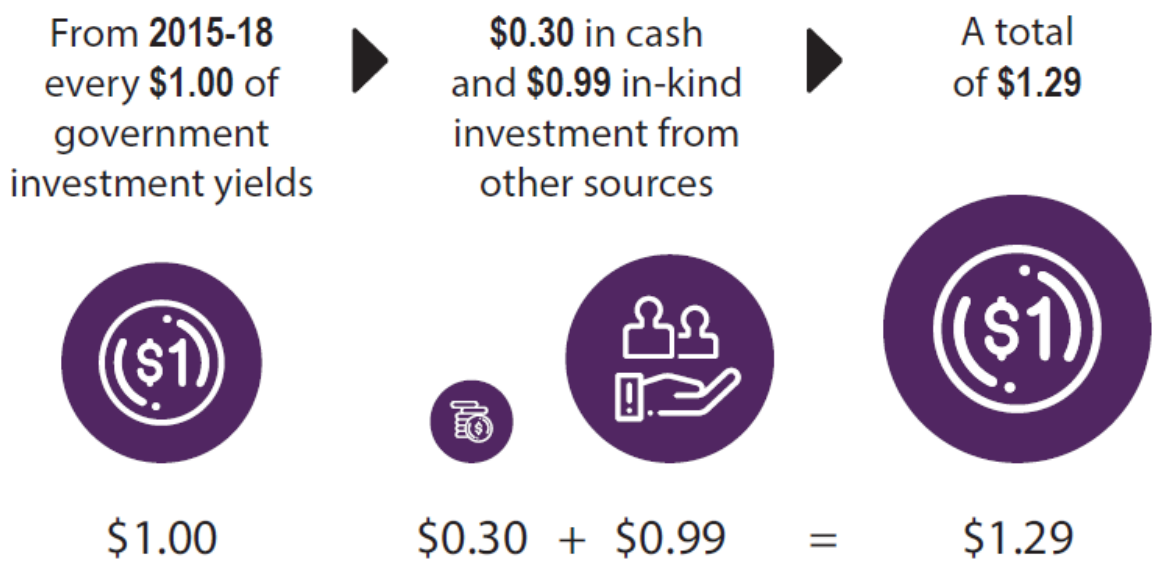
Table 12 Program-wide Cash and In-kind contributions for 2015-18

| Co-investment from 2015 to 2018 | | | |
|---|---|---|---|
| | **Cash** | **In-kind** | **Total** |
| **Sum 2015-16** | $61,383,386 | $242,011,880 | $303,395,266 |
| **Sum 2016-17** | $87,441,866 | $240,579,684 | $328,021,550 |
| **Sum 2017-18** | $57,030,113 | $198,457,950 | $255,488,063 |

Combining the co-investment figures for the three financial years of 2015-18 with NCRIS funding figures provided by the Department, yields the funding 'multipliers' shown below. At the program level, we see that NCRIS projects are able to leverage some 30c in cash co-contributions, and 99c in 'in-kind' contributions for every $1 in core funding invested. This yields a total multiplier of $1.29 for each dollar.

It is important to note that the total co-investment ratio for the 2015-17 NRI Census was $0.88 per $1.00 of government investment. These are not comparable as the co-investment calculation methodology has changed.

**Figure 24 Funding Multipliers for the three financial years 2015-18 combined**



# 7.0 People

## 7.1 Headcounts and Representation

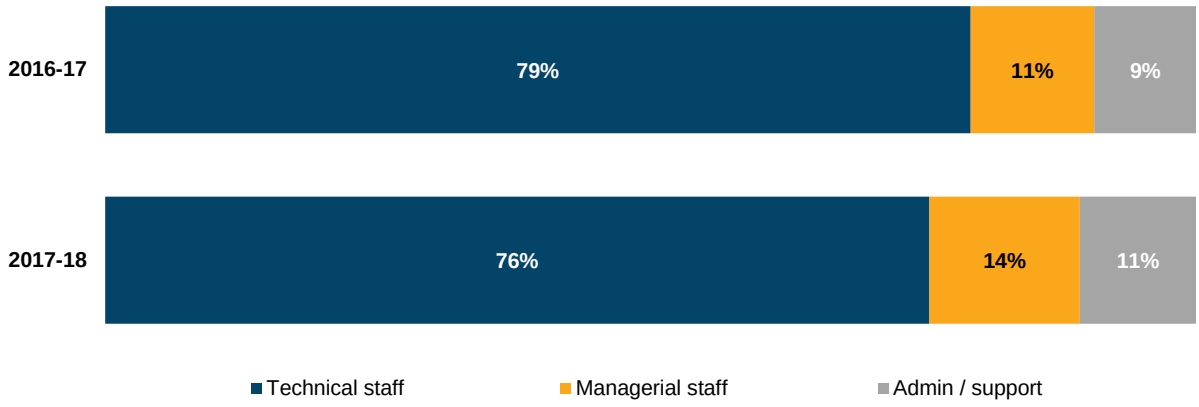
The program-wide headcount has declined by about 8 per cent since 2016-17. There was also a 12 per cent decline in full time equivalent positions.

Table 13 NCRIS Program-wide staffing

| Total NCRIS | 2015-16 | 2016-17 | 2017-18 | % Change 2016-17 to 2017-18 |
|---|---|---|---|---|
| Headcount | 1,963 | 1,975 | 1,809 | **-8%** |
| Full-time equivalent positions | 1,529 | 1,573 | 1383 | **-12%** |

The vast majority (76 per cent) of staff employed at NCRIS facilities are employed as technical staff, with managerial staff making up 14 per cent, and only 11 per cent of the headcount being administrative. Nevertheless, this reflects a small change from 2016-17, where technical staff made up a larger proportion of total NCRIS staff. This can be seen in Figure 25.

Figure 25 Staff categories, as a proportion of headcount[21]

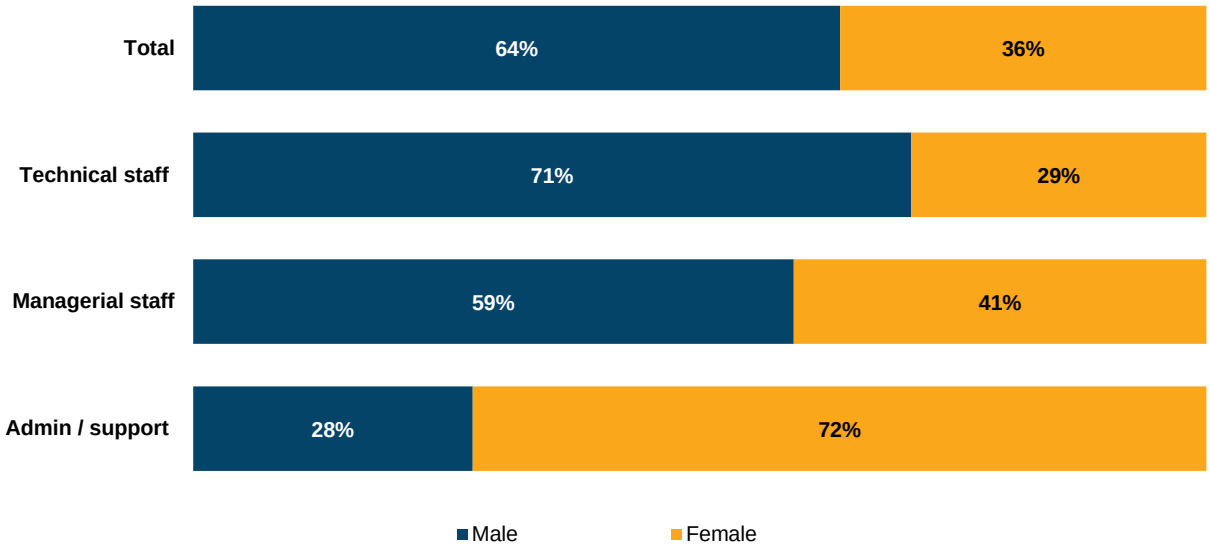



Across all the NCRIS projects in 2015-17, only one in four (25 per cent) staff members were female. Also as of 2017-18, more than a third of total NCRIS staff are female. Furthermore, in terms of managerial staff, females now exceed 40 per cent, as can be seen in Figure 26. As a relative comparison, the Office of the Chief Scientist's report on *Australia's STEM Workforce*[22] identified that 16 per cent of Australia's STEM skilled workforce are women.

