ACIL ALLEN CONSULTING

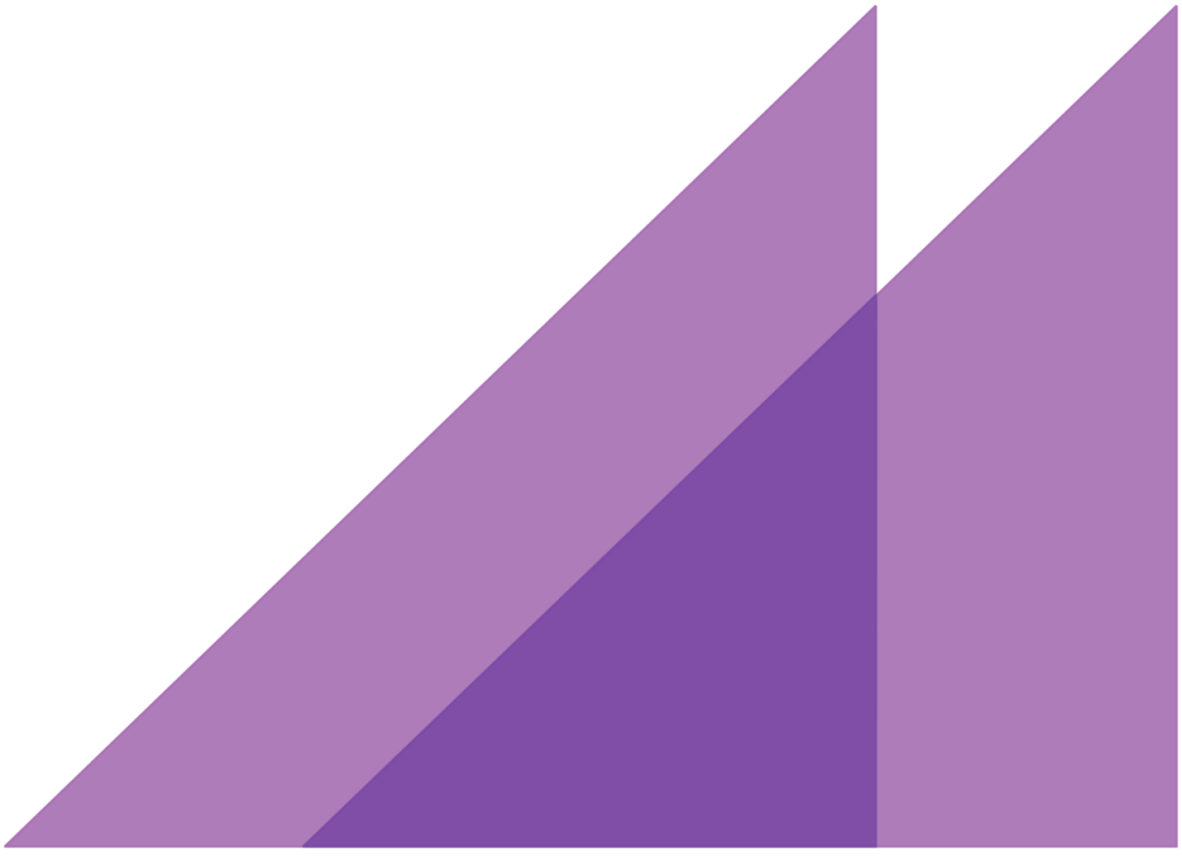
REPORT TO
THE AUSTRALIAN RESEARCH COUNCIL

27 SEPTEMBER 2013

BENEFITS REALISATION REVIEW

OF EXCELLENCE IN RESEARCH FOR AUSTRALIA

FINAL REPORT



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Acronyms

Acronym	Word
ABS	Australian Bureau of Statistics
ANZSRC	Australian and New Zealand Standard Research Classification
APA	Australian Postgraduate Awards
ARC	Australian Research Council
ARCom	Australian Research Committee
ARWU	Academic Ranking of World Universities
BRR	Benefits Realisation Review
CRC	Cooperative Research Centre
DIICCSRTE	Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education
DIISRTE	Department of Industry, Innovation, Science, Research and Tertiary Education
DVCR	Deputy Vice-Chancellor (Research)
Ei	Excellence Index
ERA	Excellence in Research for Australia
FAO	Food and Agriculture Organisation (of the United Nations)
FoR	Field of Research
FTE	Full Time Equivalent
GERD	Gross Expenditure on R&D
GHG	Greenhouse Gas
HDR	Higher Degree by Research
HEFCE	Higher Education Funding Council for England
HEP	Higher Education Provider
HERDC	Higher Education Research Data Collection
HESDC	Higher Education Student Data Collection
IPRS	International Postgraduate Research Scholarships
JRE	Joint Research Engagement
NRIP	National Research Investment Plan
OECD	Organisation for Economic Cooperation and Development
PBRF	Performance-Based Research Fund
PC	Productivity Commission
R&D	Research and Development
REC	Research Evaluation Committee
REF	Research Excellence Framework
RIBG	Research Infrastructure Block Grants
RQF	Research Quality Framework
RTS	Research Training Scheme
SRE	Sustainable Research Excellence
SyReNS	Sydney Research Networks Scheme
TC	Transparent Costing
THEWUR	Times Higher Education World University Rankings
UK BIS	United Kingdom Department of Business, Innovation and Skills
UoE	Unit of Evaluation

Glossary

This report refers to a number of ERA specific terms. The following glossary defines these terms. It has been adapted from the glossary provided in the *ERA 2012 National Report.*

Term	Definition
Citation Analysis	Scrutiny of references contained in journal articles, including analysis of frequency and patterns.
Discipline	For the purposes of ERA, 'disciplines' are defined as four- or two-digit FoR codes as identified in the ANZSRC.
Eligible institutions	Australian higher education providers eligible to participate in ERA, defined as Table A and B providers listed in the Higher Education Support Act 2003.
ERA 2012 Journal List	A list of journals eligible for institutions' ERA 2012 submissions.
Esteem measures	Esteem measures indicate that a researcher is held in particularly high regard by their peers or other qualified parties.
Field of Research (FoR)	A hierarchical classification of fields of research set out in the ANZSRC. The term 'Field of Research' or 'FoR' applies to all three ANZSRC levels (two-digit, four-digit and six-digit). Only two- and four-digit FoR codes are used for the purposes of ERA.
Four-digit FoR	The middle level of the three hierarchical levels within ANZSRC Fields of Research. An example of a four-digit FoR code is '0206-Quantum Physics'. Within the ANZSRC classification, this level is referred to as a 'Group'.
Full-time equivalent (FTE)	FTE staffing profile base on academic salary classification, as used in HESDC. Includes Levels A – E and 'Other'.
Higher Education Research Data Collection (HERDC)	The annual research data collection exercise undertaken by the Department of Innovation, Industry, Science, Research and Tertiary Education (DIISRTE).
Low volume threshold	Each discipline within an institution is only subject to ERA evaluation if a certain volume of research outputs has been submitted. For disciplines where citation analysis was used, the low volume threshold was 50 apportioned indexed journal articles. For disciplines where peer review was used, the low volume threshold was 50 apportioned research outputs. For the purpose of calculating the low volume threshold in peer review disciplines, books ('weighted research outputs') were given an effective weighting of 5:1 compared with other research outputs.
Non-traditional research outputs	Research outputs which do not take the form of published books, book chapters, journal articles or conference publications.
Peer review	In this context, peer review is the process by which scholarly work is examined by experts in the field in order to form a judgement about its quality. (1)
Portfolio	A group of individual works submitted separately which together constitute a single non-traditional research output. The portfolio has to demonstrate coherent research content.
Reference periods	The periods during which research outputs must have been published, research income reported under HERDC etc.; in order for associated data to be included in ERA submissions. ERA reference periods vary according to the research item.
Research	For the purposes of ERA, research is defined as the creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understandings. This could include synthesis and analysis of previous research to the extent that it is new and creative.
Research Evaluation Committees (REC)	The Discipline Grouping-specific committees which undertake ERA evaluations. Each such committee includes internationally-recognised members with expertise in research evaluation and broad discipline expertise.
Research output	Research outputs include journal articles, book chapters, artistic performances, films etc.
Traditional research outputs	Research outputs in the form of published research books, book chapters, journal articles or conference papers.
Two-digit FoR	The highest of the three hierarchical levels within ANZSRC Fields of Research. An example is '02 Physical Sciences'. Within the ANZSRC classification, this level is referred to as a 'Division'.
Unit of Evaluation	A discipline for a specific institution. In some contexts, the term refers to the package of associated ERA information (including submission data, indicators and evaluation outcomes). While all ERA data collection is at the four-digit FoR level for a specific institution, the UoE is either at the four-digit or two-digit FoR for an institution.

NOTE: 1. The source of this definition is ACIL Allen Consulting

Executive summary

Excellence in Research for Australia (ERA) is an assessment system, administered by the Australian Research Council (ARC), which evaluates research quality in Australian universities. Forty-one institutions in total are eligible for evaluation in ERA. ERA aims to identify and promote excellence across the full spectrum of research activity at these institutions.

The ARC commissioned ACIL Allen Consulting in 2013 to undertake a Benefits Realisation Review of ERA. The objective of the project was to explore the monetary and non-monetary benefits of ERA.

Context

Research and development (R&D) forms an important part of Australia's economy, with Australia's Gross Expenditure on R&D (GERD) totalling $27.7 billion in 2008-09. Business expenditure accounts for the majority of GERD, and is focused predominately on applied research and experimental development. The higher education sector, however, is the dominant sector with regard to pure basic research, making up 86 per cent of funding for this type of research.

In 2011, higher education providers received just over $3.25 billion in research income. In addition, the Australian higher education sector receives block grants for research and research training, through a number of schemes. In 2013 block grants totalled $1.67 billion.

Given the significance of research to the Australian economy and the benefits it generates, the measurement of research quality is highly important. The proposal for a Research Quality Framework (RQF) marked the start of discussions on how best to assess the quality of Australian university research. ERA replaced the RQF in March 2008, with full scale ERA processes taking place in 2010 and 2012. This movement towards the measurement of research quality in Australia sits within a broader movement internationally, with the emphasis on excellence and quality being found in the performance-based funding schemes of a number of other countries.

The benefits and impacts of ERA

The study has found that ERA has helped to increase the social rate of return of research, generate cost savings, increase university revenue, enhance economic activity and improve accountability, transparency and policy-making. With ERA having only been in operation for a short period of time, it is anticipated that ERA will lead to even greater benefits in the future.

These benefits have occurred through ERA's influence on three key areas. These are as follows.

1. **Improved research performance** – ERA has:
   - improved the quality of research;
   - focused research effort;
   - enhanced collaboration;
   - improved resource allocation; and
   - informed human resource decision-making.

   Ultimately, improvements in research performance lead to a better return on investment in research, and improve the social rate of return of research. With the large amount of funding involved (an estimated total of $4.77 billion), small improvements in the social rate of return generate significant monetary benefits. For example, a one percentage point increase in the social rate of return (such as an

increase in the social rate of return from 25 to 26 per cent) would generate a $47.7 million increase in GDP per annum.

Over time, it would be expected that improvements to the social rate of return due to ERA's influence on the five benefits discussed above would be increasingly evident and, as a result, monetary benefits would increase in the future.

2. **Enhanced university planning, strategy and operation** – ERA has:
   - improved coordination and management;
   - enhanced strategic planning; and
   - improved recognition and promotion.

   As a result of these benefits, cost savings are anticipated from improved coordination, management and enhanced strategic planning. In addition, it is likely that there will be an increase in university revenue and enhanced economic activity associated with improved recognition and promotion.

   The analysis presented in this report shows that even small percentage reductions in costs can generate significant monetary benefits. For example, if ERA's effect on coordination, management and strategic planning led to cost savings of half a per cent of total research funding, savings of $23.85 million per annum would result.

   In addition, there are significant benefits related to increasing the number of international higher education students studying in Australia. For example, if ERA increased international higher education enrolments by half a per cent, an additional 1,151 students would study in Australia per annum. This would result in an increase in international student expenditures in Australia of $58.5 million, comprising of just over $21 million in university fees and just under $37.5 million in expenditure on other goods and services.

3. **Better accountability, transparency and policy-making** – ERA has:
   - improved the level of accountability, transparency and monitoring associated with Australian university research; and
   - positively informed a diverse number plans, strategies, reviews and policies.

Table ES 1 outlines the influences of ERA in these three areas, the resulting benefits and their impacts.

TABLE ES 1 **THE INFLUENCES, BENEFITS AND IMPACTS OF ERA**

Influence of ERA	Benefit	Impact
Research performance		
Better quality research	— attract and retain international students and academic staff — generate economic benefits to regions where universities are located — increase the absorptive capacity of businesses — encourage new partnerships with other researchers and with industry — enhance Australian researchers' access to international networks — enhance the economic, social, cultural and environmental benefits of research	Increased social rate of return of university research
Focusing research effort	— enhance coordination and improve resource allocation — enhance the concentration of research, resulting in increased financial returns, greater collaboration with industry and gaining an influential role in international research collaboration — avoid research duplication as a result of streamlining programs — increase the number of high-quality publications (and attain greater international recognition)	
Enhancing collaboration	— resolve complex problems, share knowledge, develop skills, stay up-to-date with new developments, expand market reach and achieve economies of scale — spread risk, build critical mass and capacity, and drive innovation — enhance the capacity of innovators to absorb new knowledge, recruit new personnel and subsequently develop new skills — reduce costs by removing duplication, realising economies of scale and improving access to expensive infrastructure	
Improving resource allocation	— ensure resources are used to their best effect — lead to the realisation of goals in a faster and more efficient manner — improve operational efficiencies	
Informing human resource decision making	— enhance skills utilisation, productivity and innovation — increased efficiency of resources — enhance collaboration	
University planning, strategy and operations		
Improved coordination and management	— maximise research capabilities — allocate resources effectively — alleviate challenges related to the limited availability of funding — avoid overlapping efforts and duplication	Cost savings for universities
Enhanced strategic planning	— improve labour productivity and mobilisation of resources — enhance decision-making, competitive advantage and enable a greater focus on achieving desired goals — reduced the cost of products and services — improve awareness of gaps in products and services to achieve operational efficiencies	
Recognition and promotion	— recruit international students and academics — increase research commercialisation — enhance industry collaboration	Increased university revenue and economic activity
Accountability, transparency and policy-making		
Accountability, transparency and monitoring	— increase research funding — enhance national data collections — improve the monitoring of progress against performance indicators and targets	Increased accountability, transparency and more informed government policy-making
Better informed government policy	— provide reliable data about research quality across all Fields of Research — provide a framework (with associated processes) that can help to drive future policy agendas about research quality	

SOURCE: *ACIL ALLEN CONSULTING*

1 Introduction

This chapter provides an introduction to the Benefits Realisation Review. It outlines the scope of the review and the review logic.

1.1 Scope of the review

The Australian Research Council (ARC) commissioned ACIL Allen Consulting to provide a Benefits Realisation Review (BRR) of Excellence in Research for Australia (ERA). This involves a comprehensive review of the monetary and non-monetary benefits that have resulted from ERA. Box 1 identifies the BRR's Terms of Reference.

BOX 1 **TERMS OF REFERENCE**

The objective of the BRR is to provide an assessment of the benefits of ERA, both monetary and non-monetary.

The benefits to be analysed include direct benefits, such as:

- Increased accountability — taking responsibility for activity and disclosing its results in a transparent manner. Accountability may include:
  - Governments' accountability for public expenditure on university-based research; and
  - universities' accountability to their various stakeholders for the fulfillment of their stated mission and priorities, especially those relating to research.
- Performance improvement — overall research performance improvement driven by the measurement of performance through ERA. This may include improvements in research quality or in the quality of research management driven by:
  - better knowledge of the research strengths and weaknesses of universities;
  - the perception that ERA results influence the reputation of universities/researchers; and/or
  - the knowledge that ERA informs Government funding for universities and Compacts.
- Improved decision making — specific decisions by universities, governments and others about research opportunities, research policy and research investment. This may include:
  - improved decision-making by potential postgraduates in relation to research training opportunities and by researchers in relation to employment opportunities;
  - improved decision-making by the end-users of research in relation to research providers; and
  - improved decision-making by those seeking to collaborate with researchers at universities.

Some of these benefits will be directly attributable to ERA, however the study will also consider any evidence of indirect benefits arising from positive effects, such as:

- improved data management, including management of institutional repositories and the use of the ARC's SEER system, and the benefits of any such improvement;
- improved data management by Government, including any improvement to Australian Bureau of Statistics (ABS) collections, and the benefits of any such improvement.

SOURCE: ARC REQUEST FOR TENDER

ERA is an assessment system, administered by the ARC, which evaluates the research quality of Australian universities. Forty-one institutions in total are eligible for evaluation in ERA (a list of eligible institutions is at Appendix B). ERA aims to identify and promote excellence across the full spectrum of research activity at these institutions. Further details of ERA are outlined in Box 2.

BOX 2 **EXCELLENCE IN RESEARCH FOR AUSTRALIA**

ERA evaluates the quality of the research undertaken in Australian universities against national and international benchmarks. The ratings are determined and moderated by committees of distinguished researchers, drawn from Australia and overseas.

The indicators used in ERA include a range of metrics such as citation profiles which are common to disciplines in the natural sciences, and peer review of a sample of research outputs which is more broadly common in the humanities and social sciences. ERA is a comprehensive collection. The data submitted by universities covers all eligible researchers and their research outputs. The precise set of indicators used has been developed in close consultation with the research community. This approach ensures that the indicators used are both appropriate and necessary, which minimises the resourcing burden of ERA for Government and universities and ensures that ERA results are both robust and broadly accepted.

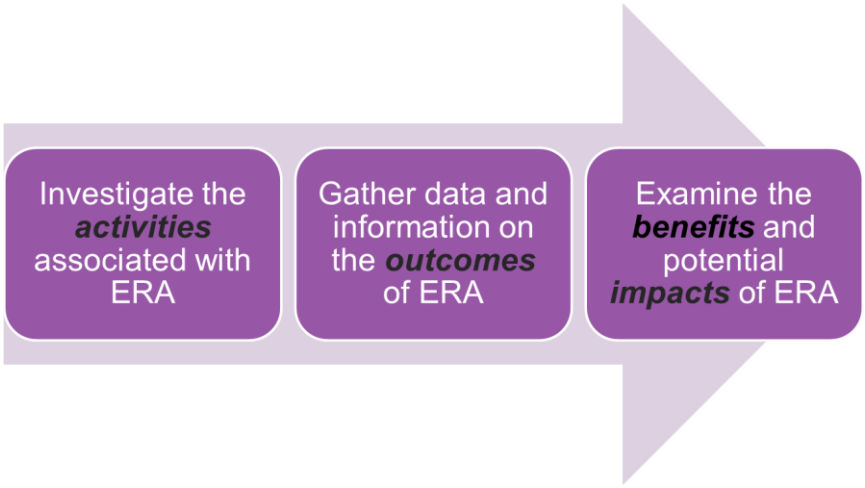
The first full round of ERA occurred in 2010 and the results were published in early 2011. The reference period for this round considered publications produced in the period 2003 to 2008 (inclusive). This was the first time a nationwide stocktake of discipline strengths and areas for development had ever been conducted in Australia. The second round of ERA was completed with the publication of the *ERA 2012 National Report* on 6 December 2012. The reference period for this round considered publications produced in the period 2005 to 2010. The next ERA round is scheduled for 2015 and preparations are currently under way.

SOURCE: *WWW.ARC.GOV.AU/ERA/DEFAULT.HTM*

1.2 Review logic

ERA entails a variety of activities. These activities lead to outcomes, which in turn, generate impacts. The review logic used in the BRR has been to explore the activities associated with ERA and observe the outcomes of these activities. These outcomes have then been traced to potential impacts, and benefits have been derived from these impacts. Where possible, these impacts have been quantified. Figure 1 shows this review logic.

FIGURE 1 **REVIEW LOGIC**



SOURCE: ACIL ALLEN CONSULTING

In understanding the benefits of ERA, a key conceptual question is to what extent are the benefits attributable specifically to ERA, as opposed to other factors (such as changes in university strategy and management). The development of a 'base case' (or counterfactual scenario) is usually an important aspect in understanding this question, and in determining the level of additionality realised through an activity, investment or policy intervention. This is because a well-established base case can demonstrate what achievements could have been realised in the absence of a certain activity, investment or policy (in this case ERA). A well-established base case would also help to determine the speed and rate at which benefits are realised from ERA.

However, developing a robust and comparable base case is problematic in the context of Australia's research performance. First, there have been significant changes in policy settings and university funding that impact on research output and research quality which makes a reliable comparison with a base case difficult.

Second, comparable system-wide evidence about Australia's research performance prior to the introduction of ERA does not exist. The dynamic and evolving nature of research means that it is highly complex to track research performance through historical indices, or capture the full spectrum of research. The evolving nature of research also has an impact on the way research is coded and classified. For example, in 2008 the Australia and New Zealand Standard Research Classification (ANZSRC) was updated to account for new research fields and to reflect changes in research activity in Australasia.

To overcome these difficulties, and ensure that the BRR considers the extent to which identified benefits are attributable to ERA, stakeholders were asked specifically about ERA's effect on research quality, as well as the importance of ERA in influencing these areas of benefit. This approach helped to determine the significance of ERA within the broader context.

The BRR also estimated the monetary benefits of ERA. During consultations, stakeholders unanimously reported that they could not estimate the monetary benefits that have resulted from ERA. As a result, monetary impacts have been produced to indicate the potential monetary impact and provide a guide only.

Further details about the BRR's methodology (including the steps taken to collect and analyse data) are outlined in Appendix C.

1.3 Report structure

The remainder of this report is structured as follows:

- Chapter 2 describes the key contextual factors of ERA. In particular, it discusses the importance of Australian research, the rationale and benefits of publicly funded research, the rationale for measuring research quality and key elements of ERA.
- Chapter 3 explores the impact of ERA on the social rate of return of university research, resulting from improvements to Australia's research performance.
- Chapter 4 analyses the cost savings, increased university revenue and enhanced economic activity, resulting from ERA's influence on university planning, strategy and operations.
- Chapter 5 details ERA's benefits to accountability, transparency and policy-making.
- Chapter 6 summarises the effects of ERA, the benefits and its potential impacts.

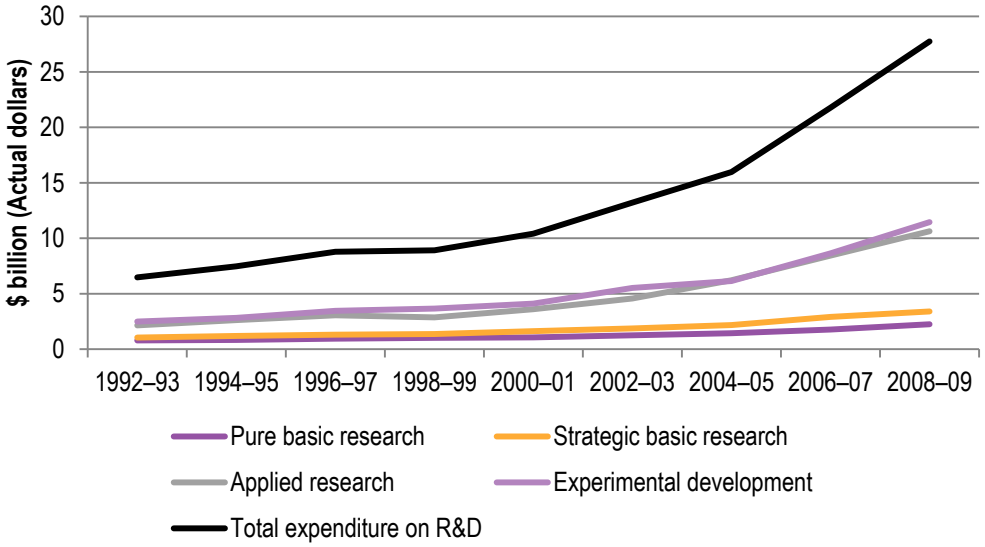
2 Context

This chapter outlines the importance of Australian research and discusses the rationale and benefits of publicly funded research to the economy. It also explores the rationale for measuring research quality and the key elements of ERA.

2.1 The importance of Australian research

Research and development (R&D) forms an important part of Australia's economy. As shown in Figure 2, Australia's Gross Expenditure on R&D (GERD) has grown strongly since the late 1990s to a total of $27.7 billion in 2008-09.

FIGURE 2 **AUSTRALIAN GERD, BY TYPE OF ACTIVITY (1992-93 TO 2008-09)**



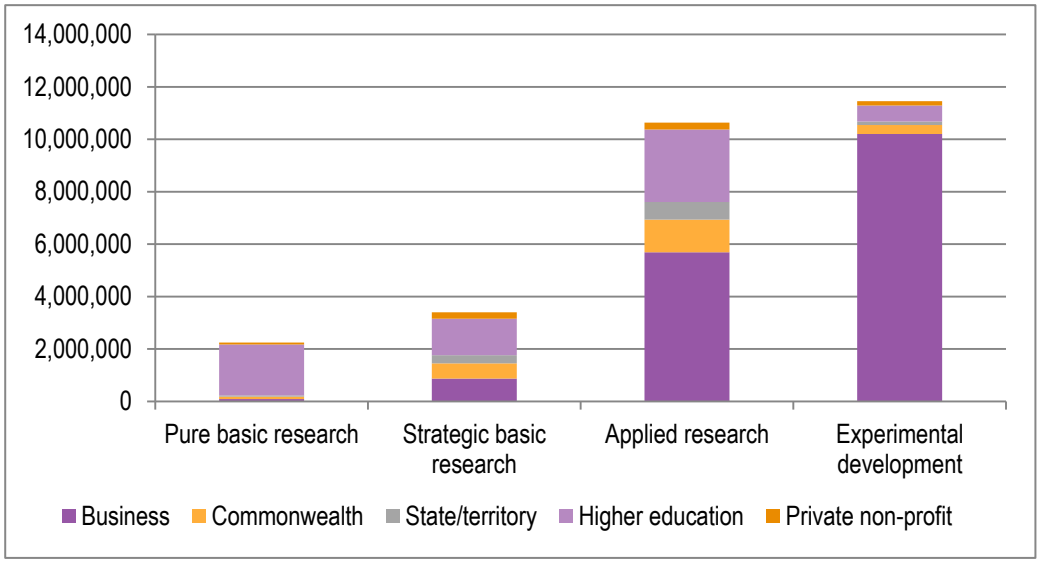
SOURCE: ABS (2010A) RESEARCH AND EXPERIMENTAL DEVELOPMENT, ALL SECTOR SUMMARY, AUSTRALIA, 2008-09

Business expenditure accounted for the majority of GERD (approximately 61 per cent) in 2008-09. However, as seen in Figure 3, business expenditure focuses predominately on applied research and experimental development.

The higher education sector accounted for $6.7 billion (or 24 per cent) of GERD in 2008−09. The higher education sector was the dominant sector with regard to pure basic research, making up 86 per cent of funding for this type of research.

Research, particularly basic or blue‑sky research, may not immediately lend itself to innovative applications or new goods and services. However, it provides a stock of knowledge that current and future generations rely on to undertake innovation. The nature of basic research expertise is integral in generating a multidisciplinary capacity to address complex research questions (DIISRTE 2012a, p. 66). The higher education sector is therefore highly important in Australia's research effort, given the sector's focus on this type of research.

FIGURE 3 **GROSS EXPENDITURE ON R&D, BY TYPE OF ACTIVITY AND SOURCE (2008-09)**



SOURCE: ABS (2010A) RESEARCH AND EXPERIMENTAL DEVELOPMENT, ALL SECTOR SUMMARY, AUSTRALIA, 2008-09

The following sub-sections demonstrate the size and importance of university research to the Australian economy.

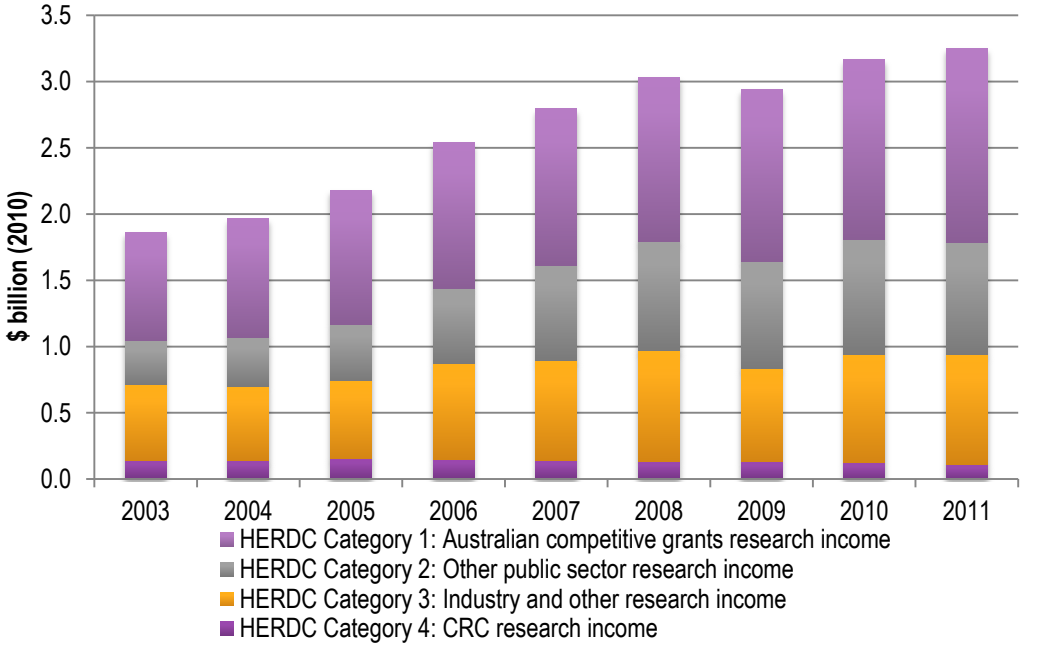
University research income

In 2011, the higher education sector received just over $3.25 billion in research income. The four categories of research income received by higher education sector are:

- Higher Education Research Data Collection (HERDC) Category 1: Australian competitive grants;
- HERDC Category 2: Other public sector research income;
- HERDC Category 3: Industry and other research income; and
- HERDC Category 4: Cooperative Research Centre (CRC) research income.

The change in higher education funding between 2003 and 2011 is shown in Figure 4. From 2003 to 2011 university research income (categories 1-4) grew (in real terms) by approximately 74 per cent. Income from 'industry and other research income' has grown by over 152 per cent and funding from 'Australian competitive grants' has grown by approximately 80 per cent over the same period. 'CRC research income' has declined over the period by just over 23 per cent.

FIGURE 4 **RESEARCH FUNDING BY CATEGORY (2003-11)**



NOTE: MEASURED IN 2011 DOLLARS
SOURCE: HERDC INCOME AND PUBLICATION DATA BY SUB-CATEGORY 2003-2011.

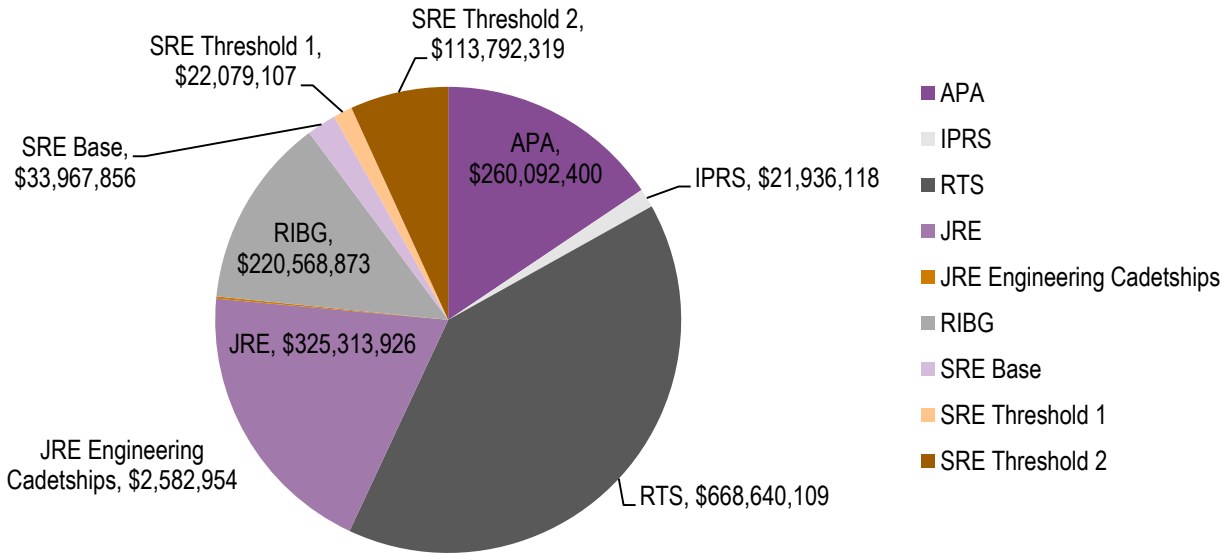
In addition the higher education sector receives block grants for research and research training. Research block grants are allocated according to performance-based formulae and are independent of funding for specific research projects, programs, or fellowships.