The project with the highest rate of female employment in total is IMOS, of which 86 per cent of total staff are female. However, the project with the highest proportion of female **technical** staff is the Australian Phenomics Network (APN), with 87 per cent of their technical staff being female. Microscopy Australia has the highest proportion of female **managerial** staff (100 per cent).

[21] The reference periods 2015-16 and 2016-17 were essentially identical on these measures and so 2015-16 is not charted here.
[22] Available at https://www.chiefscientist.gov.au/2016/03/report-australias-stem-workforce

Figure 26 Proportion of NCRIS staff by gender[23]

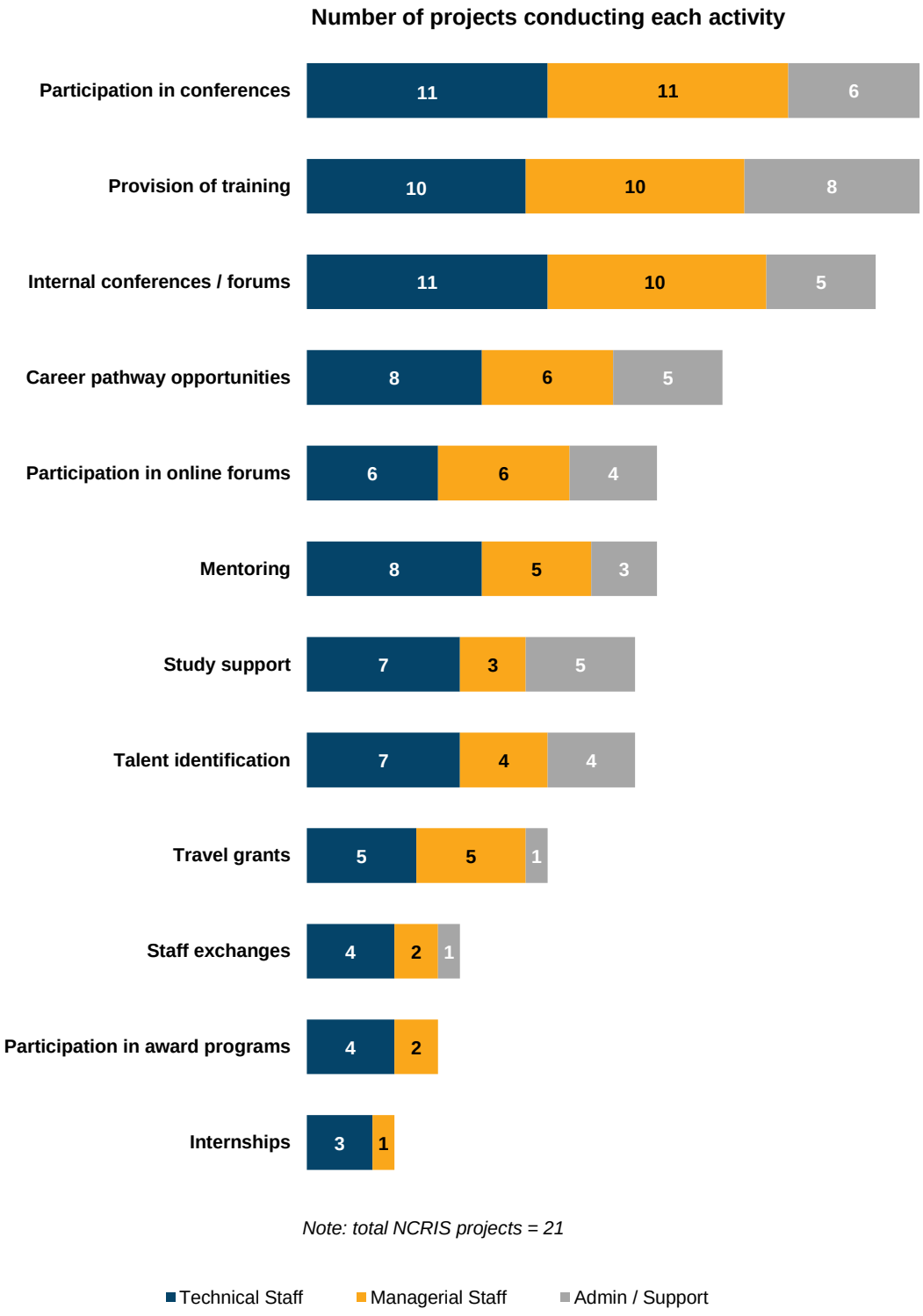



[23] Note that some NCRIS projects were unable to provide a gender breakdown of their staff. Some projects were unsure of their gender breakdown of some of their staff. The percentages here exclude from their base staff counts where gender is unknown or undeclared.

## 7.2 Building Human Capacity

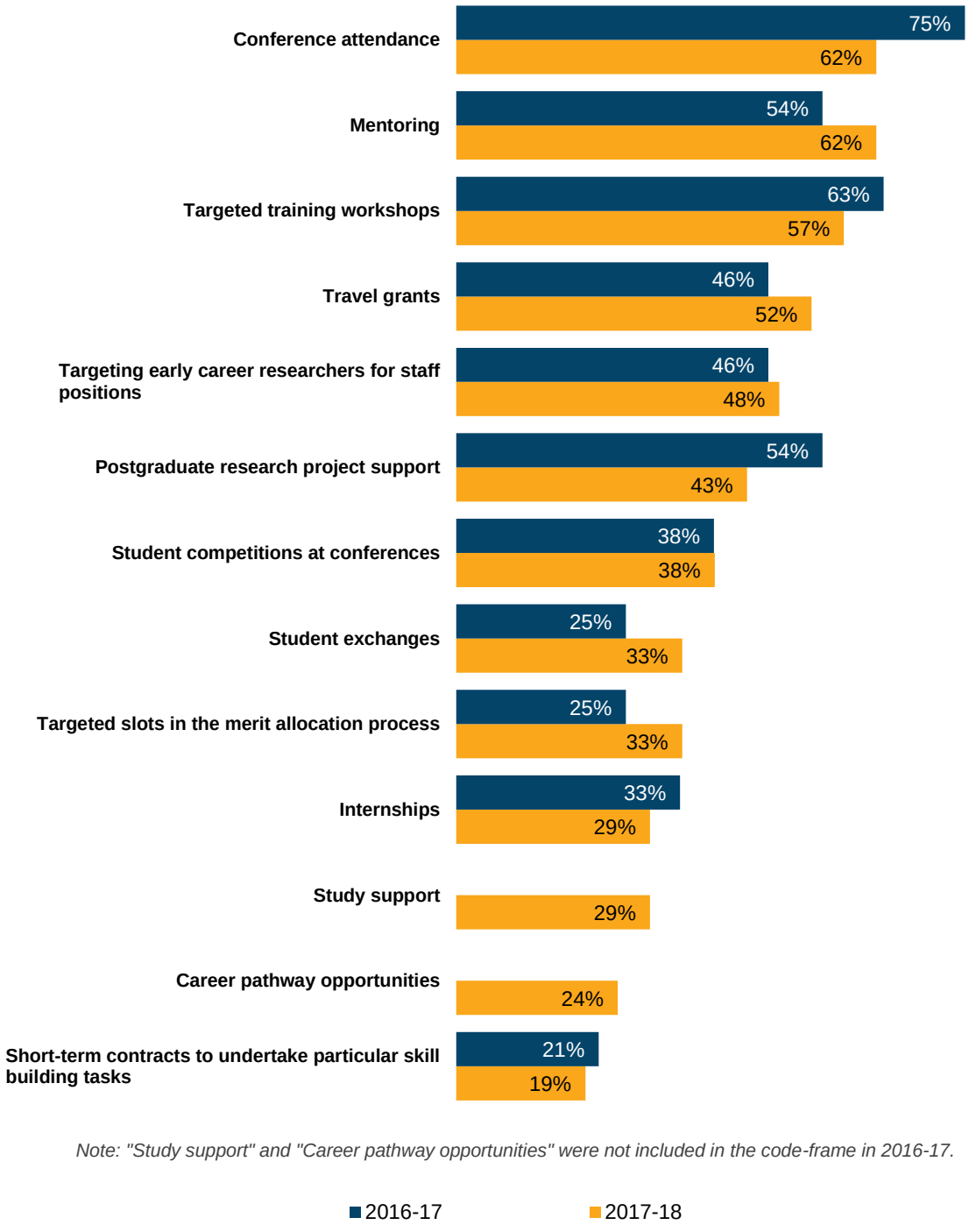
Most of the 21 NCRIS projects used participation in conferences as well as provision of training to create career progression opportunities. This indicates that NCRIS projects place a high degree of importance on training and professional development.