The current research block grants are:

- Australian Postgraduate Awards (APA)
- International Postgraduate Research Scholarships (IPRS)
- Research Training Scheme (RTS)
- Joint Research Engagement (JRE)
- Sustainable Research Excellence (SRE)
- Research Infrastructure Block Grants (RIBG)

Figure 5 shows the breakdown of block grants in 2013. It also shows that grants totalled $1.67 billion in 2013, which compares to $1.63 billion allocated in 2012 and $1.52 billion allocated in 2011.

FIGURE 5 **RESEARCH BLOCK GRANT ALLOCATIONS (2013)**

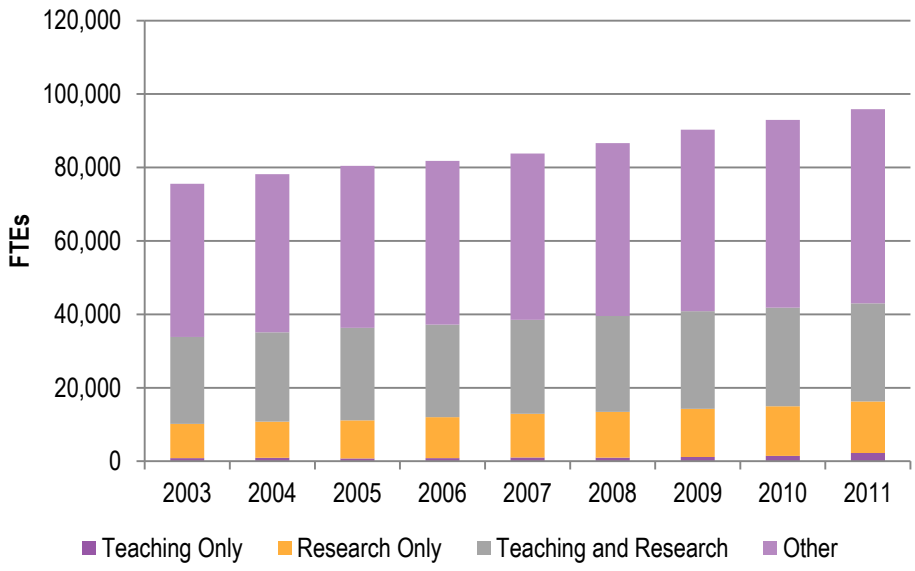


SOURCE: DEPARTMENT OF INDUSTRY, INNOVATION, CLIMATE CHANGE, SCIENCE, RESEARCH AND TERTIARY EDUCATION, 2013

University employment

In 2011, universities employed nearly 96,000 Full Time Equivalent (FTE) staff. Figure 6 shows that the number of FTEs classified as 'research active' (i.e. research only, and teaching and research) increased by 24 per cent between 2003 and 2011. The biggest growth in FTE has occurred in the category of 'other' staff (an increase of nearly 27 per cent between 2003 and 2011).

FIGURE 6 **UNIVERSITY STAFF, BY CATEGORY AND FTE (2003-11)**

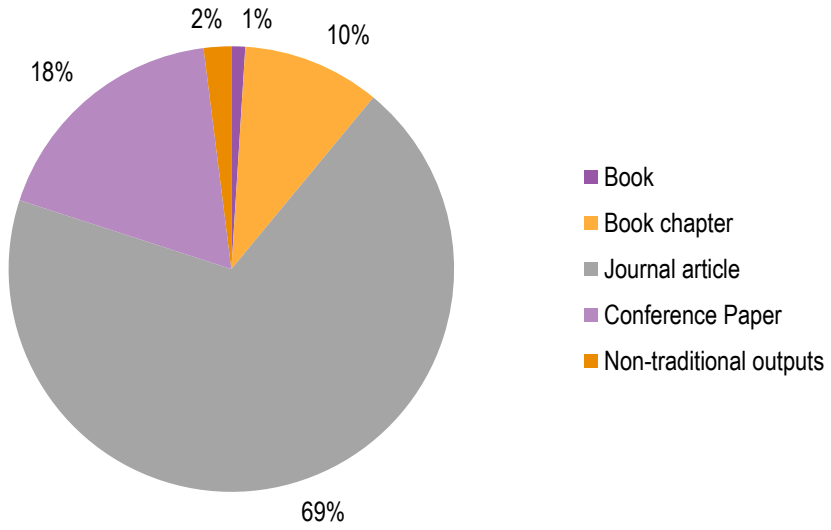


SOURCE: HIGHER EDUCATION STATISTICS COLLECTION – VARIOUS YEARS

University research outputs

A total of 413,477 research outputs were submitted for evaluation to ERA 2012. These represent research outputs from the period 2005 to 2010. In 2010, just over 74,500 research outputs were identified for that year alone, and a total of 333,000 for ERA 2010. The vast majority of these were journal articles, as seen in Figure 7.

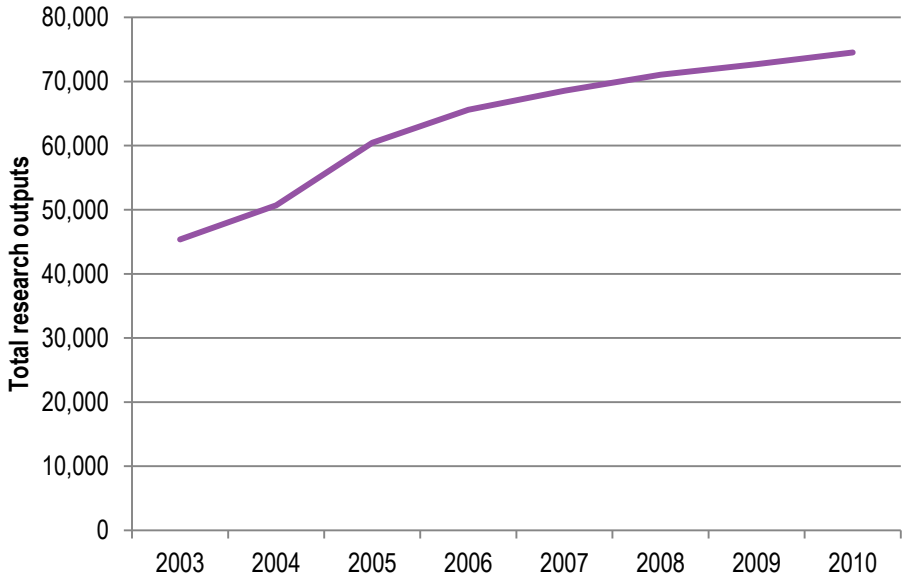
FIGURE 7 **RESEARCH OUTPUTS BY TYPE (2010 ONLY)**



SOURCE: ARC 2012a, *ERA 2012 NATIONAL REPORT*, P. 25

Figure 8 indicates that research outputs have grown significantly in recent years. Between 2003 and 2010 total research outputs (excluding 'portfolios') have grown by just over 65 per cent.

FIGURE 8 **GROWTH IN RESEARCH OUTPUTS (2003-10)**



NOTE: 'TOTAL RESEARCH OUTPUTS' BY YEAR DOES NOT INCLUDE 'PORTFOLIOS'.PORTFOLIOS CAN SPAN MULTIPLE YEARS AND ARE THERFORE NOT INCLUDED IN YEARLY FIGURES.
SOURCE: ARC 2012a, *ERA 2012 NATIONAL REPORT*, P. 216, AND ARC 2011, ERA 2010 NATIONAL REPORT, P.230

2.2 Publicly funded research

The Australian Government provides funding for a range of research activities, including research conducted by Australia's universities. The rationale for this investment, and the benefits that it generates, are discussed in this section.

Rationale

There are a variety of rationales for publicly funded research and innovation. One rationale notes that the government acts as a supplier in a range of knowledge-intensive areas of the service sector, including healthcare and education services. As government undertakes these functions, it needs to invest in R&D to enhance services or to better fulfil its functional or democratic obligations. For example, R&D is a valuable input into defence technology and wide-ranging environmental problems such as weed and pest control (Productivity Commission (PC) 2007, p.74).

Another rationale considers the presence of market failure in the form of spillovers. Spillovers occur when those undertaking research are incapable of realising the full benefit of their innovations due to ideas being adapted or being used relatively inexpensively by others. These effects provide incentives for the private sector to minimise the extent and type of research it undertakes (DIISRTE 2012a, p.12). Market forces therefore lead to significant underinvestment in research and innovation from society's perspective, thereby bolstering the rationale for government intervention (Bernanke 2011, pp. 3-8).

Within the research spectrum, underinvestment most commonly occurs in relation to basic research by comparison with applied types of research. This is due to the fact that basic research is not likely to realise direct benefits in the short to medium term and is therefore unlikely to be funded except by government. Universities are the main participants in basic research and therefore require public funding to support their activities.

Further, socially worthwhile projects are frequently at great risk of not being financed. This is largely due to the high risks and uncertainties associated with research activities and the lack of knowledge by relevant financiers. Similarly, asymmetric information about the value and quality of research activities can prevent financing (PC 2007, p.83)[1].

Other rationales for publicly funded research and innovation include (PC 2007, p. 53, DIISRTE 2012a, p.15):

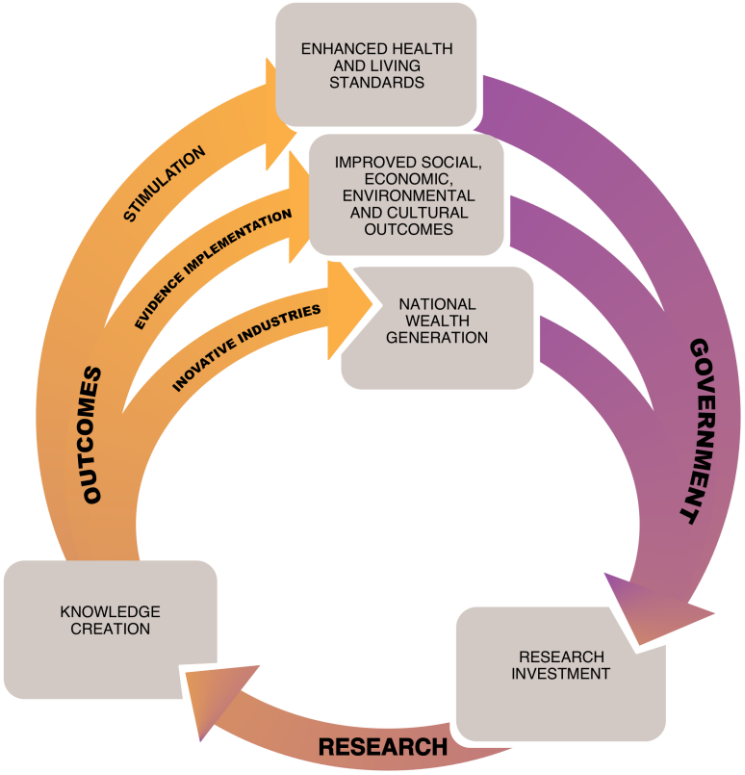
- a robust and well-reputed research capability strengthens Australia's role in the global community;
- government investment in research and innovation consistently generates high social and economic returns; and
- support for investment that generates intangible factors, such as national identity, national prestige and moral obligations.

Benefits

Publicly funded research can lead to enhanced health and living standards, improved economic, social, cultural and environmental outcomes and national wealth creation. It can also raise national productivity, increase national competitiveness, create new jobs and increase tax revenues. Publicly funded research generates a valuable innovation cycle that ultimately permits further investment in research (NHMRC 2010, p. 3). This cycle is illustrated in Figure 9.

[1] It is noted that measuring the performance of research may also help overcome this problem.

FIGURE 9 **THE CYCLE OF PUBLICLY FUNDED RESEARCH**



SOURCE: ACIL ALLEN CONSULTING AND NHMRC 2010, STRATEGIC PLAN 2010-2012, P.3

Martin & Salter (2000, p. 520) have identified the main types of benefits from publicly funded research that lead to economic growth. These benefits can be categorised in the following six ways:

- increasing the stock of useful knowledge;
- training skilled graduates;
- creating new scientific instrumentation and methodologies;
- forming networks and stimulating social interaction;
- increasing the capacity for scientific and technological problem solving; and
- creating new firms.

There is also a range of social, cultural and environmental benefits resulting from publicly funded research. A selection of these include the ability to confront environmental and health challenges; enhanced food security; a better educated and skilled workforce; and improved national security. Appendix D describes these benefits in further detail.

2.3 Performance-based funding of research

Performance-based funding systems provide a mechanism to measure and reward quality research and are based on allocating a portion of a government's higher education budget according to specific performance measures. These systems offer universities incentives to deliver higher quality output:

> The rationale of performance funding is that funds should flow to institutions where performance is manifest: 'performing' institutions should receive more income than lesser performing institutions, which would provide performers with a competitive edge and would stimulate less performing institutions to perform. Output should be rewarded, not input.
>
> Herbst, M., 2007. Financing Public Universities. Higher Education Dynamics, Vol. 18, Springer, p. 90

Performance-based funding systems are also aimed at increasing productivity, global competitiveness, accountability and transparency, enabling performance to be tracked over time and allowing the identification of areas of research strength, weakness and areas of emerging importance.

The development of performance-based funding systems, in Australia and overseas, is a direct reflection of the significance of research to the economy, the large amount of resources dedicated to university research and the benefits flowing from publicly funded research.

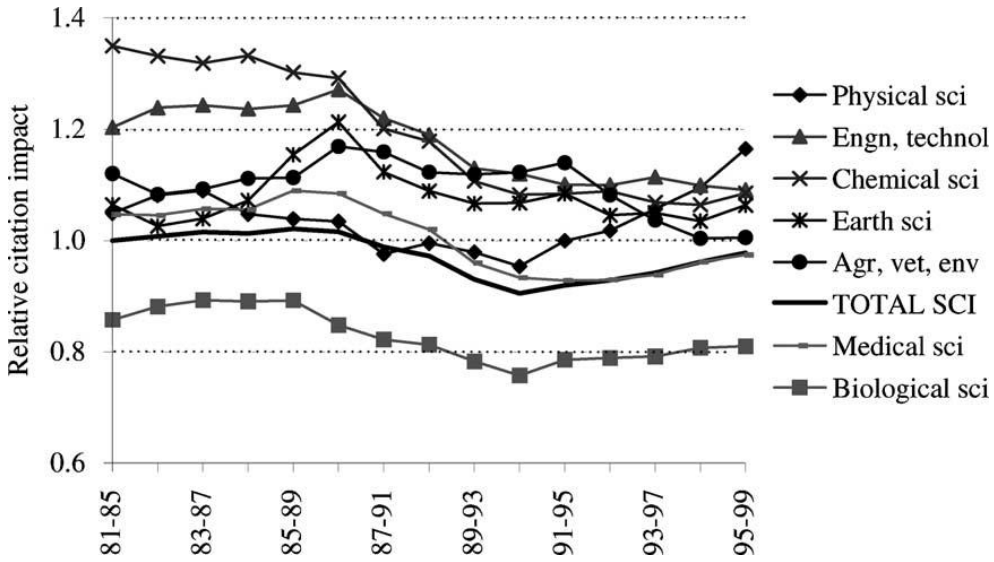
Measuring research quality in Australia

In the early 1990s, concerns were raised about the declining quality of Australian scientific publications as measured by citations in the indices of the Institute for Scientific Information (Butler 2003, p. 143). As shown in Figure 10, a decline in relative impact is noticeable across all fields of science during the late 1980s with the exception of agricultural sciences. During the 1990s, performance was varied, and improved across some fields.

In addition, between 1988 and 1993 Australia's citation impact dropped from 6th to 11th among Organisation for Economic Cooperation and Development (OECD) countries (Hicks 2008, p. 8). During this time Australian researchers were publishing more papers, but in journals with lower average citation impact (Hicks 2008, p.8).

Taking citations as a proxy for quality, this suggests that while the volume of research was increasing, the quality of research was declining.

FIGURE 10 **AUSTRALIA'S RELATIVE CITATION IMPACT (1981-85 TO 1995-99)**



SOURCE: BUTLER 2003

Within this context, the proposal for a Research Quality Framework (RQF) marked the start of discussions on how best to assess the quality of Australian university research. The then Prime Minister, the Hon John Howard, announced the Government's intention to establish quality frameworks for publicly funded research in 2004.

An issues paper was released by the Government in May 2005, followed by the release of details of the Government's preferred model in September of that year. Sir Gareth Roberts provided advice to the Minister for Education Science and Training in March 2006, who announced the appointment of the RQF Development Advisory Group chaired by the Chief Scientist. This Group reported back to the Minister in October 2006.

The RQF was intended to ensure public money was being invested in research of the highest quality and to identify and reward areas of research excellence. Box 3 summarises the RQF's objectives as stated in 2006.

BOX 3 **OBJECTIVES OF THE RQF**

In 2006 the RQF Development Advisory Group provided advice to the Government on the RQF. As part of this advice (as contained in the report *Research Quality Framework: Assessing the quality and impact of research in Australia*), the Advisory Group outlined the objectives of the RQF. Excerpts from this report highlighting the main objectives are provided below.

> The Australian Government seeks to ensure that public money is being invested in research of the highest quality that delivers real benefits not only to the higher education and research sectors but also to the wider community.
>
> The existing distribution of university research block funding is based on quantitative measures (i.e. numbers of publications, external research income and Higher Degree by Research (HDR) student load and completions) that have been used as proxies for quality.
>
> These particular quantitative measures do not provide sufficient information upon which to identify and reward areas of research excellence or to encourage the wider community to increase its investment in Australian research.
>
> Consequently, the Australian Government is committed to the development of a RQF that will provide a broad assessment mechanism for research quality and impact.
>
> The RQF will recognise and reward high quality and high impact research wherever it occurs. The RQF should also be transparent to the Australian Government and taxpayers so that they are better informed about the results of the public investment in research. This in turn will encourage greater investment from Australia's business community, which seeks information about the directions of research and its possible applications.

SOURCE: COMMONWEALTH OF AUSTRALIA 2006, RESEARCH QUALITY FRAMEWORK, ASSESSING THE QUALITY AND IMPACT OF RESEARCH IN AUSTRALIA, DEPARTMENT OF EDUCATION, SCIENCE AND TRAINING, CANBERRA

Following a change of Government in 2007, the new Government announced a revised approach to research quality in March 2008. ERA replaced the RQF, and was trialled in late 2008 and early 2009. The Minister for Industry, Innovation, Science and Research announced further details of ERA in July 2009. Full scale ERA processes then took place in 2010 and 2012, with some adjustments made to the ERA processes between these two events. These adjustments were designed to ensure comparability between ERA 2010 and 2012.

During this time, further support for the measurement of research quality was provided with the release of *Powering Ideas*, which outlined the Government's ten year innovation agenda. The document outlined the importance of university performance:

> We depend so much on universities, in fact, that if their performance slips, the whole innovation system suffers. It is therefore essential that we keep them working well — not just by some standard we set ourselves, but as measured against the world's best. An internationally competitive economy begins with an internationally competitive innovation system — and that begins with internationally competitive universities.
>
> Commonwealth Government 2009, p. 32

Powering Ideas also detailed the Government's policy ambition to increase the number of research groups performing at world-class standard, as measured by international performance benchmarks. ERA was outlined as the mechanism to measure research quality against international benchmarks, with the goal of enabling the Commonwealth Government to link funding to measures of research performance.

The movement towards the measurement of Australian research quality sits within a broader movement internationally. Initiatives aimed at improving research excellence and quality (which included performance-based funding schemes) were also being adopted in a number of other countries during this period (see Box 4 for a summary of these developments).

BOX 4 **INTERNATIONAL DEVELOPMENTS IN THE MEASUREMENT OF RESEARCH QUALITY**

Hicks (2012, p.10) has identified at least 14 performance-based funding systems in 2010, citing the Research Assessment Exercise (1986) in the UK as the first performance-based funding system. These systems all have slightly different aims and objectives.

In the United Kingdom, the Higher Education Funding Council for England (HEFCE) sees its current performance-based funding system, the Research Excellence Framework (REF), as helping to develop and sustain a dynamic and internationally competitive research sector that makes a major contribution to economic prosperity, national wellbeing and the expansion and dissemination of knowledge (HEFCE 2010). In the UK where a significant proportion of university research funding is based on the results of the REF, government authorities consider that rewarding excellent quality research provides best value for money.

In New Zealand, the primary purpose of the Performance-based Research Fund (PBRF) is to ensure that excellent research in the tertiary education sector is encouraged and rewarded. The guidelines for the 2006 PBRF cycle indicated that the main aims, as agreed by the Government were to:

- increase the average quality of research;
- ensure that research continues to support degree and post graduate teaching;
- ensure that funding is available for post graduate students and new researchers;
- improve the quality of public information on research output;
- prevent undue concentration of funding that would undermine research support for all degrees or prevent access to the system by new researchers; and
- underpin the existing research strength in the tertiary education sector.

As Adams (2008, p. 79) has noted, the most frequently stated primary aim of the PBRF is to reward research excellence, in the expectation that this will lead to general improvement of research performance in New Zealand's research base.

At a more micro level, the rationales/outcomes of governments in relation to performance-based funding schemes include:

- strengthening research quality (most countries);
- greater selectivity in funding (UK);
- concentration of research resources (Sweden);
- increasing research productivity (Spain); and
- measuring and stimulating institutional research activity (Norway).

Global competitiveness is a rationale mentioned by other countries. For example, the European Commission (EC) has linked economic and social benefits to the quality and excellence of research (EC 2010, p.41-48).

SOURCE: VARIOUS

Importantly, it has been recognised that Australia's form of research performance measurement is state of the art, with the OECD (2010a, p. 43) stating 'departmental level performance-based research funding systems using peer judgment based on indicators seems to be the state of the art and is being implemented in ERA'.

2.4 Excellence in Research for Australia

The objectives of ERA, as stated in the *Excellence in Research for Australia 2012 National Report,* are to (ARC 2012a, p. 3):

- establish an evaluation framework that gives government, industry, business and the wider community assurance of the excellence of research conducted in Australia's higher education institutions;
- provide a national stocktake of discipline-level areas of research strength and areas where there is opportunity for development in Australia's higher education institutions;
- identify excellence across the full spectrum of research performance;
- identify emerging research areas and opportunities for further development; and
- allow for comparisons of Australia's research nationally and internationally for all discipline areas.

ERA assesses the research quality of all Australian universities. Forty-one institutions in total are eligible for evaluation in ERA. These institutions are required to provide comprehensive data about their research activities for evaluation by eight Research Evaluation Committees (RECs) comprising approximately 150 distinguished researchers from Australia and overseas. The membership of these committees is broadly representative of the major research disciplines that underpin Australia's research activity.

ERA results highlight which universities are active in particular fields of research and how well each university is performing in these disciplines. ERA data informs the performance-based funding that universities receive in order to sustain their excellence in research via the SRE initiative (administered by the Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education - DIICCSRTE). This function provides Australian universities with a financial incentive to focus on research quality. The Mission-Based Compacts negotiated between the Australian Government and universities include ERA results and accompanying targets. The purpose of the Compacts is to enable universities to pursue their own missions while simultaneously contributing to the overall Government innovation agenda.

In December 2012, a further round of ERA was announced, to take place in 2015. The ARC will, in the meantime, consult with the education sector on the value of including other measures to extend evaluation of university research performance (ARC 2013).

Appendix E provides further details of ERA including an overview of the ERA process, indicators used to define data collected, Units of Evaluation (UoEs) and volume thresholds, the treatment of interdisciplinary and multidisciplinary research and changes to ERA over time.

3 Increasing the social rate of return from university research

This chapter outlines the potential impact on the Australian community of improved research performance resulting from ERA. It then examines the effect of ERA and the resulting benefits of specific areas of improved research performance.

3.1 The impact of improved research performance

ERA has improved the research performance of Australian universities through:

- improving the quality of research;
- focusing research effort;
- enhancing collaboration;
- improving resource allocation; and
- informing human resource decision-making.

There is a range of benefits associated with improving research performance in these areas, which are outlined in sections below.

Ultimately, improvements in research lead to a better return on the Government's investment in university research. This is because the benefits (such as productivity improvements and enhanced competitiveness) of high quality research are likely to be more directly realised by the economy than by research that is of a lower standard.

ERA's potential monetary impacts have been estimated specifically for the purposes of this project. Estimations have been undertaken by examining ERA's impact on the social rate of return arising from publicly funded research. The social rate of return is defined as the permanent increase in GDP as a percentage of the dollar cost of the investment that lead to this increase (Allen Consulting Group 2003, p. 1). The social rate of return explores the economic, environmental, cultural and social impacts of research and is a broad measure of return on investment or value creation resulting from research.

Historical estimates of the social rate of return of research vary, with studies reporting social rates of return anywhere between 10 and 160 per cent, but most results falling in the 20 to 50 per cent range (Allen Consulting Group 2003, p. 41). In 2003, the Allen Consulting Group estimated that the average rate of return from all publicly funded research and development in Australia was 25 per cent (Allen Consulting Group 2003, p. 41).

Improving research performance in universities would be anticipated to improve the future social rate of return from research. To understand the impact on the Australian economy of improving the social rate of return on research it is necessary to calculate the total amount of money invested in university research. This study has used HERDC (Category 1-4) income and research block grant funding as an estimation of total investment in university research. Consultations suggested that while some research block funding is used for training and infrastructure, this method is appropriate as improvements in research quality are also likely to improve the return on these aspects of research.[2]

[2] There are specific exclusions in what is reported as research income under HERDC. For details see http://www.innovation.gov.au/Research/ResearchBlockGrants/Documents/2013%20HERDC%20Specifications.pdf

The most recent year for which data is available for both HERDC income and research block grants is 2011, with total funding for this year standing at $4.77 billion.

With the large amount of funding involved, small improvements in the social rate of return can generate significant monetary benefits. For example, a one percentage point increase in the social rate of return (such as an increase in the social rate of return from 25 to 26 per cent) would generate a $47.7 million increase in GDP per annum.

While a one percentage point increase in the social rate of return to research may seem small, it is noted that the quantum of university research activities is large and improving the social rate of return by one percentage point would result in a significant economic impact.

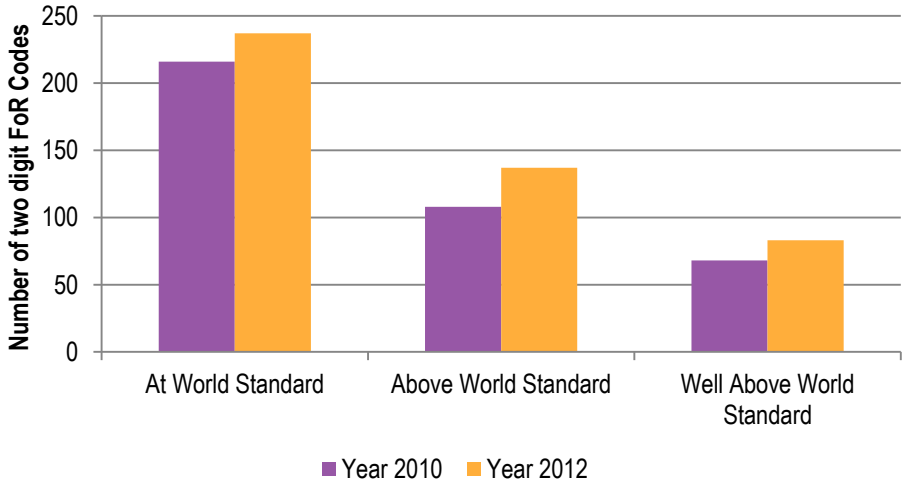
Over time, it would be expected that improvements to the social rate of return, due to ERA's influence, would be increasingly evident. As a result, monetary benefits arising from improved research quality would be likely to increase in the future.

3.2 Better quality research

This section explores changes in research quality through an examination of ERA results and international rankings. It then examines the effect of ERA on research quality and concludes by identifying the benefits of improving research quality.

A high level analysis of changes in research quality, as measured by changes in ERA ratings, gives an indication of how research quality has improved since the introduction of ERA. Figure 11 shows the total number of units of evaluation (UoEs) for all universities (by two-digit Field of Research (FoR)) rated at or above world standard for 2010 and 2012. It shows that between 2010 and 2012, there was an increase in the total number of UoEs rated 'at', 'above' and 'well above' world standard. Importantly, the number of UoEs rated 'at' world standard increased by nearly 10 per cent, while the number of UoEs rated 'above' and 'well above' world standard increased by nearly 27 per cent and just over 22 per cent respectively. This suggests that improvements are even more evident at higher levels of quality.

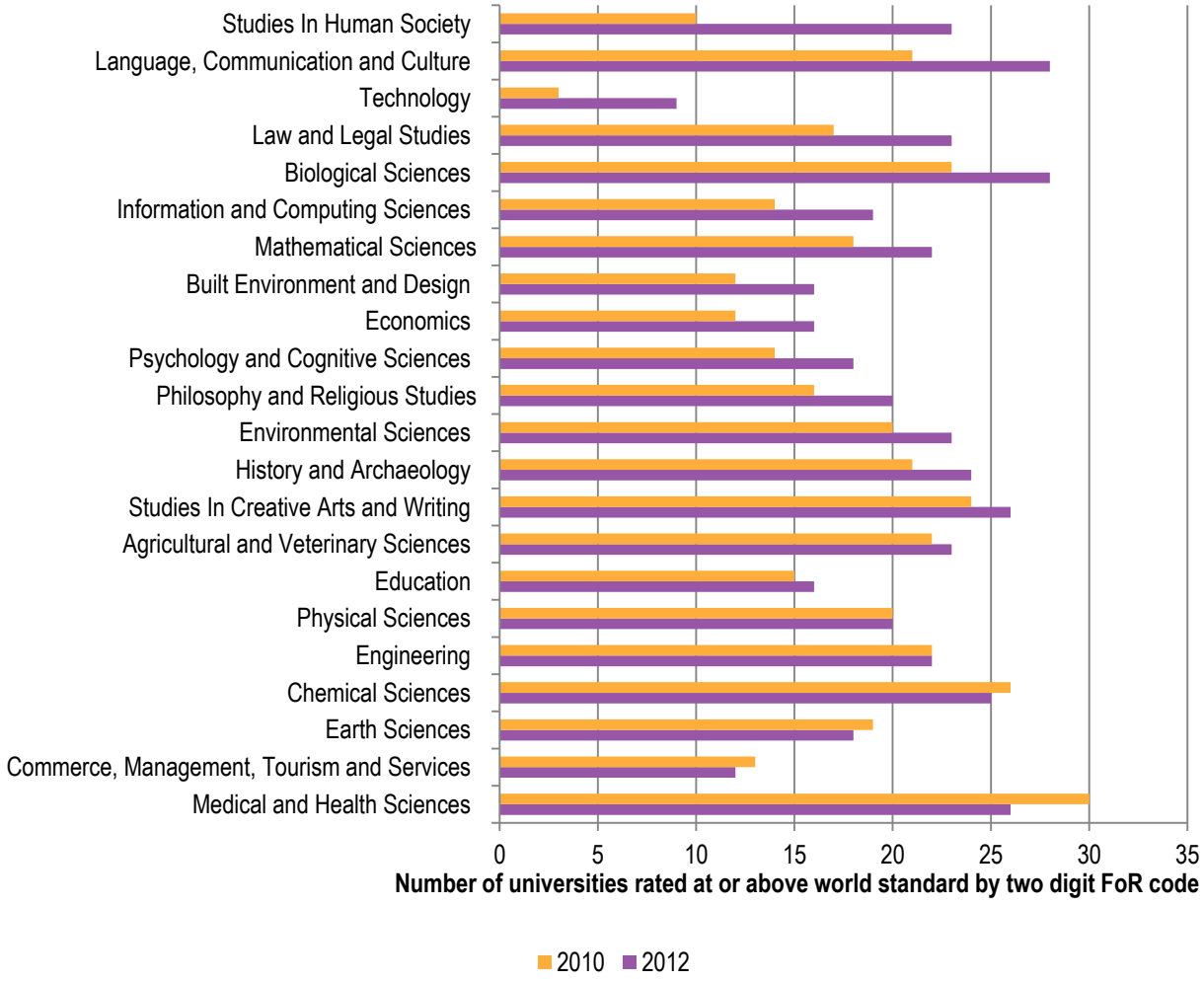
FIGURE 11 **TOTAL NUMBER OF TWO-DIGIT FOR CODES RATED AT OR ABOVE WORLD STANDARD**



SOURCE: ACIL ALLEN CONSULTING, BASED ON DATA OBTAINED FROM ARC 2011 AND ARC 2012a

Figure 12 compares the number of universities rated 'at', 'above' and 'well above' world standard at the two-digit FoR level. It shows that research quality has improved across most FoRs.