Figure 27 Activities conducted to build technical skills or create career progression



Conference attendance, along with mentoring, is the most frequently employed early-career initative. However, conference attendance appears to be not quite as freqeuntly employed as it was 2016-17, while mentoring appears to be more frequently employed than it was in 2016-17. More than half of the NCRIS projects also use initatives more specific to early-career researchers, such as targeted training workshops along with mentoring. However, just under half of NCRIS projects target early-career researchers for staff positions. Post graduate research project support appears to be used by a lower proportion of NCRIS projects in 2017-18 compared to 2016-17.

**Figure 28 Early-career researcher initiatives offered by projects[24]**




*Note: "Study support" and "Career pathway opportunities" were not included in the code-frame in 2016-17.*

[24] The reference periods 2015-16 and 2016-17 were essentially identical on these measures and so 2015-16 is not charted here.

# 8.0 NRI Infrastructure Platforms: Risk and future challenges

Over half of the NCRIS projects have at least one asset with risk of obsolescence in the next two years. Half of NCRIS projects have at least one asset with an unmanaged risk of some sort of failure during the same period. Furthermore, over the next four years, about 70 per cent of NCRIS projects have at least one asset with the risk of some sort of failure.

**Figure 29 Proportion of projects with an asset at risk of obsolescence or failure over the next two/four years**


Comments about the end-of-life scenarios and risk of failure were rather varied, as might be expected given the diverse range of NCRIS facilities. The following is an example of a comment submitted by HIA, which highlights that while the likelihood of failure of certain assets in a given period is low, the operational consequences can nonetheless be great.

> *The probability of any single item failing in a given year is low, but for key items, the short-term consequences for accelerator facilities can be interruption of operations for months, and in some cases replacement costs are high. Up to now, budgets have not allowed maintaining a stock of spares, and we have managed to avoid total operation shutdowns through temporarily re-purposing magnet power supplies, which restricts some accelerator uses, but does not shutdown operations. Maintenance, refurbishment and replacement are the sequence of actions we apply to all our sub-systems. This minimises expenditure but does require higher expenditure of accelerator staff time. The detailed knowledge of the sub-systems allows the most appropriate choice of action and widens our possibilities to cope with problems.*

Some projects provided some alternative perspectives on risk. For example, TIA sees risk more in terms of human resources than physical assets.

> *TIA capabilities are [arranged] around the expertise of highly trained translational scientists who offer bespoke services in support of therapeutic development. Therefore, the greatest risk is the inability to attract qualified and expert staff. As such, while there is less direct reliance on physical assets compared to staff assets. Additionally, TIA recently distributed $2.7M to address near-term critical equipment needs, such that the risk of near-term obsolescence and failure (2-4 years) for major assets is now reduced. These recent investments reflected planned future investments in facilities, which differ markedly from those that formed the TIA consortium in 2017-2018.*

Another perspective on risk was provided by NCI, which cautions against comparing obsolescence timeframes in the IT sector with those of other sectors.

> *For the IT sector … normal design life can be [approximately] 3 to 5 years. When compared with other sectors, this approach to risk might give the false impression that the IT sector is always in crisis, when it simply has a shorter upgrade cycle.*

## 8.1 Infrastructure Challenges for the future

Some infrastructure challenges for the present and future include the need to meet international standards, and the need to keep up with constantly evolving technologies. The challenge to provide accessible and high-quality data was also an important theme. In this report, we focus on the infrastructure challenges that reflect relatively universal themes.

As an example, below is a response from the APN about the challenge of rapidly evolving technologies in biomedical research

> *The technologies underpinning biomedical research, especially those related to the delivery of Genomic Medicine, are **fast evolving**. Therefore, the service developments and opportunities required to meet changing research needs are difficult to predict. Therefore, we need to undertake a continual process of service review and adjustment within an **agile** business delivery model to quickly modify investments in key areas to ensure sufficient resources are dedicated to meet the emerging needs.*

Similarly, from the ANFF:

> ***Maintenance of Cutting-Edge Facilities**: To maintain our position at the cutting edge of fabrication science we need to provide tools that fall into 2 main categories, new tools using existing technologies and new technologies that need new tools developed. The area of fabrication relies on a vast array of technologies to produce final products. Some of those technologies are stable and robust and while the instruments and tools may improve, the underlying technology is consistent.*
>
> *The other side to this is the **constant development of new applications** in the area of fabrication for current technology systems, such as the repurposing of AFM* [Atomic Force Microscopy] *technology to 3D nano-etching and other new technologies such as dual-photon lithography.*

> *The initial tool for these technologies is usually very bespoke and expensive, but it is crucial that a facility such as ANFF is at the forefront of employing these technologies and building expertise and user experience at the earliest steps to gain the best competitive advantage. In order to achieve this outcome, ANFF **needs to be able to move quickly**, provide resourcing and rapidly deploy these technologies when they arise. ANFF should also be part of the drive towards tooling that can provide outputs that cannot currently be achieved.*

An important challenge highlighted by NIF is how to prevent facilities from becoming financially inaccessible to researchers.

> ***Cost of access:** Remains too high for many researchers, especially those needing pilot data for funding applications. This is largely dominated by the cost of maintenance contracts on our infrastructure. There are no immediate solutions, as it requires additional funding to either cover the cost of the maintenance or provide subsidies to early career researchers to enable them to prepare competitive grant applications. In the meantime, we rely on our partners to provide internal grants to their staff. This does not support*

*researchers to get access to infrastructure outside their own institution. This is a perennial problem, and NIF will continue to look for opportunities to support our users.*

The challenge of providing FAIR data was highlighted by AuScope. The FAIR data principles are concerned with data meeting standards in the dimensions of Findability, Accessibility, Interoperability, and Reusability.

> *Integrated data assimilation framework for geoscience across research, government and industry. Much work has been done to **provide FAIR data** across the sector but the next 5 years are crucial to ensuring this develops as an integrated platform with strong national leadership and aligned development from AuScope, commonwealth and state government and other organisations to ensure a truly integrated and accessible product is delivered that spans geodesy, geophysics, geochemistry and geology.*

Another project to delve into the challenges of providing accessible but high-quality data was the Australian Urban Research Infrastructure Network (AURIN)

> *Perhaps the highest risk to AURIN is the data we hold. Users want data that is current and generally not found elsewhere on the Internet. The AURIN systems have been developed to tackle a range of urban data sets. For many users, other flavours of data are required. Without these data sets, there is a danger that AURIN will become like many open data efforts – of historic significance only. Many such data sets require payment for access and use since they are only accessible through commercial providers.*
>
> *The availability of data is increasing exponentially. Many organisations publish open data, but it is **typically very poorly curated**; in our field AURIN is **burdened by making these data discoverable**. Likewise, other (non-open) data is in greater demand, requiring negotiations to access and maintain these for researchers. This includes tackling far more voluminous data sets and/or data sets that are created in near real time. Such data require a rethink of the AURIN infrastructure and how it delivers data to users. This includes real-time traffic data, or weather data, or pollution data, or social media data for example.*

Finally, the projects have the challenge of measuring their impact. This is highlighted by the ARDC.

> *A perennial challenge for infrastructures which operate early in the research workflow is the ability to accurately and objectively reflect the impact of their services. This is a challenge faced by not only the ARDC but also our partners.*
>
> *Commencing in 2019, the ARDC will engage in activity to develop agreed impact measures across the research infrastructure system, including facilities to improve the discoverability and accessibility of the infrastructures themselves.*

## 8.2 In closing

There were several highlights of the 2017-18 NRI census. The number of domestic research users (excluding government department use and use by unaffiliated parties) in total across all NCRIS projects was considerably higher in 2017-18 compared to the previous two years. At the same time, NCRIS projects were generally reporting less over-subscription and over-utilisation.

While domestic usage has risen noticeably, international usage has fallen somewhat, although not nearly to the same degree that domestic usage has risen. Also, when the number of university research users is examined over time, it is evident there has been strong and steady growth domestically over the last three reference periods. However, the number of users from overseas universities, during that same timespan, has continued to decline, albeit at a much slower rate.