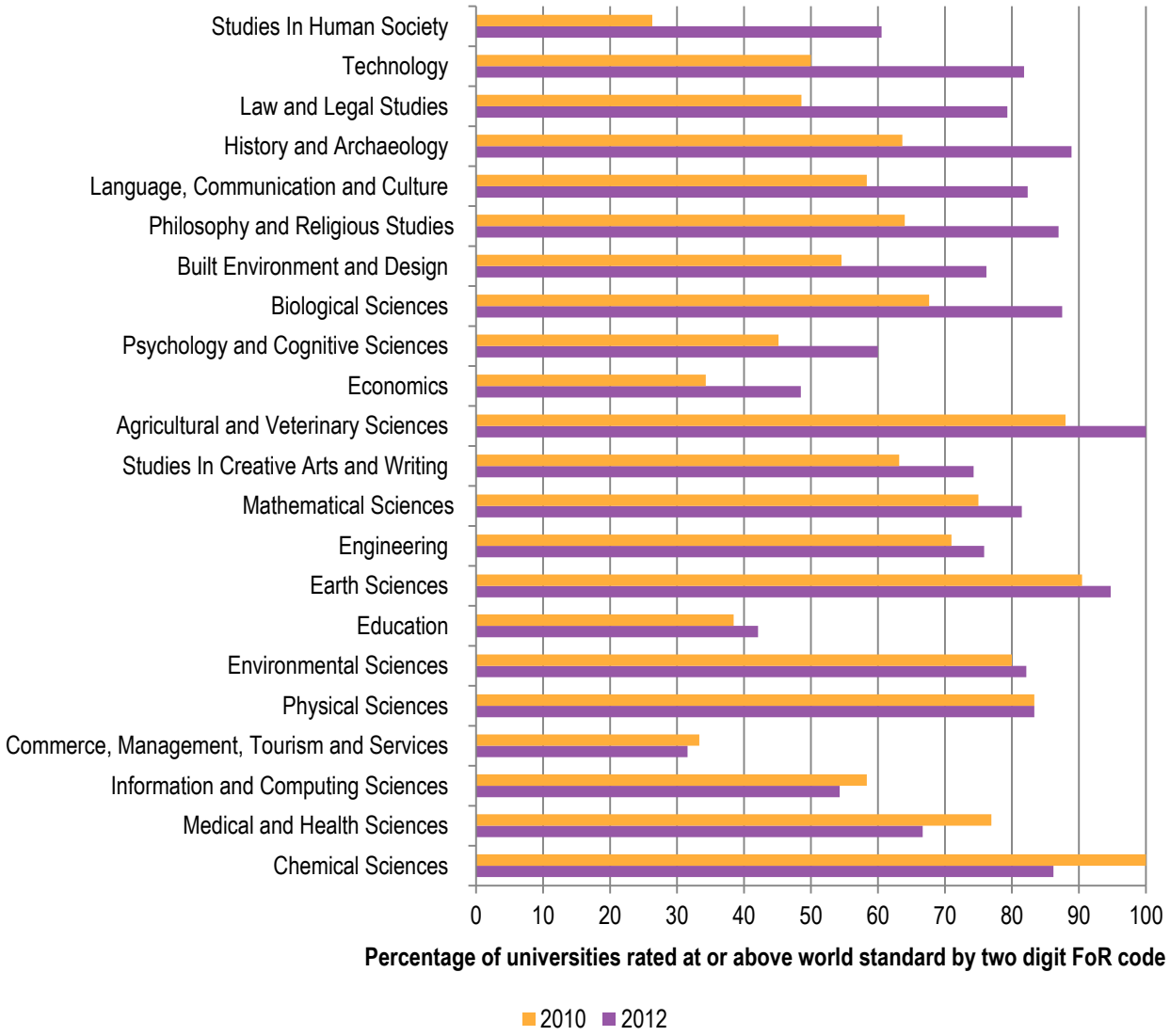
FIGURE 12 **NUMBER OF AUSTRALIAN UNIVERSITIES RATED AT OR ABOVE WORLD STANDARD BY TWO-DIGIT FOR CODES**



SOURCE: ACIL ALLEN CONSULTING, BASED ON DATA OBTAINED FROM ARC 2011 AND ARC 2012a

Figure 13 shows the percentage of universities assessed in ERA rated at or above world standard by FoR. It demonstrates that ratings have not only improved in an absolute sense but, for most FoRs the percentage of universities rated at or above world standard relative to the total number assessed for each two-digit FoR has improved. This adds further support to the argument that ERA has contributed positively to an increase in Australian research quality.

FIGURE 13 **PERCENTAGE OF AUSTRALIAN UNIVERSITIES RATED AT OR ABOVE WORLD STANDARD BY TWO-DIGIT FOR CODES**



SOURCE: ACIL ALLEN CONSULTING, BASED ON DATA OBTAINED FROM ARC 2011 AND ARC 2012a

Improved performance of Australian universities in international ranking schemes supports the conclusion that the quality of Australian research has improved since the 2009 ERA trial. There are a number of university ranking schemes, all using different criteria and methodologies, which are in some part a reflection of Australia's research performance and quality.

Between 2008 and 2009 the Times Higher Education World University Rankings (THEWUR), used a rating scheme based on analysis provided by QS Limited. Table 1 shows the rankings for those Australian universities in the top 200.

TABLE 1 **QS RANKING OF AUSTRALIAN UNIVERSITIES - TOP 200**

University	Ranking		
Year	2008	2009	2011
Melbourne	38	36	31
ANU	16	17	26
Sydney	37	36	38
Queensland	43	41	48
UNSW	45	47	49
Monash	47	45	60
Adelaide	106	81	92
UWA	83	84	73

SOURCE: VARIOUS

Since 2010, THEWUR has been based on an analysis from Thomson Reuters. These "top universities" (TU) rankings are based on 13 performance indicators, grouped into five areas:

- teaching: the learning environment (worth 30 per cent of the overall ranking score);
- research: volume, income and reputation (worth 30 per cent);
- citations: research influence (worth 30 per cent);
- industry income: innovation (worth 2.5 per cent); and
- international outlook: staff, students and research (worth 7.5 per cent).

Table 2 shows the TU ratings from 2010-11 to 2012-13.

TABLE 2 **TU RANKING OF AUSTRALIAN UNIVERSITIES - TOP 200**

University	Ranking		
Year	2010-11	2011-12	2012-13
Melbourne	36	37	28
ANU	43	38	37
Sydney	71	58	62
Queensland	81	74	65
UNSW	152	173	85
Monash	178	117	99
Adelaide	73	N/A	176
UWA	N/A	189	190

SOURCE: VARIOUS

While the QS and the TU ranking measures are different, the THEWER results demonstrate that most Australian universities in the top 200 have maintained or improved their position since 2008.

The Academic Ranking of World Universities (ARWU) was first published in 2003 by the Centre for World-Class Universities and the Institute of Higher Education of Shanghai Jiao Tong University, China. Table 3 shows Australia's highest ranked universities by ARWU in 2013 and their movement since 2003. It also demonstrates an improvement in Australian university rankings in recent years.

The ARWU index is updated annually. It uses six indicators to rank world universities:

- the number of alumni and staff winning Nobel Prizes and Fields Medals;
- the number of highly cited researchers selected by Thomson Scientific;
- the number of articles published in journals *Nature* and *Science*;
- the number of articles indexed in Science Citation Index – Expanded and Social Sciences Citation Index; and

— per capita performance with respect to the size of an institution.

TABLE 3 **ARWU ACADEMIC RANKING OF AUSTRALIAN UNIVERSITIES**

University	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
University of Melbourne	92	83	82	78	79	73	75	62	60	57	54
Australian National University	50	53	56	55	57	59	60	59	70	64	66
University of Queensland	102-151	101-152	101-152	102-150	102-150	101-151	101-151	101-150	86	90	85
University of WA	152-200	153-201	153-202	102-150	102-150	101-151	101-151	101-150	102-150	96	91
University of Sydney	102-151	101-152	101-152	102-150	102-150	100	95	92	96	93	97
Monash University	152-200	202-301	203-300	201-300	203-304	201-302	201-302	151-200	151-200	101-150	101-150
University of NSW	152-200	153-201	153-202	151-200	151-202	152-200	152-200	151-200	151-200	101-150	101-150
Macquarie University	301-400	302-403	203-300	201-300	203-304	201-302	201-302	201-300	201-300	201-300	201-300
University of Adelaide	201-300	202-301	203-300	201-300	151-202	201-302	201-302	201-300	201-300	201-300	201-300

SOURCE: ACADEMIC RANKING OF WORLD UNIVERSITIES

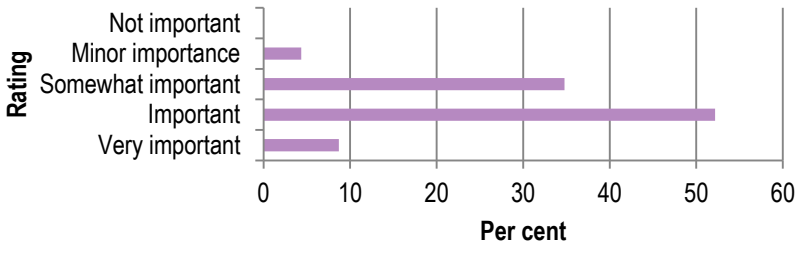
Importantly, international rankings are relative measures. This means that to gain a higher ranking, Australian universities not only have to improve but have to improve more than their international counterparts.

Evidence collected for this BRR suggests that ERA has had a positive impact on the rankings of Australian universities. For example, Phil Baty, editor of the Times Higher Education Rankings, has publicly credited ERA with improvements in Times Higher Education Rankings for Australian universities in 2012. Baty has suggested that improvements in international ranking are a sign of more competitive and concentrated research funding, and credited this to ERA (The Australian, 2012).

Evidence collected for this BRR has also identified agreement amongst universities that ERA has had a positive influence on the quality of Australian research. For example, Figure 14 shows that approximately 66 per cent of universities surveyed for the BRR agreed that ERA had contributed positively to the quality of research being undertaken at their institutions. Of these universities, approximately 9 per cent of universities surveyed indicated that ERA has been 'very important' in influencing research quality, while 52 per cent of universities surveyed noted that ERA was 'important' in influencing research quality at their institutions. An additional 35 per cent of universities noted that ERA was 'somewhat important' in influencing research quality.

Other feedback from universities indicates that the spread of faculties, departments and schools performing lower quality research has narrowed since ERA's introduction.

FIGURE 14 **THE IMPORTANCE OF ERA IN INFLUENCING RESEARCH QUALITY**



SOURCE: ACIL ALLEN SURVEY

These survey results are supported by comments from universities about the importance of ERA to the overall research quality in Australia. These comments include:

> ERA has focused researchers' attention to research quality and generated discussion around "what is research quality" for different disciplines. It has focused attention to our performance on a global scale.
>
> The university is very supportive of qualitative research evaluation, such as ERA, for its focus on understanding research excellence. A system such as ERA is of benefit to the University for the benchmarking capacity it enables across the national performance in individual disciplinary areas. ERA's focus on research excellence means that Australian researchers, as individuals, will tend to focus their attention on maintaining and improving the quality of their research outputs. ERA also enables a more internationally-contextualized understanding of relative performance in research, through the use of indices, such as citation benchmarks.
>
> ERA encouraged research focus, which allows for concentration of strategic support - the outcome of which is a higher proportion of quality research.

These comments also identify that there has been a shift from an emphasis on research *quantity* to research *quality* as a result of ERA. This has included a focus on publishing research in high quality internationally-recognised journals – as outlined in the comments below.

> ERA has resulted in researchers focusing on quality in contrast to the longstanding quantity driver that metrics based funding had encouraged.
>
> There's an increased understanding of the need to publish in quality journals.
>
> Academic staff are now more selective about journals in which they publish - targeting specific, higher quality journals.
>
> We have observed a broad-based change in the attitude of researchers to quality publications, with a much higher level of awareness of the importance of quality outputs rather than quantity. Also, we believe that ERA has encouraged some areas of research focus to improve the quality of their research outputs.
>
> ERA has been important as it has led to an increase in the quality of research outputs rather than just further increases in quantity. ERA has also been very important in recognising the Creative Works research outputs and providing a framework for their recognition.
>
> ERA has enhanced the recognition of quality outputs as opposed to quantity.

The benefits of improved research quality

There are a number of benefits resulting from an improvement in research quality. Broadly these benefits allow Australia to both maintain its research performance, as well as enhance it in certain areas.

Improved research quality helps universities to:

- attract higher quality staff and students;
- enhance their reputations as providers of high quality research to external stakeholders – such as business, government, and the non-government sectors; and
- increase their attractiveness to national and international students seeking high quality education and research training experiences – this contributes to university revenues.

Consultations with universities and government officials suggested that international students are significantly influenced by international university rankings. Enhanced rankings combined with improvements in research quality at universities are therefore likely to lead to greater numbers of international students coming to Australia.

University graduates also benefit from improved research quality in that they are seen to have studied at prestigious universities, something which employers value.

In addition, universities provide economic, cultural and social benefits to the regions in which they are located. Thus improvements in research quality can result in growth in university employment and visitor numbers, bringing with them economic benefits to those regions where campuses are located.

Universities are responsible for supplying skilled graduates to the workforce and are recognised as a major contributor to the innovation capacity of a nation. They add significant value in the creation and distribution of knowledge (see for example UK BIS 2011a, pp. 47-48). Thus improvements in research quality can be expected to generate national benefits, with universities that achieve improvements in research quality making a greater contribution to national innovation and economic growth.

When universities link their research base with business, as well as the broader innovation ecosystem, the benefits of improved university research quality can flow more broadly (UK BIS 2011a, pp. 47- 48). Increased research quality may increase a business's absorptive capacity. Absorptive capacity refers to increasing a firm's ability to identify and use new information. Enhanced research quality may lead to an improved ability on the part of researchers and research graduates working in industry to absorb and adopt research findings. Thus ERA can contribute to enhancing Australia's absorptive capacity, in terms of the ability of Australian firms employing Australian-trained researchers to take up new technology from Australian universities and from overseas sources.

Strong research quality can encourage new partnerships to develop and attract support from other researchers, as well as from industry. High quality university research is important for attracting industry partners. Partnerships with industry bring a number of benefits to universities including funding for research, opportunities for students and the development of intelligence and new ideas. Improved research performance can also lead to the establishment of start-up companies. Spin-off companies can play a major role in the access and application of knowledge (Martin & Salter 2000, pp. 526-528).

Strong research quality can also ensure that Australian researchers have a presence in international networks. Research quality provides Australian researchers with access to the latest developments in international research, cutting-edge infrastructure and research equipment, and enables them to access the latest thinking and knowledge.

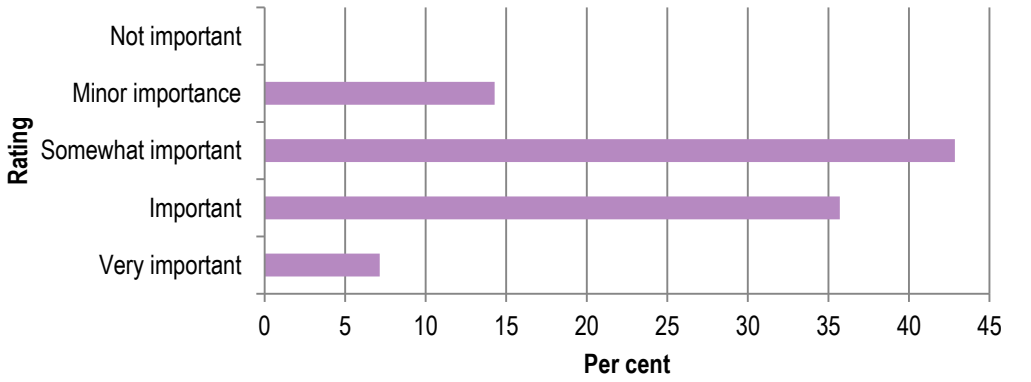
Better quality research as a result of ERA is further likely to result in better quality *outcomes* from research. This is likely to enhance the impact of research and result in increased economic, social, cultural and environmental benefits (such as those outlined in Section 2.2 and Appendix D).

3.3 Focusing research effort

Critical mass is widely regarded as important to success in research. By focusing and/or concentrating research effort, ERA can be expected to generate benefits in the form of more successful outcomes.

Evidence collected for this BRR suggests that ERA has assisted universities to focus their effort by identifying research gaps and discontinuing some areas of activity. The vast majority of universities surveyed (78 per cent) indicated that ERA has assisted them to identify gaps in their research profile and/or capabilities. ERA has been influential in this regard, with 43 per cent of universities that identified ERA as assisting them identify gaps rating this as either 'important' or 'very important' (see Figure 15).