Regarding fields of research, in comparison to the two previous years, a noticeably higher proportion of NCRIS projects are being utilised by the Medical and Health Sciences, as well as the Environmental Sciences. The Medical and Health Sciences are now, along with the Biological Sciences, the fields that utilise the highest proportion of NCRIS projects. The Environmental Sciences are now clearly the next most prolific users of NCRIS projects, after the Medical and Health Sciences and the Biological Sciences.

Another highlight for 2017-18 has been the recorded increase in the employment of women in the NCRIS program. Across all the NCRIS projects in 2015-17, only one in four staff members were female. However, as of 2017-18, more than a third of total NCRIS staff are female. Furthermore, in terms of managerial staff, female staff now exceed 40 per cent.

Co-investment continues to be a vital and valuable part of the NCRIS program. Combining the co-investment figures for the three financial years of 2015-18 with NCRIS funding figures provided by the Department, yields an impressive funding ‘multiplier’. At the program level, we see that NCRIS projects are able to leverage some 30c in cash co-contributions, and 99c in ‘in-kind’ contributions for every $1 in core funding invested. This yields a total multiplier of $1.29 for each dollar.

Patent data is often used by economists as an indicator of scientific and technical progress[25] as well as innovation[26]. In this context, a worthwhile highlight is the growth of patents that have come about as a result of the NCRIS program. The number of patents has risen from 40 patents in 2015-16 to 46 patents in 2016-17, and then up to 72 patents in 2017-18. In other words, in just two years, there has been an 80 per cent increase.

Finally, some infrastructure challenges for the present and future include the need to meet international standards, and the need to keep up with constantly evolving technologies. The need to provide accessible and high-quality data is also an important and growing infrastructure challenge.

[25] Griliches (1990), "Patent Statistics as Economic Indicators: A Survey," Journal of Economic Literature.
[26] Nagaoka, Motohashi, and Goto (2010), Patent Statistics as an innovation indicator, in Hall and Rosenberg (eds.), Handbook of Economics of Innovation

# APPENDIX 1

NRI Census Form

# 8.3 Australian Government Department of Education National Research Infrastructure Census

## 8.3.1 Questionnaire (2018)

### INTRODUCTION

The Australian Government Department of Education and Training is tasked with providing an aggregated and detailed picture of how the National Research Infrastructure supports quality research that benefits Australia. To help achieve that objective this tool will collect data from National Research Infrastructure facilities across Australia.

This census is a requirement for NCRIS projects and fulfils obligations under the NCRIS guidelines.

The data and reports generated from the responses provided will be used to assist with policy development, program planning and investment plans.

Wallis works within the Australian Privacy Act. Any information you provide about the project or its users will remain with the Government or Wallis on behalf of the Government. We believe that there are no questions that will reveal a project user's identity. However, the data you provide is not confidential, in that the Department will be able to identify your response.

A final public report will be developed that will provide a summary of the data collected, and any direct attributions to projects in the report will be discussed with individual projects prior to finalisation.

### REFERENCE PERIOD

The survey's reference period is the 2017-18 financial year.

### HELP OR QUESTIONS ABOUT THE SURVEY

If you require any assistance or have any queries, please email Wallis at ncris@wallisgroup.com.au

## INTRODUCTION (continued)

## SECTION A: PROJECT DEFINITION & INVENTORY CONFIRMATION

A1 When answering individual questions, answers might change depending on the boundaries that you set for your project. For example, a certain definition may count in (or out) a particular piece of equipment and this in turn may affect the number and type of users.
We are asking you to define your project and to keep it in mind when answering all questions. (**[NCRIS] Wherever possible, and except where specifically advised otherwise, we ask that you focus your project reporting on the activities of the project that are NCRIS-funded.**)

**[ALL]** We also ask you to be mindful of double counting and to avoid it, where possible. This may mean communicating with another project and asking them to count in (or out) particular facilities, tools or other resources. For example, ARDC (NECTAR, ANDS, and RDS) funded tools are to be excluded from all projects' answers except for ARDC's.

Please explain the scope of the project (your definition) that you have chosen when answering questions here. This may be useful to record if more than one person from your project is answering the survey. They can use this answer as a reference.

95 Please specify

## SECTION B: USE

This section of the census relates to how the project was made use of in the 2017-18 financial year.

It is up to your project to define a user. If necessary, use project lead / chief investigator as a unit of measure and advise of any issues in the text box at the bottom of this page.

B1 Across the 2017-18 financial year, how many users did the project have in each of the following categories?

*Note: this question differs from B2. This question is about how many entities people used the project. B2 is about how many times the project/facility was used.*

*If your project cannot measure the number of **users**, please select 'cannot measure users' then complete the table B2.*

Please enter a number in each of the cells below. (If zero, it's ok to leave it blank)

| | Domestic | International |
|---|---|---|
| Researchers from within Universities | | |
| Researchers from within Publicly Funded Research Agencies (PFRA) | | |
| Researchers from within Medical Research Institutes (MRI) | | |
| Researchers from International Organisations | | |
| Researchers from industry / commercial organisations | | |

| | | |
|---|---|---|
| Researchers from within other organisations (please specify) | | |
| Users from government departments (incl. local government) | | |
| Unaffiliated users<br>*(i.e. individuals who are NOT part of a wider organisation including for purposes such as citizen science or primary / secondary education)* | | |
| Other (specify) / (further) disaggregation unavailable | | |
| Total | | |

95 Please type in any notes for us to be aware of in your definition of users
99 Cannot measure users
*(i.e. your project is setup to measure uses rather than users, proceed to next question)*

B2 Across the 2017-18 financial year, how many times was the project used in each of the following categories?

*Note: this question differs from B1, which is asking about number of users. This question is asking about the number of times the project was used or accessed as a discrete count.*

*If you provided a measure of users in the previous questions, but also have measured the number of times the facility was used, please include these measures in the table below.*

RESPONSE

Please enter a number in each of the cells below. (If zero, it's ok to leave it blank)

| | Domestic | International |
|---|---|---|
| Universities | | |
| Publicly Funded Research Agencies (PFRA) | | |
| Medical Research Institutes (MRI) | | |
| International Organisations | | |
| Industry / commercial organisations | | |
| Other organisations (please specify) | | |
| Government departments (incl. local government) | | |
| Unaffiliated uses<br>*(i.e. individuals who are NOT part of a wider organisation including for purposes such as citizen science or primary / secondary education)* | | |
| Other (specify) / (further) disaggregation unavailable | | |
| Total | | |

95 Please type in any notes for us to be aware of in your definition of uses

**For the following question (B3/B3A), projects have the option to provide information on usage of your facility at either the Infrastructure Platform level (B3) or at the Asset level (B3A).**

**It is up to projects to choose which is the most applicable question for you to report use and oversubscription.**

**Please only complete ONE of the questions - B3 or B3A.**

Please list all of your Infrastructure Platforms in the description column.
B3: During the 2017-18 financial year, what percentage of your facility was being used? And to what extent were any components over-subscribed?"

*For example, if an asset has a capacity of 100 users per month, but there is on average a demand of 120 users per month, then the service is 20% oversubscribed*

| | Please enter a number in each of the cells below. (If zero, it's ok to leave it blank) | | Please select whether the asset is best described as hardware or software | | |
|---|---|---|---|---|---|
| | % being used | % over subscribed | Hardware | Software | Intangible capability |
| Infrastructure Platform_1 | | | | | |
| Infrastructure Platform_1 | | | | | |
| and so on … | | | | | |

B3A: During the 2017-18 financial year, what percentage of your facility was being used? And to what extent were any components over-subscribed?

| | Please enter a number in each of the cells below. (If zero, it's ok to leave it blank) | | Please select whether the asset is best described as hardware or software | | |
|---|---|---|---|---|---|
| | % being used | % over subscribed | Hardware | Software | Intangible capability |
| Asset_1 | | | | | |
| Asset_2 | | | | | |
| and so on … | | | | | |

Please add in any comments in regards to your facility, its use and over-subscription.

NOTE: B4 eliminated as only one reference period in this census.