FIGURE 15 **THE IMPORTANCE OF ERA IN IDENTIFYING GAPS IN RESEARCH PROFILE AND/OR CAPABILITY**



SOURCE: ACIL ALLEN SURVEY

In addition, six universities (17 per cent) surveyed reported that they had decided to discontinue some areas of research as a result of ERA, which also contributes to a more focused research effort.

These survey results are supported by comments which suggest that universities have used ERA to profile research, to identify areas of poor performance and to understand strengths and weaknesses within universities.

> ERA has provided another mechanism for profiling research at the University.
>
> ERA has provided a framework for understanding the research strengths and weaknesses at the university within a four digit coding system. The analysis of the results certainly focuses attention to weaker areas.
>
> The ERA has identified some important gaps in research performance…. It has also highlighted areas of vulnerability.
>
> It has highlighted areas where performance is strong but also where the gaps are, where performance was considered to be strong.

Universities have also used ERA to review performance to determine future directions, take action to improve performance in weaker areas, including targeting specific disciplines, and to discontinue some areas of research.

> [ERA] has raised discussions and interactions with head of schools and Exec members to understand the research capabilities in more detail so providing a framework for future directions.
>
> The externally assessed ratings and in particular the rating comparison with other universities in the same discipline, has provided evidence that at times has been useful at a strategic and operational level.
>
> Areas that are not as demonstrably strong are examining current research areas and determining future research pathways.
>
> The ERA exercise has allowed reflection on an individual area basis of where they direct their research effort.
>
> The university has identified a number of areas where ERA performance was less than hoped or lower than could potentially be achieved and efforts are being made to improve performance in these areas.
>
> The institution has targeted a discipline with a low 2012 ERA rank - for further work to improve research performance.

> Poor or worse than desired ERA results has confirmed existing internal assessment of research performance and has resulted in research centre discontinuation.
>
> [We have discontinued research] in fields that did not meet ERA thresholds.

The benefits of focusing research effort

The focusing of university research effort generates a range of benefits that can lead to better returns on investment in research for the government and for the universities. These benefits include streamlining, coordination and improved resource allocation.

The benefits of concentrating research effort were recognised in 1988. The Dawkins 1988 White Paper on Higher Education advocated for the introduction of policies that led to a concentration in research. The White Paper argued (Dawkins 1988, p. 90):

> The application of research findings into processes of direct social or economic benefit is also crucial to the government's objectives and must be increased. None of these areas of research can be effective if limited resources are spread thinly. Concentration and selectivity in research are needed if funding is to be fully effective.

A more recent study by the Russell Group[3] (2010, p. 1) showed that strong concentrations of research excellence can have significant impacts for universities. These benefits include generating increased financial returns, greater collaboration with industry and gaining an influential role in international research collaboration. Additionally, a joint study conducted by the University of Sydney and the University of Sussex (Johnston 1994, p. 34) found that research concentration helps boost university research group output and the achievement of significant advances that gain international recognition (Go8 2009, p. 13).

In the United Kingdom, where there has been a strong focus on research quality over several decades, a stronger, more focused research effort is seen to result in a range of benefits. Larger groups of researchers (HEFCE 2000, p.26):

- contribute to overall intensity via peer stimulus and create opportunities to collaborate and develop ideas;
- lead to a reduction in per capita marginal costs of research (i.e. administration) by contributing to infrastructure;
- lead to the simultaneous development of research concepts, thereby resulting in overall acceleration; and
- contribute to diversity of ideas and potentially increase the potential of cross-discipline themes and development.

In addition, larger groups of research students can generate a supportive atmosphere to underpin successful research training (HEFCE 2000, p.26).

3.4 Enhancing collaboration

Stakeholders reported that ERA has enhanced collaboration within the university sector, and between universities and external partners. Approximately 43 per cent of universities surveyed reported that ERA encouraged increased collaboration with other institutions, with 7 per cent of universities rating ERA as 'very important', 20 per cent as 'important' and 73 per cent as 'somewhat important' in influencing collaboration.

ERA has increased collaboration through the identification of areas of strength and the raising of research profile, with researchers using ERA results to identify research partners. In addition, it was noted that ERA has boosted collaborations within universities and that ERA will increase opportunities for collaboration in the future. For example, it was indicated that:

[3] The Russell Group is an organisation representing 24 leading United Kingdom universities.

> The university is seeing more opportunities for collaboration in areas where ERA outcomes have affirmed research strengths. ERA may be removing barriers to collaboration where our relatively small size may have created a negative perception. There is evidence to suggest that well-established institutions now feel more comfortable collaborating with us in high ERA rated disciplines.
>
> ERA's influence on collaboration has been seen for example in the Centres of Excellence process, whereby ERA outcomes have enabled collaborators to identity researchers with whom they wish to collaborate.
>
> ERA has raised our profile such that it is clear we can bring something to the table when collaborating with bigger, older and better institutions … overall joint publications are increasing at 5 per cent per annum in the last three years.
>
> A benefit for the university is improved collaborative relationships across University units such as the Research Office, the Library and IT.
>
> It is anticipated that the objective measures provided by ERA will increase opportunities for collaboration.

It was also reported that the focus on research quality resulting from ERA has enhanced collaboration, with universities seeing collaboration as a mechanism to improve research quality.

> ERA most certainly has encouraged strategic partnerships as a means of performing higher quality research.
>
> There is an understanding that activities that increase opportunities for collaboration are likely to improve ERA results.
>
> There has been a greater focus on achieving critical mass by collaboration with top groups nationally and internationally.
>
> New internal funding schemes have been established to increase cross-disciplinary research and increase collaboration across expertise.

An example of the way in which ERA has been used to enhance collaboration at the University of Sydney is outlined in Box 5.

BOX 5 **ENHANCING COLLABORATION**

ERA data/outcomes facilitate multi-disciplinary collaboration by providing a pan-university view of research strengths to support data-driven strategies across organisational structures and geographical boundaries.

The Sydney Research Networks Scheme (SyReNS) is an incubator program which identifies and nurtures mid-sized groups in themed areas with potential to evolve into large-scale multi-disciplinary collaborations addressing pressing societal issues.

The SyReNS scheme invites multi-disciplinary teams (of up to 20 individuals) from two or more faculties to establish their research excellence, collaborative potential, capacity to achieve critical mass and strategic importance. Applicants' claims are verified by the review panel against ERA data and other metrics.

SyReNS are initially seed funded for two years to conduct networking activities, such as building web presence, conducting research seminars and workshops, with a view to proving their longer-term viability. SyReNS leaders meet regularly to share experiences and resources.

Currently 14 emerging networks are supported by SyReNS across a broad range of themes including climate change, biosecurity, social justice, learning technologies, health and work, energy storage and physical activity.

SOURCE: UNIVERSITY OF SYDNEY

The *ERA 2012 National Report* includes information on cross-institutional collaboration. The data contained in the report indicates the percentage of research outputs submitted by one or more Australian institutions. For example, the proportion of outputs that are submitted by more than one institution ranged from 8 per cent (History and Archaeology) to 45 per cent (Medical and Health Science).

This information highlights the differences between disciplines in levels of collaboration. Such data can be used by the sector to better understand the extent of collaboration and to

address any areas where low levels of collaboration are having a negative impact on research quality.

The benefits of enhanced collaborations within universities

Institutions collaborate to (DIISRTE 2012b, p. 64):

- resolve complex problems;
- share knowledge, material and risk;
- develop skills and other capabilities;
- stay up-to-date with new developments; and
- expand their market reach and realise economies of scale (for businesses).

Further, enhanced collaboration spreads risk, fosters skills, builds critical mass and allows for greater research capacity. In addition, innovation is increasingly driven by collaboration. For example, approximately two-thirds of the USA's award winning innovations involve collaboration between federal laboratories, government agencies and research universities; in the 1970s, this was less than a fifth (Commonwealth Government 2009, p. 23 and p. 60).

Collaboration also enhances the capacity of innovators to absorb new knowledge, recruit new individuals and subsequently develop new skills. It allows for a reduction in costs by removing duplication, realising economies of scale and improving access to expensive infrastructure. Collaboration undertaken internationally builds capacity within the nations involved, attracts foreign investment, facilitates access to new knowledge and extends a country's worldwide influence (Commonwealth Government 2009, pp. 60-61).

3.5 Improving resource allocation

ERA has improved resource allocation within universities, having an influence on the allocation of funding, the funding of major investments and the formation of annual university budgets. However, ERA's influence on these aspects does not appear to be widespread amongst universities to date. That said, the influence identified has the potential to generate significant positive impacts due to the large amount of resources involved.

Approximately 43 per cent of universities surveyed reported that ERA had led to a re-allocation of funding or resources within their university. The majority (67 per cent) of these universities noted that ERA had been 'somewhat important' in influencing this aspect.

Further, 33 per cent of universities surveyed suggested that ERA has influenced processes to fund major investments. Those universities using ERA to determine the funding of major investments suggested that ERA had an important impact in this area with 17 per cent suggesting ERA was 'very important' and a further 50 per cent suggesting ERA was 'important' in the process.

ERA has also been used by 33 per cent of universities surveyed to inform the development of annual university budgets, although ERA's influence on this was not seen to be highly important.

Survey respondents outlined that ERA provides information used to allocate resources to support research and has influenced resource and funding decisions, as evidenced by the following comments.

> ERA has provided quality performance information in a national context for areas of research. The information includes, but is not limited to, the outcome of the ERA assessment. ERA, at university level, resulted in significant base data that could be considered, in the context of a national conversation on what constituted quality at a discipline level, and in the context of resultant rankings, when allocating resources to support research.

> The strength of ERA performance of specific areas of the institution has been recognised, and has influenced some decisions regarding resourcing and funding.
>
> ERA has resulted in minor adjustments to funding for strategic research centres and has assisted strong research areas in maintaining their research funding.
>
> [ERA] has guided allocation of resources to some extent both in strengthening high performing areas and in lifting performance in a couple of areas of strategic importance where improvement is necessary.

In addition, it was noted that in specific instances, ERA has been used to inform decisions on major investments.

> The university has acquired a Research Centre with leading researchers (from the 2010 ERA).
>
> The university is currently in the process of attracting additional research groups and associated infrastructure.

The benefits of improving resource allocation

Effective resource allocation ensures available resources are used to best effect. This is particularly important where only limited resources are available. With finite resources, organisations require an efficient resource management strategy to gain competitive advantage and achieve their goals. This process requires establishing priorities to focus the creation, distribution and application of new knowledge. Improved resource allocation can also lead to the realisation of goals in a faster and more efficient manner.

By distributing resources efficiently, institutions can achieve greater operational efficiency and achieve improved coordination and management of their supply of skills and related resources. Further, the allocation of resources to activities that add little to productivity and value over a long period of time can result in drain of valuable capital.

In addition, the method by which resources are used in the workplace is an important determinant in achieving productivity improvements and innovation. An effective resource allocation strategy is largely concerned with maximising the contributions of resources in a workplace and the extent to which they are deployed and developed to optimise organisational performance (DIISRTE 2012b, pp. 38-39).

3.6 Informing human resource decision making

ERA data and outcomes are being used to inform human resource decision-making within universities. ERA provides a range of performance information which previously did not exist.

The two key areas of decision-making that ERA has been used to the greatest extent were found to be staff recruitment and retention. Some 75 per cent of universities surveyed reported that ERA has been used to influence decisions related to recruitment and 56 per cent of universities reported that they used ERA results to inform decisions about staff retention.

Universities also reported that they had used ERA results in decisions related to:

- staff performance (39 per cent);
- professional development (36 per cent);
- promotion (34 per cent); and
- remuneration (8 per cent).

ERA has been used in recruitment and retention, to maintain staff profile in specific research areas and focus on excellence, to develop repositories of data which have been used to measure staff performance, to evaluate staff performance and in the consideration of promotions. Comments that highlight the use of ERA in these areas include:

Recruitment and retention has been a specific focus in areas where the university either performed well in ERA or where the university has aspirations to perform well in the future.

The University has been mindful of ERA, as well as other measures of research performance and evaluation, in the retention and recruitment of its research staff.

Discretionary university funds have been used to support recruitment in targeted areas where the university intends to improve its research capacity, and therefore, improve its ERA performance.

ERA has increased focus on concentrating resources and maintaining staff profile in areas of research excellence.

Far greater attention is being given to developing staff research capacity, and in finding ways to provide research time and funding for them.

ERA assessment has motivated better performance data collection for monitoring staff performance. ERA has reinforced the importance of track record in new staff.

ERA provided funding to allow development of a university digital repository plus associated systems and processes to enable storage of all university research outputs. Without this government source of funding, the ability to extend processes and information for staff performance development would not have been possible.

ERA has provided an additional suite of metrics by which to evaluate research performance.

Staff recruitment and retention now involves an ERA based component, where the anticipated performance of a staff member in an ERA assessment exercise is considered.

The major impact that ERA has had on our human resources strategies has been in the roll-out of a unified academic staff classifications and promotions policy, in which research track record is of primary importance.

It has led us to reconsider the value of adjunct academic staff who are not producing quality research outputs. It has also led to identification of high performing researchers to be considered for promotion.

Many stakeholders suggested that a number of factors influence their human resource decision making, and that while ERA data is used, it is often used in conjunction with other information.

An example of how ERA has been used in human resource decision making at the University of Sydney is outlined in Box 6.

BOX 6 **INFORMING HUMAN RESOURCE DECISION MAKING**

Australian Universities have established digital repositories supported with funding from the commonwealth government (ASHER and the Implementation Assistance Programme) as required by ERA. At the University of Sydney the Library and Research Portfolio collaborated to plan, design, implement and populate the digital repository, and link it to the University Research Management System, to seamlessly capture all research outputs, and associated metadata, required by the HERDC, ERA and other output collections.

This comprehensive store of research outputs has facilitated analysis leading to data-driven strategies for researcher development and promotion, for example:

- HERDC or ERA eligible research outputs and metadata are automatically integrated into the university Academic Planning and Development system, providing verified and validated research outputs to supervisors for staff development, research reflections and promotion discussions.
- The university Academic Profiles system, currently being implemented, draws outputs for each academic into a web-based, searchable portal to facilitate cross-disciplinary research within the university and with external collaborators.

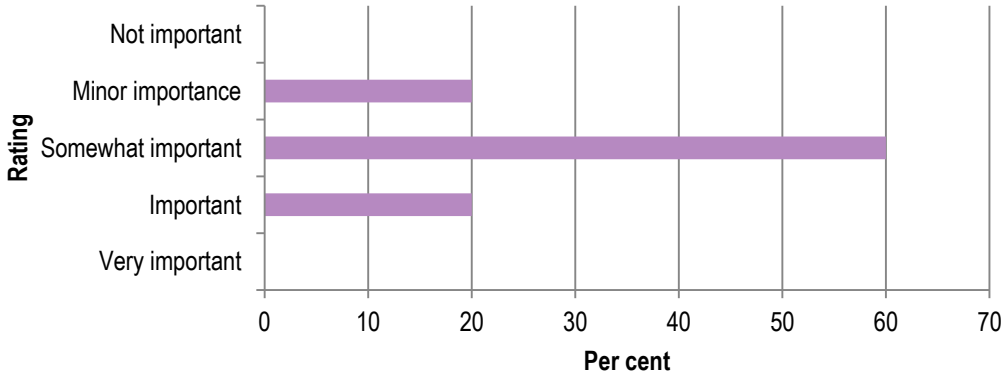
Due to copyright limitations this valuable collection is stored in a “dark” repository that has very restricted access. Where outputs are copyright free they are systematically copied across to a secondary “open access” repository.

SOURCE: UNIVERSITY OF SYDNEY

Figure 16 outlines the importance placed on ERA in human resource decision making. The majority of universities that use ERA to influence human resource decision making (60 per

cent) noted that ERA was 'somewhat important' in this regard. Another 20 per cent of respondents noted it was 'important'.

FIGURE 16 **THE IMPORTANCE OF ERA IN INFLUENCING HUMAN RESOURCES DECISION-MAKING**



SOURCE: ACIL ALLEN SURVEY

The benefits of informing human resource decision making

More informed human resource decision making enhances skills utilisation. Skills utilisation relates to optimising the contributions of employees within the workplace to maximise organisational performance. By making more informed decisions relating to human resources, the quality of staff and their contribution to university performance would be expected to be enhanced.

Increased efficiency of resources is a key source of maintaining productivity growth in every economy. By introducing new processes relating to human resources, embracing best practices or reorganising responsibilities, universities can potentially raise productivity, lower costs and guarantee that individual talents are being used efficiently (OECD 2010b, p. 73).