B5 Which universities (this includes any users from these universities) used your project's infrastructure?
*Please describe what services your project provided to those universities.*

Please select all that apply.

| code | University | 2017-18 | What services did you provide |
|---|---|---|---|
| 01 | Australian Catholic University | | |
| 02 | Australian National University | | |
| 03 | Bond University | | |
| 04 | Carnegie Mellon University - Australia | | |
| 05 | Central Queensland University | | |
| 06 | Charles Darwin University | | |
| 07 | Charles Sturt University | | |
| 08 | Curtin University | | |
| 09 | Deakin University | | |
| 10 | Edith Cowan University | | |
| 11 | Federation University Australia | | |
| 12 | Flinders University | | |
| 13 | Griffith University | | |
| 14 | James Cook University | | |
| 15 | La Trobe University | | |
| 16 | Macquarie University | | |
| 17 | Monash University | | |
| 18 | Murdoch University | | |
| 19 | Queensland University of Technology | | |
| 20 | Royal Melbourne Institute of Technology | | |
| 21 | Southern Cross University | | |
| 22 | Swinburne University of Technology | | |
| 23 | Torrens University Australia | | |
| 24 | University of Adelaide | | |
| 25 | University of Canberra | | |
| 26 | University of Divinity | | |
| 27 | The University of Melbourne | | |
| 28 | University of New England | | |
| 29 | University of New South Wales | | |
| 30 | University of Newcastle | | |
| 31 | University of Notre Dame Australia | | |
| 32 | University of Queensland | | |
| 33 | University of South Australia | | |
| 34 | University of Southern Queensland | | |
| 35 | University of the Sunshine Coast | | |
| 36 | The University of Sydney | | |
| 37 | University of Tasmania | | |

| | | | |
|---|---|---|---|
| 38 | University of Technology Sydney | | |
| 39 | The University of Western Australia | | |
| 40 | University of Wollongong | | |
| 41 | Western Sydney University | | |
| 42 | Victoria University | | |
| 44 | Overseas Universities<br>(Please list each of them) | | |
| 97 | None | | |
| 99 | Don't know | | |

B5b Which of the following types of institutions (this includes any users from these institutions) used your project's infrastructure?

Please select all that apply.

| code | Institute type | 2017-18 | Please list each of them |
|---|---|---|---|
| 01 | Cooperative Research Centres | | |
| 04 | Industry Growth Centres | | |
| 05 | Medical Research Institutes (MRI) | | |
| 95 | Other such research institutions<br>(Do NOT include government agencies) | | |
| 97 | None | | |
| 99 | Don't know | | |

B5c Does your project support research projects funded through any of the following Australian Research Council (ARC) schemes? If so, how many?

| Code | Grant type | 2017-18 | Please list each of them, if known |
|---|---|---|---|
| 01 | Australian Laureate Fellowships | | |
| 02 | Discovery Early Career Researcher Award (DECRA) | | |
| 03 | Discovery Indigenous | | |
| 04 | Discovery Projects | | |
| 05 | Future Fellowships | | |
| 06 | ARC Centres of Excellence | | |
| 07 | Industrial Transformation Research Program (Industrial Transformation Training Centres and Industrial Transformation Research Hubs) | | |
| 08 | Linkage Infrastructure, Equipment and Facilities | | |
| 09 | Linkage Learned Academies Special Projects | | |
| 10 | Linkage Projects | | |
| 11 | Special Research Initiatives | | |
| 12 | Supporting Responses to Commonwealth Science Council Priorities | | |
| 95 | Other ARC Grants | | |
| 97 | None | | |
| 99 | Don't know | | |

B5d Does your project support research projects funded through any of the following National Health and Medical Research Council (NHMRC) schemes? If so, how many?

| code | Grant type | 2017-18 | Please list each of them, if known |
|---|---|---|---|
| 01 | Program Grants | | |
| 02 | Project Grants | | |
| 03 | Fellowships and Scholarships | | |
| 04 | Strategic and Leveraging Grants | | |
| 05 | Investigator Grants | | |
| 06 | Synergy Grants | | |
| 07 | Ideas Grants | | |
| 08 | Development Grants | | |
| 09 | Equipment Grant Scheme | | |
| 10 | Clinical Trials and Cohort Studies Grants | | |
| 11 | Partnership Projects | | |
| 12 | Targeted Call for Research | | |
| 13 | Centres of Research Excellence | | |
| 95 | Other NHMRC Grants | | |
| 97 | None | | |
| 99 | Don't know | | |

B6 Which Government agencies (this includes any users from these agencies) used your project's infrastructure?

Please select all that apply.

| code | Government agency type | 2017-18 | Please list each of them |
|---|---|---|---|
| 01 | Publicly Funded Research Agencies | | |
| 02 | Federal Government Departments or agencies | | |
| 03 | State Government Departments or agencies | | |
| 04 | Local Government | | |
| 95 | Other Government initiatives, including cultural institutions such as museums | | |
| 97 | None | | |
| 99 | Don't know | | |

**DESIGN NOTE: In tool, we have combined B7 a,b,c in a single grid.**

B7a What collaborations do you have with other NCRIS projects and other NRI?

*Please select all that apply, include details of the services.*
*Please do NOT select your own project.*

| NCRIS Project | Formal/ Informal | Specify collaboration |
|---|---|---|
| Astronomy Research Infrastructure | | |
| Atlas of Living Australia | | |
| AuScope | | |
| Australian Animal Health Laboratory | | |
| Australian National Fabrication Facility | | |
| ANSTO National Deuteration Facility | | |
| ANSTO Nuclear Science Facilities | | |
| Australian Phenomics Network | | |
| Australian Plant Phenomics Facility | | |
| Australian Research Data Commons | | |
| Australian Urban Research Infrastructure Network | | |
| Bioplatforms Australia | | |
| European Molecular Biology Laboratory Australia | | |
| Heavy Ion Accelerators | | |
| Integrated Marine Observing System | | |
| Microscopy Australia | | |
| National Computational Infrastructure | | |
| National Imaging Facility | | |
| Pawsey Supercomputing Centre | | |
| Population Health Research Network | | |
| Terrestrial Ecosystem Research Network | | |
| Translating Health Discovery | | |
| Other NRI (please specify) | | |
| None | | |
| Don’t know | | |

B7b What critical dependencies does your project have on NCRIS projects and other NRI?

*Please select all that apply, include details of the services.*
*Please do NOT select your own project.*

| code | NCRIS Project | 2017-18 | Specify critical dependency |
|---|---|---|---|
| 01 | Astronomy Research Infrastructure | | |
| 02 | Atlas of Living Australia | | |
| 03 | AuScope Limited | | |
| 04 | Australian Animal Health Laboratory | | |
| 05 | Australian Microscopy and Microanalysis Research Facility | | |
| 06 | Australian National Fabrication Facility | | |
| 08 | ANSTO National Deuteration Facility | | |
| 09 | ANSTO Nuclear Science Facilities | | |
| 10 | Australian Phenomics Network | | |
| 11 | Australian Plant Phenomics Facility | | |
| 40 | Australian Research Data Commons | | |
| 13 | Australian Urban Research Infrastructure Network | | |
| 14 | Bioplatforms Australia | | |
| 15 | European Molecular Biology Laboratory Australia | | |
| 17 | Heavy Ion Accelerators | | |
| 18 | Integrated Marine Observing System | | |
| 19 | National Computational Infrastructure | | |
| 21 | National Imaging Facility | | |
| 22 | Pawsey Supercomputing Centre | | |
| 23 | Population Health Research Network | | |
| 25 | Terrestrial Ecosystem Research Network | | |
| 26 | Translating Health Discovery | | |
| 95 | Other NRI (please specify) | | |
| 97 | None | | |
| 99 | Don’t know | | |

B7c What services did your project provide to other NCRIS projects?

*Please select all that apply, include details of the services.*
*Please do NOT select your own project.*

| code | NCRIS Project | 2017-18 | Specify service |
|---|---|---|---|
| 01 | Astronomy Research Infrastructure | | |
| 02 | Atlas of Living Australia | | |
| 03 | AuScope Limited | | |
| 04 | Australian Animal Health Laboratory | | |
| 05 | Australian Microscopy and Microanalysis Research Facility | | |
| 06 | Australian National Fabrication Facility | | |
| 08 | ANSTO National Deuteration Facility | | |
| 09 | ANSTO Nuclear Science Facilities | | |
| 10 | Australian Phenomics Network | | |
| 11 | Australian Plant Phenomics Facility | | |
| 40 | Australian Research Data Commons | | |
| 13 | Australian Urban Research Infrastructure Network | | |
| 14 | Bioplatforms Australia | | |
| 15 | European Molecular Biology Laboratory Australia | | |
| 17 | Heavy Ion Accelerators | | |
| 18 | Integrated Marine Observing System | | |
| 19 | National Computational Infrastructure | | |
| 21 | National Imaging Facility | | |
| 22 | Pawsey Supercomputing Centre | | |
| 23 | Population Health Research Network | | |
| 25 | Terrestrial Ecosystem Research Network | | |
| 26 | Translating Health Discovery | | |
| 95 | Other NRI (please specify) | | |
| 97 | None | | |
| 99 | Don’t know | | |

B8 Thinking of all the project's research users, which fields of research (FoR) do you think they would likely cover?

This list is from the Australian and New Zealand Standard Research Classification. Click here for more detail.

Please select all that apply.

| code | Field of Research | 2017-18 |
|---|---|---|
| 01 | Mathematical Sciences | |
| 02 | Physical Sciences | |
| 03 | Chemical Sciences | |
| 04 | Earth Sciences | |
| 05 | Environmental Sciences | |
| 06 | Biological Sciences | |
| 07 | Agricultural and Veterinary Sciences | |
| 08 | Information and Computing Sciences | |
| 09 | Engineering | |
| 10 | Technology | |
| 11 | Medical and Health Sciences | |
| 12 | Built Environment and Design | |
| 13 | Education | |
| 14 | Economics | |
| 15 | Commerce, Management, Tourism and Services | |
| 16 | Studies in Human Society | |
| 17 | Psychology and Cognitive Sciences | |
| 18 | Law and Legal Studies | |
| 19 | Studies in Creative Arts and Writing | |
| 20 | Language, Communication and Culture | |
| 21 | History and Archaeology | |
| 22 | Philosophy and Religious Studies | |

B9 Which industries did your industry users cover?

Please select all that apply.

*This list is from the Australian and New Zealand Standard Industry Classification. Click here to go to an ABS search facility.*

*Here are some examples to help:*

- *Pharmaceuticals are C Manufacturing*
- *Environmental services are M Professional, Scientific and Technical Services*

*Diagnostic services are dependent on what is being diagnosed, but could be Q Health care if it's medically-related, or could be C Manufacturing if it's machinery-related.*

| code | Industry category | 2017-18 |
|---|---|---|
| 01 | A Agriculture, Forestry and Fishing | |
| 02 | B Mining | |
| 03 | C Manufacturing | |
| 04 | D Electricity, Gas, Water and Waste Services | |
| 05 | E Construction | |
| 06 | F Wholesale Trade | |
| 07 | G Retail Trade | |
| 08 | H Accommodation and Food Services | |
| 09 | I Transport, Postal and Warehousing | |
| 10 | J Information Media and Telecommunications | |
| 11 | K Financial and Insurance Services | |
| 12 | L Rental, Hiring and Real Estate Services | |
| 13 | M Professional, Scientific and Technical Services | |
| 14 | N Administrative and Support Services | |
| 15 | O Public Administration and Safety | |
| 16 | P Education and Training | |
| 17 | Q Health Care and Social Assistance | |
| 18 | R Arts and Recreation Services | |
| 19 | S Other Services | |
| 97 | None of the above as no industry or corporate users | |

NOTE: B10-11 removed

B12 If there is anything you need to explain or further describe about your project users and/or your answers regarding this section, please enter here.

95 Please specify
97 Nothing further to add

## SECTION C: IMPACT of NRI

Publications are peer reviewed journal articles, chapters or books. They include items:

- which were authored / co-authored by project staff and
- where project / support was cited in the publication and
- where infrastructure (both hard and soft) was used to support the science within the publication but not cited

C1 Do you currently collect publications data relating to your project?

01 Yes
02 No

**IF C1 = 02, SKIP TO C4**

**C2** Please complete table with publications

Please report for calendar years 2017 and 2018.
Complete fields in columns A, B, & C.

FYI: The DOI number is used to produce all relevant fields for a publication. We ask you to provide the Year and Title also as a check in case of DOI# data entry error etc.

Please consult with your librarian if possible for help completing this table.

| Year | Article (or chapter etc.) title | DOI number |
|---|---|---|
| | | |

Note: C3 deleted. C11 formerly E11

C11 When considering impact, how does your project define and/or measure its impact?

| Code | | 2017-18 |
|---|---|---|
| 95 | Please specify | |

C4 Has the facility produced (or had published) any promotional articles or materials during the period?

Note: this can also include material written by the project but published by others, or any published material about the project even if written by others.

Please provide a list those you consider amongst the most important (i.e. a full list is not required).

| Code | | 2017-18 |
|---|---|---|
| 95 | Yes (Please provide a list) | |
| 97 | None/Not applicable | |
| 99 | Don't know | |

C5 Has the facility participated in any **promotional events** during the period?

**Please list any examples** that fall within any of the below categories

Please select all that apply.

| code | | Hosted/Organised (enter number or leave blank) | Key participation (e.g. given presentation, arranged panel) |
|---|---|---|---|
| 01 | Conferences | | |
| 02 | Workshops | | |
| 04 | Showcases | | |
| 05 | Forums | | |
| 95 | Other (Please specify) | | |

C6 Please outline the role of the project in providing critical or operational services/functionality to enable Government policies and program delivery.

(For example, but not limited to – Environmental data collection and modelling, defence research or meteorology.)

Note: if you have any concerns about the sensitivity of your response to this question, please contact the department"

| Code | | "Please specify the relevant Government portfolio (e.g. Environment, Health, and Defence)" | "Australian Government / State Government/ Local Government" |
|---|---|---|---|
| 95 | Please type your response here | | |
| 97 | Nothing further to add | | |

C7 Please outline any key government priorities that are supported by the facility, and outline the nature of the support.

(For example, but not limited to – the Defence White Paper, Industry 4.0, Northern Australia, Data Partnership for Australia)

| Code | | 2017-18 |
|---|---|---|
| 95 | Please type your response here | |
| 97 | Nothing further to add | |

C8 Which of the following categories of advice did the facility provide during the period?

Please select all that apply.

| | | **Project initiated** advice to government | Advice **specifically requested** from the project by government |
|---|---|---|---|
| 01 | Technical advice using infrastructure | | |
| 02 | Specialist advice | | |
| 03 | Policy advice | | |
| 04 | Supplied data | | |
| 95 | Other (please specify type of advice) | | |
| 97 | None | | |
| 99 | Don't know | | |

## SECTION D: IP / COMMERCIALISATION

D1 How many of the following IP/commercialisation activities occurred during the period as a result of infrastructure provided by the facility?

Please enter a number in each of the cells below. (If zero, it's ok to leave it blank)

| | 2017-18 |
|---|---|
| Proof of concept | |
| Process improvements | |
| Products introduced to market | |
| Clinical trials | |
| New enterprises / spin-offs | |
| Patents | |
| Copyrighted Material | |
| Licences | |
| Plant Breeders' rights | |
| Invention Disclosures | |
| Creative Commons-style licences | |
| Other | |

**IF D1 GRID LEFT TOTALLY BLANK, PROVIDE A CONFIRMATION "NONE OF THESE DURING THE PERIOD" OPTION (CODE 97) AS CONFIRMATION.**

**PRE D2 IF ANSWERED CODE 95 (OTHER-SPECIFY) AT D1**

D2 If you answered about "other" benefits in the previous question, please provide further details of these in the appropriate box below.

| Code | | 2017-18 |
|---|---|---|
| 95 | Please specify | |

**ALTERNATE D2 TEXT, IF LEFT D1 BLANK:**
If you left the previous question blank but wish to provide some other relevant comment, please do so in the appropriate box below.

## SECTION E: COLLABORATION

E1 Excluding formal project partners, how many of the following **domestic** collaborative arrangements did the project have in place during the period?

*Note: Formal project partners include project nodes and lead agents*

*Please be aware that NCRIS collaborations are excluded in this section as they are addressed in B7*

Please enter a number in each of the cells below. (If zero, it's ok to leave it blank)

| | 2017-18 | Please specify |
|---|---|---|
| Memoranda of Understanding (MOUs) | | |
| Other **formal** collaborative arrangements with research infrastructure providers | | |
| Other **informal** collaborative arrangements with research infrastructure providers | | |
| Other **formal** collaborative arrangements with research organisations | | |
| Other **informal** collaborative arrangements with research organisations | | |
| Other **formal** collaborative arrangements with industry organisations | | |
| Other **informal** collaborative arrangements with industry organisations | | |
| Awards, commendations, used as exemplar | | |
| Representation on expert working groups, reviews, key committees, etc. | | |
| Invitations to speak at domestic conferences, forums, meetings | | |
| Other | | |

E2 How many of the following **international** activities occurred during the period?