The utilisation of material and human resources and the potential for developing staff skills and knowledge in a university's work environment can also significantly add to its innovation and productivity performance. In particular, networking and collaborating within institutions can enable staff to share information, experiment and challenge existing patterns to enhance products and processes. By efficiently harnessing a workforce, institutions can encourage individuals from a range of disciplines to collaborate to solve problems, resulting in improved openness and creativity (OECD 2010b, p. 73).

4 Cost savings, increased university revenue and enhanced economic activity

This chapter estimates the potential impact that improved university planning, strategy and operations will have on the Australian university research. It also outlines the effects of ERA, and resulting benefits, on a number of areas of university planning, strategy and operation.

4.1 The impact of enhanced university planning, strategy and operation

This section explores the potential cost savings which may arise from:

- improved coordination and management as a result of ERA; and
- enhanced strategic planning as a result of ERA.

It also examines the increase in revenue and enhanced economic activity associated with improved university recognition and promotion. The specific benefits of each of these areas are then discussed in detail in the subsequent sections.

Cost savings[4]

As outlined in Section 2.1, HERDC (Category 1-4) income and research block grant funding have been used as an estimate of total investment in university research. The most recent year for which data is available for both HERDC income and research block grants is 2011, with a total of $4.77 billion of funding.

Small percentage reductions in costs can generate significant monetary benefits. For example, if ERA's effect on coordination, management and strategic planning led to cost savings of half a per cent of total funding, savings of $23.85 million per annum would result.

Such savings would provide significant additional resources that could be used for research. For example, it is estimated that a professor's salary (Level E1), with on-costs, totals approximately $193,000 (Allen Consulting Group, 2013). Based on this estimate, cost savings of half a per cent across Australia would enable universities to employ an additional 124 professors to deliver research and research training.

Increased university revenue and economic activity

It is anticipated that ERA's effect on promotion and recognition would lead to an increase in international student numbers. In 2012, there were 230,255 international students enrolled in higher education (Australian Education International 2013).

A study undertaken for the Australian Technology Network of Universities found that in 2009, on average, each international higher education student studying at an onshore

[4] It is noted that while ERA has resulted in cost savings to universities, there are also costs to universities in participating in the ERA process. Hence, savings identified may be offset by associated costs. The extent of these costs is beyond the scope of this review and therefore they have not been considered here.

campus in Australia generated $50,874 (Phillimore and Koshy 2010, p. 1). The study found that just over a third of average student expenditure ($18,281) was on fees. The rest was spent on goods and services throughout the rest of the economy (mainly accommodation, cafes and restaurants; and retail trade) – generating more jobs and income (Phillimore and Koshy 2010, pp. 18-19).

There are significant benefits related to increasing the number of international higher education students. For example, if ERA increased international higher education enrolments by half a per cent, an additional 1,151 students would study in Australia per annum. This would result in an increase in increased international student expenditures in Australia of $58.5 million, comprising of just over $21 million in university fees and just under $37.5 million in expenditure on other goods and services.

4.2 Improved coordination and management

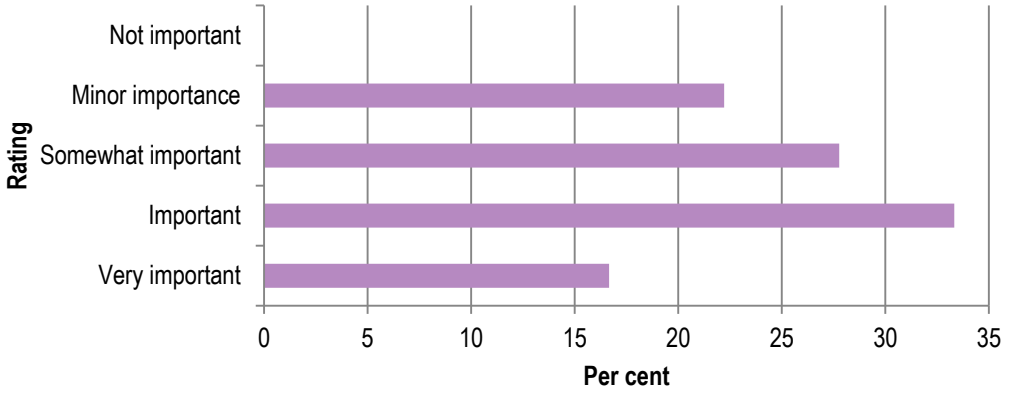
Both consultations and survey results indicate that ERA has had beneficial impacts on university coordination and management. For example, ERA has led to a broader understanding of research across universities and has enhanced the amount of data and information available. ERA is also reported to have increased internal, as well as external, visibility of university performance.

For some universities, ERA has highlighted the importance of research management and data systems. In these instances, ERA has assisted universities to develop information management systems that are built on nationally recognised data protocols. Comments supporting this included:

> ERA has highlighted a need to for stronger management and dissemination of research management data across the university and the university is trying to actively improve these activities.
>
> ERA has led to a broader understanding of research across the university and not just within faculty structures.
>
> There is now a better understanding of the importance of research and how it is captured and presented.
>
> Some divisions in the university have now appointed associate heads of school (research) to improve coordination of research activity.
>
> [ERA has] led to improvements in our internal systems to capture and report research activity, supporting informed decisions about research. [ERA has] assisted with external benchmarking and facilitated a more grounded understanding in some discipline areas.
>
> As part of the preparation for research quality assessment, the government provided funding to build information systems. This consisted of both library repositories and data systems that could provide the information required for the assessment. Our university has continued to build and enhance the data system to serve a number of research purposes and this has been very beneficial for researchers, managers and administrators alike.
>
> We are moving towards having a lot more research metric data available as well as information about how to improve a researcher's visibility. It has assisted in developing data systems and increasing the timeliness and accessibility of that data. ERA has made it clear that there needs to be a single source of research performance data. Further, ERA has intensified the demand for these data (not ERA data) to aid in evaluating individuals, groups, schools, faculties, institutes and centres and disciplines. ERA has certainly intensified our awareness and use of bibliometric data.

These comments are supported by survey results from 51 per cent of universities which suggest that ERA led to better management and coordination of research activity (see Figure 17).

FIGURE 17 **THE IMPORTANCE OF ERA IN INFLUENCING MANAGEMENT AND COORDINATION OF RESEARCH ACTIVITIES**



SOURCE: ACIL ALLEN SURVEY

An example of ERA's impact on management at the Queensland University of Technology is outlined in Box 7.

BOX 7 **IMPROVING COORDINATION AND MANAGEMENT**

The Australian Scheme for Higher Education Repositories (ASHER) funding was provided by the Federal Government to assist universities in preparing library repositories for a research quality assessment exercise, initially the RQF and then ERA. This funding allowed the Queensland University of Technology to upgrade its existing library repository software expanding its functionality. The funding was also used to prepare outputs for assessment by external reviewers.

A separate pool of funding, Implementation Assistance Programme, was also provided to assist universities in the deployment of new administrative and reporting systems to support a research quality assessment. At the Queensland University of Technology, this funding was used to develop a web based information system which integrated relevant data from existing university systems such as the HR, Research and Finance Databases with the flexibility for new data, such as Esteem Measures, to be added.

The new database allowed the Queensland University of Technology to prepare ERA submissions relatively easily. It also meant researchers were able to see all their research data at one website and ensure it was being correctly reported. Managers and other staff could also see information for all the researchers in their area.

After meeting ERA requirements, the functionality of the information system has expanded to such things as keyword searches across research criteria, performance averages, impact information etc. The database is now established as an essential research tool at our university and is widely used by those involved in research. It has also assisted the Queensland University of Technology in its goal to achieve research quality across a wide range of disciplines.

SOURCE: QUEENSLAND UNIVERSITY OF TECHNOLOGY

The benefits of improved coordination and management

Failure to carefully manage resources can have a significant impact on the costs of universities. A strong coordination and management strategy is required to allocate resources effectively so that priorities and goals are achieved in a cost-effective manner.

Organisations can also gain a competitive advantage through greater coordination and management processes. With finite resources, university management is encouraged to establish priorities to underpin the development, distribution and implementation of new knowledge.

Further, improved coordination and management mechanisms can alleviate challenges related to the limited availability of funding. Efficient management can lead to strategic internal decisions designed to maximise existing research capabilities.

Enhanced coordination and management also allows institutions to address changes in policies and priorities over time and to deal with the diversity of funding sources. The PC

(2007, p. 360) noted that a few nations have demonstrated exemplary coordination and management. It highlighted Japan, which uses central coordinating bodies to address overlapping issues in research, and Denmark which has merged several science-related ministries to promote synergy and encourage collaboration, as leading examples (however these models may not be appropriate in Australia).

In addition, improved coordination and management assists in enhancing operational efficiency by avoiding instances of overlapping effort and duplication. The careful management of resources can allow for greater synergy and lead to greater individual and collective efforts. Where problems persist in terms of overlap, duplication or inconsistent priorities, institutions are encouraged to address these issues by enhancing or strengthening their coordination and liaison mechanisms (PC 2007, p. 360).

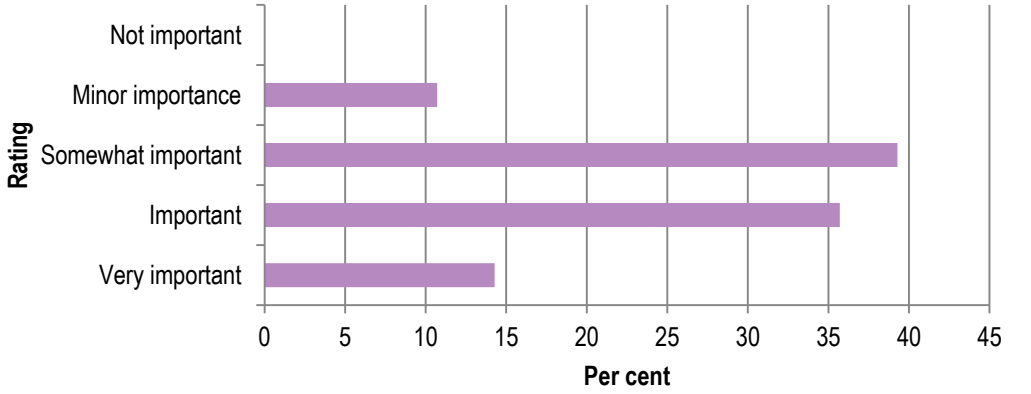
4.3 Enhanced strategic planning

This BRR has demonstrated that ERA has positively influenced university planning and strategy. This was supported by both consultations and survey results. Additional evidence of the use of ERA in strategic planning has been obtained from an analysis, undertaken by the ARC, of university annual reports and strategic plans (discussed below).

It was reported in consultations that ERA provides increased evidence for university administrators who want to make strategic changes or set strategic plans. It was also noted that, through ERA, Deputy Vice-Chancellors of Research (DVCRs) now have an independent source of advice on performance and can use this advice as a lever to make changes in the best interests of the whole institution. Additionally, it was reported that universities have become more strategic about the research areas they want to be involved in, as well as maintaining their existing strengths.

Approximately 80 per cent of universities agreed that ERA had influenced their longer-term strategic planning processes with 15 per cent of universities viewing its influence as 'very important' and a further 35 per cent viewing ERA's influence on this aspect as 'important' (see Figure 18).

FIGURE 18 **THE IMPORTANCE OF ERA IN INFLUENCING LONGER-TERM STRATEGIC PLANNING PROCESSES**



SOURCE: ACIL ALLEN SURVEY

Analysis provided by the ARC further demonstrates the use of ERA in strategic planning. In August 2012, the ARC examined the Strategic Plans and Annual Reports of Australian universities to ascertain the number of documents which specifically mention ERA or ERA outcomes, or reference ERA targets. Table 4 shows that 82 per cent of annual reports examined specifically mentioned ERA, as did 53 per cent of strategic plans. These

documents also contained specific ERA targets and specific targets relating to ERA journal ratings.

TABLE 4 **STRATEGIC PLANS AND ANNUAL REPORTS REFERRING TO ERA**

Document	Use of ERA	Number of documents mentioning ERA	Percentage of documents mentioning ERA (%)
Strategic Plans	specifically mentioned ERA	18	53
Annual Reports	specifically mentioned ERA	31	82
Strategic Plans and Annual Reports	specific ERA targets (references to ratings, numerical or descriptive)	19	26
Strategic Plans and Annual Reports	specific targets relating to ERA journal ratings	5	7

* As at 17 August 2012

Note: 34 Strategic Plans were assessed and 38 Annual Reports were assessed. Not all are available online to the general public.

SOURCE: ARC ANALYSIS

A number of comments provided in the survey of universities indicated that ERA has had an impact on planning and strategy. It was noted that ERA has been, and will continue to be, used to provide strategic direction and assist benchmarking and review strategies, as outlined below.

> We would expect that there will be continued reinforcement at the highest governance levels of the University's research strategy through the effect of ERA.
>
> ERA data has been used both to interrogate and help formulate Faculty Strategic Plans.
>
> ERA is an external measure that reinforces University strategic direction.
>
> ERA has assisted with external benchmarking and facilitated a more grounded understanding in some discipline areas.
>
> ERA provides access to national benchmarking information at a discipline level.
>
> Faculties have examined the results and reviewed strategies and strengthened research directions. ERA has also contributed to supporting evidence driven policy making and evidenced based research reviews.
>
> The university is currently under-going a major restructure. While the restructure is not being driven by ERA outcomes, attention is being given to ensuring that changes do not compromise existing areas performing well in ERA or inhibiting development of additional areas of ERA strength.
>
> Considerations related to ERA have been incorporated in the University's mission based Compact and into the University's research strategy.
>
> The impact of ERA on longer term strategic planning at the university has been at school/department level. ERA's influence has been to amplify the university's existing efforts to focus the efforts of schools on longer term, high quality research planning and development.
>
> Overall our university's performance in ERA 2012 was significantly better than ERA 2010 which demonstrates an improved focus on research quality. It also reinforced the strategic research areas that our university wishes to grow. In addition, it highlighted weaker areas in an international and national context, and which are being assessed as to further support and adjustment.
>
> [ERA] has raised discussions and interactions with head of schools and Exec members to understand the research capabilities in more detail so providing a framework for future directions.
>
> ERA data has led to greatly enriched annual faculty research reviews in conjunction with Compact-like meetings with the DVCR to discuss longer term research strategies. Internally within faculties research focus has increased with attention to quality of applications and outputs. From 2014 this process of data-informed conversations will be extended to meetings of cognate faculties, to facilitate the development of a university-wide research strategy.

ERA's importance in strategic planning processes is multi-factorial - publication of national results that are factored into 'league tables' influencing to some degree researchers, institutions and the broader national/international community; incorporation as a driver of major Commonwealth funding to organisations (current and threatened); impact on student choices and potential funding.

ERA has had an influence on longer-term strategic planning at the university and is discussed at every level of the University from Council down to school and centre research committees.

Box 8 provides an example of how ERA has been used by universities for planning and strategy.

BOX 8 **ENHANCING STRATEGIC PLANNING**

In line with the university's aims to become one of Australia's truly great Institutions, a strong strategic focus was placed on research and research training. In line with this goal the University appointed research chairs – individuals and teams to fulfil strategic leadership roles and attract significant research activity in their relevant fields aligned with the universities research priorities. The University appointed a new research chair and an established team of researchers which provided a major boost to the University's research capability.

The purpose of this was to add to the breadth of research and also enhance the research already being undertaken in this field. The research undertaken by the group also falls within key national priority areas and it is anticipated the high standard of quality will be captured in future quality reporting requirements. The ERA 2010 results assisted in targeting research areas of quality in relevant fields of the University's targeted growth areas.

SOURCE: UNIVERSITY (IDENTITY CONFIDENTIAL)

The benefits of enhanced strategic planning

Strategic planning creates a range of benefits, including:

- enhanced decision-making;
- the potential for gaining or enhancing competitive advantage;
- resource efficiency; and
- a greater focus on achieving desired goals.

In a general sense, strategic planning allows institutions to offer greater value by providing products or services at lower prices or by providing greater benefits that justify similar prices as competitors. In a university context this means better value for taxpayers who are funding research, better value for university students who receive education and training and better value to the end-users and consumers of research outputs.

Strategic planning can provide decision makers with improved knowledge of their goods and services and of their operating environment. Through gaining such knowledge, decision makers can develop greater awareness of gaps in their services or products and subsequently take action to fill such gaps. This process can often involve improved resource allocation. Thus strategic planning delivers efficiency benefits for universities that flow beyond research into decisions on university operations more generally, such as the courses to be offered.