Please enter a number in each of the cells below. (If zero, it's ok to leave it blank)

| | 2017-18 | Please specify |
|---|---|---|
| Memoranda of Understanding (MOUs) | | |
| Other **formal** collaborative arrangements with research infrastructure providers | | |
| Other **informal** collaborative arrangements with research infrastructure providers | | |
| Other **formal** collaborative arrangements with research organisations | | |
| Other **informal** collaborative arrangements with research organisations | | |
| Other **formal** collaborative arrangements with industry organisations | | |
| Other **informal** collaborative arrangements with industry organisations | | |
| Awards, commendations, used as exemplar | | |
| Representation on expert working groups, reviews, key committees, etc. | | |
| Invitations to speak at international conferences, forums, meetings | | |
| Visits from international bodies seeking advice | | |
| International research infrastructure facility bodies that the project was involved with | | |
| Other | | |

E4 Is your facility a member of, partnered with, or a participant in, global research infrastructure?

01 Yes (Please provide details)
02 No
97 Not applicable
99 Don't know

**IF E4=01 CONTINUE, ELSE GO TO E6**

E5 Please provide details of this (or these) international membership(s) / participation.

Please type your response in the box below:

95 Please Specify

E6 Assuming current funding levels continue in real terms, does your project have plans to join some or more global research infrastructure or other international collaboration / consortia in the future?

01 Yes
02 No
99 Unsure/ Don't know

**IF E6=99, SKIP TO E8**

E7 Why does/ doesn't your project have plans to join some or more global research infrastructure or other international collaboration / consortia in the future?

95 Please Specify
99 Don't know

E8 If you have any additional comments about international linkages please enter them here.

95 Please Specify
97 Nothing to add

E9 During the period, which of the Australian government's Science and Research priorities did your project address?

Please select all that apply:

| code | Science and Research priority | 2017-18 |
|---|---|---|
| 01 | A Food | |
| 02 | B Soil and Water | |
| 03 | C Transport | |
| 04 | D Cybersecurity | |
| 05 | E Energy | |
| 06 | F Resources | |
| 07 | G Advance manufacturing | |
| 08 | F Environmental change | |
| 09 | H Health | |
| 95 | Others (Specify) | |
| 96 | None of these | |
| 97 | Not applicable | |
| 99 | Don't know | |

E10 From the project's perspective, what are the **key** advantages the project offers users?

Please select all that apply:

01 Dependencies and collaboration between ([NCRIS=Y]: NCRIS) projects amplify advantages of any one project
02 Cost efficiencies
03 Concentration of skilled technical staff
04 Greater access to state of the art research infrastructure
05 Speed / faster time to publication
06 Innovation
07 Unique service offering
08 End-to-end process
09 Maintenance of individual, organisational and national reputation internationally
10 Access to training
11 Academic and commercial applications
12 Access to instruments
13 Access to research sites
14 Access to international collaboration/partnerships
95 Others (Please specify)
97 Not applicable

## SECTION F: USER CHARGES AND FUNDING

F1 What type of **user service** or **support** did the project offer?

Service and support could have been fee or non-fee based and could be ongoing.

NOTE: you will get the opportunity to explain more in the next section.

Please select all that apply

| code | | 2017-18 |
|---|---|---|
| 01 | Training of users (not project staff) | |
| 02 | Performing analysis, investigation, research or production for users | |
| 03 | Providing technical advice on using project infrastructure | |
| 04 | Providing specialist or expert advice to organisations other than governments of any level | |
| 05 | Providing government support or advice (any level of government including government-owned businesses) | |
| 06 | Providing advice on any aspect of translation / commercialisation like trials, pilots, prototypes, etc. | |
| 95 | Other (Please detail briefly) | |
| 97 | None of the above | |
| 99 | Don't know | |

F2 What was your project's revenue (excluding GST) from user charges for the following periods?

Please enter a number below.

**2017-18 FY**

| $ | | | | | |
|---|---|---|---|---|---|

Optional: Please include any explanatory comments if you feel it necessary

F3 Please indicate the project's current charging policy for **accessing the facility**, for the different types of users below:

Please tick one box per row:

| User | No cost (based on merit selection) | No costs (based on open access) | Marginal Cost | Full Cost | Other arrangement (please specify) | Not applicable |
|---|---|---|---|---|---|---|
| Meritorious researcher | | | | | | |
| Early career researcher | | | | | | |
| Other academic researchers | | | | | | |
| Industry | | | | | | |
| Government | | | | | | |
| Other user type (please specify) | | | | | | |
| Optional: Please include any explanatory comments if you feel it necessary | | | | | | |

F4 This question does not include revenue from user and service fees and charges. Which of the following did the project receive during the reference periods?

Please select all that apply:

| code | | 2017-18 |
|---|---|---|
| 01 | Cash co-investment excluding **[IF NCRIS=N: 'Australian Government', if NCRIS=Y: 'NCRIS']** funding and grants | |
| 02 | In-kind co-investment | |
| 97 | None of the above | |

F5 How much co-investment did you receive over the reference period?

(Co-investment refers to cash and in-kind support provided to the facility. This may include from state governments, industry, higher education institutions or not for profit organisations.)

Please complete the table below, using whole numbers.

| | 2017-18 FY | |
|---|---|---|
| Co-investor | Cash | In-kind |
| *e.g. The Philanthropic Foundation* | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

F6 If you have any additional comments about co-investment and contributions, please make them here.

95 Please specify
97 Nothing to add

## SECTION G: NRI ASSETS – Costs and Financial Risk

The purpose of this section is to establish an estimate of the risk of both obsolescence and failure of current capabilities in NCRIS and other NRI facilities. We understand that responses to these questions are forward looking, and are therefore difficult to make with any certainty. Please be assured that the department is just trying to capture a general forward looking view, and does not plan to 'hold' individual projects to these responses.

Note: G1 Deleted

G2 Please outline details for each key asset that risks failure, or will be considered obsolete over the next two to four years.

An Asset refers to individual tools, kit, ICT infrastructure (hard and soft) or capital component (physical and virtual). For example, an Argo float, a drone, a mass storage device, a mass spectrometer etc. Only include assets of significant value.

Note: you do NOT have to list all assets, only assets that risk potential failure or obsolescence within the next two to four years. Please only include assets that do not have a treatment management plan and that are not covered by current funding.

By obsolete, we typically mean that the technology no longer retains the capability to support leading edge research.

| Asset Description | Significant risk of obsolescence within the next 2 years | Significant risk of failure within the next 2 years | Significant risk of obsolescence within the next 4 years | Significant risk of failure within the next 4 years | Some significant risk of failure or obsolescence within the next 48 months. Please provide a brief description of the risk of failure and/or obsolescence, with reference to: likelihood, likely time frames, and warranty issues. What are the implications if the asset fails or becomes obsolete? | Associated Infrastructure Platform |
|---|---|---|---|---|---|---|
| (e.g. asset) | | | | | | |
| | | | | | | |
| | | | | | | |
| Optional Additional comment | | | | | | |

## SECTION H: FUTURE DIRECTIONS – Infrastructure Challenges

The next question offers a chance for you to identify or predict changes or challenges with regard to how your project's facilities might operate in the future.

H1 Based on your understanding of future research needs in the areas that your infrastructure platforms address, what do you believe will be the key challenges within those infrastructure platforms?

In your outline of each infrastructure challenge, please **briefly** describe the issue, including its importance. Please also describe (where applicable) timeframes for when we need to start addressing that issue, as well as when we must have addressed it by and/or when it will be too late to engage usefully on that challenge.

Word Limit = 1000

| | |
|---|---|
| Key challenge #1 | |
| Key challenge #2 | |
| Key challenge #3 | |

## SECTION I: PEOPLE

I1 How many employees (head count, and fulltime equivalent) were employed at the facility as at the designated time periods?

**[IF NCRIS=Y]** For the following answers, please include all employees whose positions exist because of NCRIS funding, whether those positions are directly funded through NCRIS or not, and including in-kind, other government-funded and any other types of employees.

**[ALL]**

(In-kind employees are those provided by another project partner.)

**[PROGRAMMER: ALLOW DK FOR EACH]**

**Headcount** 30/06/**2018**

Please enter a number below:

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |

**Full Time Equivalent** 30/06/**2018**

Please enter a number below:

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |

I2 As of 30 June 2018, of the total employees at the facility, please indicate how many were in the following categories:

Note that technical staff includes scientific and research staff who support the NRI.

Managerial staff includes staff who have significant management responsibilities (we are aware that these staff may have other academic responsibilities, but for the purposes of this census we are focusing on their NRI role).

Please choose the most relevant category for each member of staff.

- *Example 1) a staff member who spends 90% of the time undertaking technical/scientific tasks, and 10% managerial tasks, count them as 'technical staff'.*
- *Example 2) a highly credentialed scientist/academic who spends over 50% of their time undertaking managerial responsibilities, count them as 'managerial staff'*

Please enter a number in each cell:

**ENSURE SUM ACROSS ANY GIVEN CATEGORY DOES NOT EXCEED HEADCOUNTS @ I1**

I2A)

We understand your project may not collect the gender breakdown by staff role. In this case, record total in Column D

| | A) Male | B) Female | C) Staff who do not report gender | D) Total |
|---|---|---|---|---|
| Technical staff (i.e. staff that operate, or support the operation of assets) | | | | |
| Managerial staff | | | | |
| Admin / support | | | | |
| **TOTAL** | | | | |

I2G)

| Based in | 30/06/**2018** | Unsure |
|---|---|---|
| NSW | | |
| VIC | | |
| QLD | | |
| SA | | |
| WA | | |
| TAS | | |
| ACT | | |
| NT | | |
| Other (e.g. overseas) | | |

I2B) For either of the categories below, if you do not collect this data, please mark accordingly

| | 30/06/**2018** | Unsure / We don't collect this information |
|---|---|---|
| Aboriginal / Torres Strait Islander | | |
| **DISPLAY IF NCRIS=Y:** Funded through non-NCRIS sources | | |

I3 Which of the following activities did the project conduct to build technical skills or create career progression opportunities for employees within the project?

Another way of thinking about this is how did the project help make existing employees more valuable?

Please tick all that apply.

| | Technical Staff | Managerial Staff | Admin / Support | Any staff (complete this column if employee opportunities cannot be disaggregated into technical, managerial or admin/support) | Please specify |
|---|---|---|---|---|---|
| Talent identification | | | | | |
| Provision of training | | | | | |
| Career pathway opportunities | | | | | |
| Internal conferences / forums | | | | | |
| Participation in award programs | | | | | |
| Participation in conferences | | | | | |
| Study support | | | | | |
| Mentoring | | | | | |
| Staff exchanges | | | | | |
| Participation in online forums | | | | | |
| Other (Please Specify) | | | | | |
| None of these | | | | | |
| Don't know | | | | | |

I4 Which of the following types of early career researcher initiatives did the project offer?

*An early career researcher is someone working towards their PhD or who has been granted a PhD in the previous 5 years.*

Please tick all that apply.

| code | | 2017-18 | Please specify |
|---|---|---|---|
| 02 | Targeting early career researchers for staff positions | | |
| 03 | Targeted slots in the merit allocation process | | |
| 04 | Student competitions at conferences | | |
| 05 | Study support | | |
| 06 | Postgraduate research project support | | |
| 07 | Offering post-Doctoral positions | | |
| 16 | Career pathway opportunities | | |
| 08 | Student exchanges | | |
| 09 | Conference attendance | | |
| 10 | Pilot study grants | | |
| 11 | Short-term contracts to undertake particular skill building tasks | | |
| 12 | Targeted training workshops | | |
| 13 | Mentoring | | |
| 14 | Internships | | |
| 15 | Travel grants | | |
| 95 | Other (Please Specify) | | |
| 97 | None of these | | |
| 99 | Don't know | | |

I4a How many early career staff (research or technical) are employed at the facility?

*An early career researcher is someone working towards their PhD or who has been granted a PhD in the previous 5 years.*

Please enter a number in each of the cell below. (If zero, it's ok to leave it blank)

| | 30/06/**2018** | Unsure / We don't collect this information |
|---|---|---|
| EARLY CAREER Staff (research/technical) | | |

## SECTION J: GOVERNANCE

**NOTE: Complete this section ONLY if your project completed the 2015-17 NRI Census form.**

**If your project did not complete the 2015-17 NRI Census form, then please complete the alternate Governance section on the adjacent worksheet.**

| J7: Did you conduct / are you planning to conduct a review of your project? (Leave blank if no) | | | |
|---|---|---|---|
| | | 2017-18 | 2018-19 |
| Internal Review | Structure | | |
| | Governance | | |
| | Forward strategy | | |
| | Activities | | |
| | Other | | |
| External Review | Structure | | |
| | Governance | | |
| | Forward strategy | | |
| | Activities | | |
| | Other | | |

| J9: Please provide further details (optional) |
|---|
| |

## SECTION J: GOVERNANCE 1st Time

**NOTE: Complete this section ONLY if your project did NOT complete the 2015-17 NRI Census form.**

**If your project did complete the 2015-17 NRI Census form, then please complete the standard Governance section on the adjacent worksheet.**

| J1: As part of your project's governance, is there a Board/ Oversight Committee? |
|---|
| |

**Answer J2 if J1 = No, otherwise skip to J3**

**Answer if J1 =Yes, otherwise skip to J5**

J3: How many members were on the top level board / committee, in each of the following specialist roles as at 30 June 2017?

| | Please Specify Number | Optional comment |
|---|---|---|
| Institutional representative | | |
| Subject matter expert | | |
| Government representative | | |
| Community member | | |
| Financial / accounting specialist | | |
| Legal specialist | | |
| Risk specialist | | |
| Other role/s | | |

J4: How many of the current board/committee received the following specifically relating to probity and proprietary standards in the stewardship of public funds and resources?
Count each board / committee member once, according to their primary role only.
Only count the top level board / committee, i.e. do NOT count sub-committees etc.

Please use the optional comment boxes to add any explanation that you feel necessary

| 2017-18 | Please Specify Number | Optional comment |
|---|---|---|
| Formal training | | |
| Information material | | |

J5: Please indicate the status of each of the following stand-alone governance documents:

| | 2017-18 |
|---|---|
| Project-level governance and reporting framework | |
| Terms of reference of project board / management committee | |
| Project-level risk management plan | |
| Document specifying long-term strategic direction of the project | |
| Detailed project implementation plan, which is routinely updated | |

J6: What methods were in place to inform stakeholders and the relevant research community about board/committee or governance decisions?

Please select all that apply:

| | | 2017-18 |
|---|---|---|
| Publication / release of board / committee minutes | | |
| Publication / release of board / committee minutes | | |
| Newsletter | | |
| Other (Please detail briefly in the space to the right) | specify here | |
| None of the above | | |

| J7: Did you conduct / are you planning to conduct a review of your project? (Leave blank if no) | | | |
|---|---|---|---|
| | | 2017-18 | 2018-19 |
| Internal Review | Structure | | |
| | Governance | | |
| | Forward strategy | | |
| | Activities | | |
| | Other | | |
| External Review | Structure | | |
| | Governance | | |
| | Forward strategy | | |
| | Activities | | |
| | Other | | |

| J9: Please provide further details (optional) |
|---|
| |

| J8: Would you like to provide any other feedback with regard to governance? |
|---|
| |

# APPENDIX 2

List of NCRIS Projects Invited to the Census and their Completion Status

# National Research Infrastructure Census

(2017-18)

Appendix 2

## List of all[27] NCRIS projects invited to complete the census and their completion status.

| NCRIS project | Status |
|---|---|
| ANSTO National Deuteration Facility | Complete |
| ANSTO Nuclear Science Facilities | Complete |
| Astronomy Research Infrastructure | Complete |
| Atlas of Living Australia | Complete |
| AuScope Limited | Complete |
| Australian Animal Health Laboratory | Complete |
| Australian National Fabrication Facility | Complete |
| Australian Phenomics Network | Complete |
| Australian Plant Phenomics Facility | Complete |
| Australian Research Data Commons | Complete |
| Australian Urban Research Infrastructure Network | Complete |
| Bioplatforms Australia | Complete |
| Heavy Ion Accelerators | Complete |
| Integrated Marine Observing System | Complete |
| Microscopy Australia | Complete |
| National Computational Infrastructure | Complete |
| National Imaging Facility | Complete |
| Pawsey Supercomputing Centre | Complete |
| Population Health Research Network | Complete |
| Terrestrial Ecosystem Research Network | Complete |
| Translating Health Discovery | Complete |

[27] The *European Molecular Biology Laboratory Australia* did not have any Australian based infrastructure, and so was exempt from completing the census.