In terms of achieving a competitive advantage, institutions can gain significantly by offering unique products and services. By finding and nurturing a competitive advantage, institutions can increase their profit levels and ensure that they remain sustainable and successful in the long term. A strong and well guided competitive advantage can provide a unified direction for a range of activities undertaken by institutions, including their marketing, distribution, customer service and human resource decision making (University of Wyoming, undated).

Enhanced strategic planning, as a result of ERA, will lead to cost savings for universities by improving the efficiency and effectiveness of university operations.

4.4 Improved recognition and promotion

This section explores ERA's effect on recognition and promotion, including its influence on:

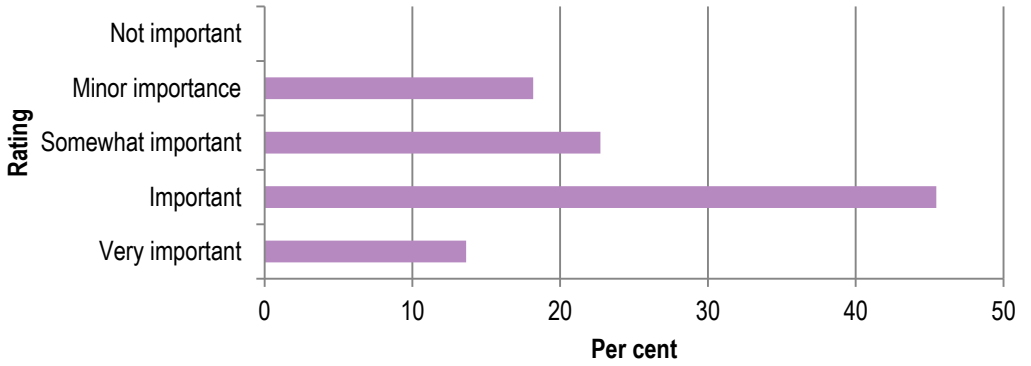
- international research recognition;
- the promotion of activities;
- business and philanthropic support; and
- research application.

Improving international research recognition

Stakeholders consulted for this BRR reported that ERA has assisted universities in receiving greater international and national recognition for their research. Additionally, stakeholders also noted that, over time, ERA will enhance Australian universities' international profile. This was supported by the survey results, with approximately 61 per cent of universities agreeing that ERA led to greater international recognition of research conducted at their institutions.

Figure 19 shows that nearly 14 per cent of these universities surveyed believe ERA has been 'very important' in influencing international research recognition. The majority of respondents (45 per cent) noted that ERA was 'important' in contributing to research recognition, while an additional 23 per cent regarded ERA as 'somewhat important'.

FIGURE 19 **THE IMPORTANCE OF ERA IN INFLUENCING INTERNATIONAL RESEARCH RECOGNITION**



SOURCE: ACIL ALLEN SURVEY

These findings were supported by comments provided in the survey, with many universities noting the important role of ERA in enhancing the reputation of courses and programs. Comments included:

> ERA outcomes have enabled the university to more confidently promote specific research areas (e.g. maritime engineering which achieved a five) knowing that an objective research metric has measured high quality activity. Universities of our size and calibre now have some evidence to back up claims of research strength in unique areas.
>
> The number of results above World Standard have been promoted to research partners, collaborators and to the general public. The high result has boosted the institution's ability to attract partners.
>
> The published ERA 2010 results confirmed our university's standing in a range of disciplines as world class or above. This assisted in enhancing our reputation both nationally and internationally, allowing us to attract interest from researchers and funding opportunities from a wider range of sources.

There is emerging evidence that in some fields, including Law, Political Science, Ecology and Environment and Quantum Physics, that ERA outcomes are being used strategically at the school/department level to project an image that leads to enhanced partnerships and reputation.

The university expects continuing improvement in its existing areas of research excellence and to build the research capacity and quality of those areas that are emerging areas of research strength or areas that have not traditionally been research active. Hand in hand with this the University expects to continue to build its reputation nationally and internationally as a leading research intensive university and to grow our collaborations in both quantity and quality based on this.

National recognition of areas of quality research provided, somewhat, a springboard for broader international recognition.

ERA has provided increased recognition for those areas in the university that in the past may not have had an externally validated assessment rating them at world class or above.

ERA results have been used in promoting our areas of research strength to international collaborators.

In international recruitment, where ratings are at world standard or above as judged through ERA, the University's attractiveness to high quality researchers has been influenced positively.

Rating five in key areas has gained recognition for our University's very high quality research.

Great awareness across Asia in particular.

[ERA] raises profile, makes it easy to highlight excellence, and has helped to attract staff. We are now finding it easier to talk to colleagues in the region.

Promoting strengths and research activities

This BBR has demonstrated that ERA has been widely used to promote university strengths and research activities to a broad range of audiences. Almost every university can find something in ERA that they can report to their advantage, and ERA has been used extensively by universities for marketing purposes.

Survey results suggest that the majority of universities have used ERA ratings to promote their strengths and research activities to a range of audiences, most notably students, government and not-for-profit collaborators (see Table 5).

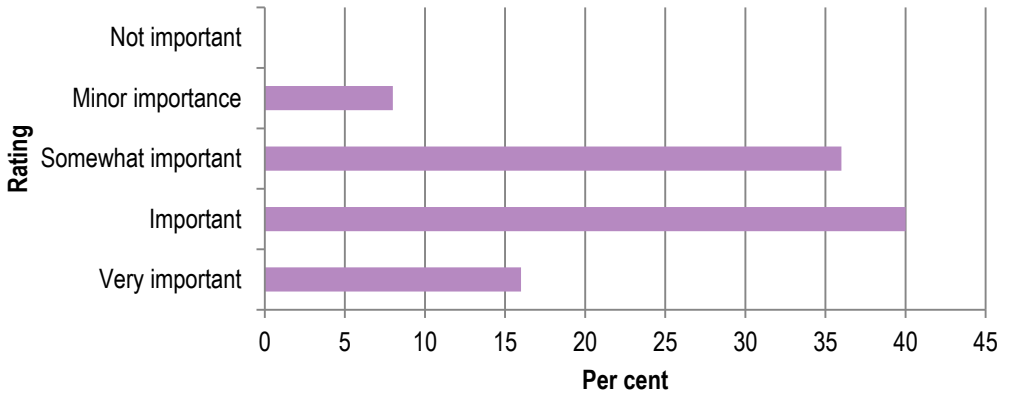
TABLE 5 **ERA'S USE IN PROMOTION ACTIVITIES**

Individual / organisation	Percentage of survey respondents using ERA for promotion
Students	66
Government or not-for-profit collaborators	62
Business collaborators	56
International collaborators	54
Donors	53

SOURCE: ACIL ALLEN SURVEY

The importance of ERA in promoting strengths and research activities is shown in Figure 20. Universities that use ERA to promote their activities generally believe its influence is significant. The majority of survey respondents (40 per cent) noted that ERA was 'important' in promoting the activities of their universities, while 16 per cent reported that ERA was 'very important' in the same regard.

FIGURE 20 **THE IMPORTANCE OF ERA IN INFLUENCING THE PROMOTION OF UNIVERSITY ACTIVITIES**



SOURCE: ACIL ALLEN SURVEY

Comments provided by universities in their survey responses added further support to the use of ERA for the promotion of strengths and research activities. It was reported that ERA is used extensively in promotional material to attract students and research collaborators, as well as promotion to government and the wider community, as evidenced by the comments below.

> All promotional material is now supported by the empirical findings of ERA.
>
> ERA is a very useful benchmarking tool to demonstrate research quality and discipline strength. ERA results have been presented via web pages and other communications channels to a range of partners. ERA results are currently used to attract students.
>
> ERA ratings were used as a significant part of the marketing campaign in 2011-2012.
>
> The university has added information about ERA outcomes and results to numerous outgoing informational items. The results have confirmed the university's excellent research and the university promotes research to collaborators, the public, government, staff and students and is able to support the statements with reference to ERA results.
>
> International students like ratings so the publicly available ERA results with externally validated ratings are used as a marketing tool by our university.
>
> ERA scores have been used on the university's website to promote the research strengths of those areas that received a world class or above score. Further this is used in specific promotional material made available to market segments and in presentations.
>
> The university has added information about ERA outcomes and results to numerous outgoing informational items. ERA has provided an objective measure of research quality. In discussions with potential industry or government collaborators, ERA ratings are of value and of particular interest. Furthermore, potential research students may factor in ERA ratings into their decision making process.

There is evidence to suggest that the promotion of universities (in which ERA results have been used to demonstrate areas of strength) has resulted in increased interest from national and international students. In addition, stakeholders reported that they believe this will grow in the future as ERA becomes more widely understood.

The survey results show that 21 per cent of universities believed that their institutions received increased interest from students in areas where ERA identified their institutions as having particular strengths. Comments suggesting ERA has led to increased interest from students include:

> Anecdotally, feedback is that interest has increased in particular areas.

> The influence of ERA on interest appears to be positive in respect to postdoctoral researchers.
>
> This interest is both domestic and international, for HDR students in particular.
>
> We do anticipate that there may be significant effects in the future as ERA outcomes are incorporated in marketing and external awareness of ERA increases.

Enhancing business interest and philanthropic support

It was noted during consultations that, at least to date, ERA has had only a limited influence on business interest and philanthropic support. It was reported that businesses tend to have a pre-existing network of university partners which they work with, and that industry partners often already know those researchers who are at the top of their field. Hence it was suggested that ERA results are not greatly used by business to identify potential research partners. It was noted however, that in some instances ERA ratings have been used by businesses to confirm that existing relationships and partnerships with universities are with the top ranked institutions.

Survey results supported this, with 11 per cent of universities surveyed reporting that their ERA ratings had led to interest from industry partners and philanthropic foundations. Amongst those respondents who reported that their ERA ratings led to increased interest from industry partners and philanthropic foundations, 50 per cent viewed ERA ratings as 'important' in influencing this aspect.

Increasing research application

It is noted that there can be significant lags between research being undertaken and the commercialisation of that research (Go8 2011, p. 4). Given that ERA has only been in operation for a short period of time, its opportunity to influence research application has been limited. This suggests that the link between ERA and research application, if there is one, may take more time to become evident. Stakeholders noted that, at least to date, ERA had not had an impact on research application. No university surveyed for this review reported that ERA had led to an increase in research commercialisation.

Some universities indicated ERA had the potential to increase awareness of the importance of research exposure in attracting external research income. This increase in exposure may therefore result in benefits in the future. Comments included:

> There has been awareness raised among researchers about the drivers of ERA and the importance of research income.
>
> It has highlighted the importance of research within the University and how researchers can gain exposure for their research through publications and external research income.

The benefits of recognition and promotion

Enhancements to research recognition and promotion provide benefits both to universities and their graduates. Research recognition assists universities in recruiting staff and students and in promoting their activities to a variety of stakeholders.

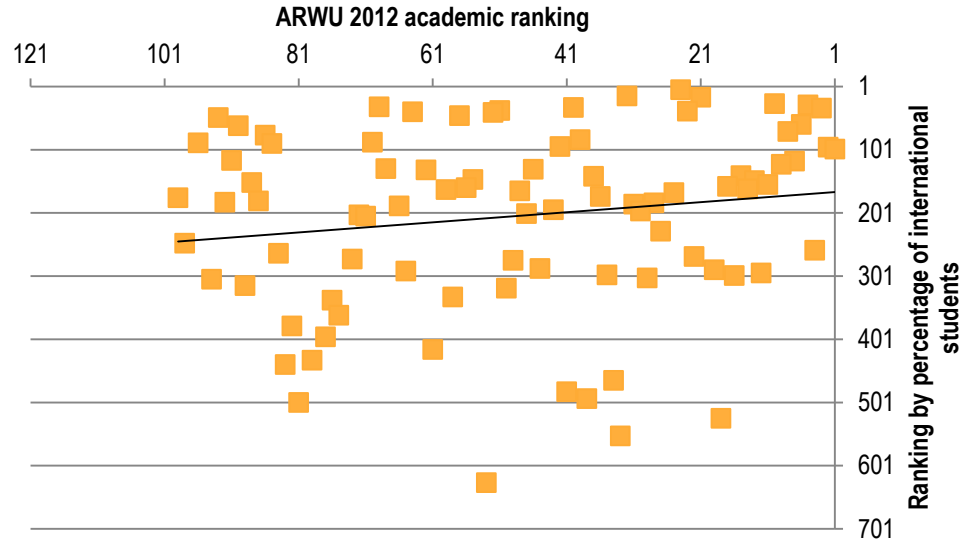
As noted earlier, the promotion of universities' research quality and standards via strong international rankings can lead to a larger influx of international students and subsequent revenue. International students can also add significant value in the creation and application of knowledge within universities (UK BIS 2011a, pp. 46-48).

A high level analysis of 2012 ARWU academic ranking of world universities against ranking by percentage of international students demonstrates a link between higher academic rankings and greater proportions of international university students. As shown in Figure 21, a correlation is evident between higher ARWU 2012 academic rankings (demonstrated

by a movement from left to right in the figure) and higher rankings by percentage of international students (demonstrated by a movement from bottom to top in the figure).

While there are a variety of factors which influence student choices about where to study, the high level analysis provides some evidence that international students are attracted to institutions with higher rankings. When Australian universities promote areas of excellence to international students, as evidenced by ERA results, it is therefore likely that this will increase the number of international students in Australia.

FIGURE 21 **CORRELATION BETWEEN ACADEMIC RANKING AND INTERNATIONAL STUDENTS**



NOTE: SAMPLE LIMITED TO TOP 100 UNIVERSITIES FOR WHICH DATA WAS AVAILABLE

SOURCE: ACADEMIC RANKING OF WORLD UNIVERSITIES

Box 9 considers the potential benefits of attracting international students to Australian society. The majority of these benefits are high-level and of interest to government.

BOX 9 **THE BENEFITS OF INTERNATIONAL STUDENTS TO AUSTRALIAN SOCIETY**

The following outlines the types of benefits to Australian society through the attraction of international students at Australian universities.

1. Aggregate net benefits to academic institutions.
2. Unmeasured pecuniary benefits
   - expenditure of students on living costs net of income earned in Australia;
   - international air travel associated with study;
   - international and domestic tourism of students and family during and after period of education;
   - revenue from visa applications; and
   - tax revenue (direct and indirect) during residence.
3. Trade effects:
   - potential source of educated immigrants (giving rise to domestic growth and a stream of tax payments and capital transfers); and
   - possible growth from trade links.
4. Unmeasured non-pecuniary benefits:
   - cultural links;
   - diplomatic relations; and
   - international friendships and understanding of other cultures.

SOURCE: THE UNIVERSITY OF MELBOURNE 2000, MELBOURNE INSTITUTE REPORT: RETURNS TO INVESTMENT IN HIGHER EDUCATION, P. 44

Universities in recent years have increased their focus on research commercialisation and promotion forms a key part of this strategy. This process is reflected in the development of institutional arrangements to assist in the transfer of potentially commercial knowledge and technology to the business sector. An emerging aim of universities is the development of effective linkages with firms to facilitate the transfer of technology and knowledge (PC 2007, p. 291). The use of ERA results to promote strengths is important in developing these links.

Additionally, promoting the strengths and research activities of universities can lead to greater industry collaboration.

Philanthropy can also play an important role in encouraging innovation. Philanthropic foundations can support innovation in several ways by directly funding a significant amount of research at universities. This can include both technological and scientific research. By successfully promoting their institutions to such foundations, universities can increase their competitive advantage by capitalising on the foundations' cross-networks, independence and flexibility. The linkages developed between universities and philanthropic foundations can have a significant impact on institutions' innovation capabilities by endowing them with additional funds to realise research objectives (OECD 2010b, p. 182).

Universities use philanthropy to further their competitive advantage by achieving research excellence, nurturing innovation, allowing diversification and supporting stronger equity of access. These funds are in addition to government dollars and can assist special projects and programs that would not have occurred via conventional funding sources. Potentially, these funds can take the form of fellowships or student scholarships, contributions towards libraries and/or research facilities (Business Higher Education Roundtable 2006, p. 10).

5 Improved accountability, transparency and policy-making

ERA has improved the level of accountability and transparency within the university research sector, and contributed positively to government policy aimed at enhancing Australia's research performance. This chapter explores how ERA has impacted on these dimensions and the resulting benefits.

5.1 The impact of improved, accountability, transparency and policy-making

This chapter demonstrates the positive impact of ERA on the development, implementation and review of policy supporting Australia's research sector. Through ERA, governments and universities have in place a robust mechanism of public accountability and transparency. They also have in place a policy and funding lever that can improve the performance of Australian university research.

The benefits arising from ERA, within this context, are:

- ERA has improved the level of accountability, transparency and monitoring associated with Australian university research. These improvements have been in the form of:
  - Increased research funding. ERA informs decisions about additional funding to universities on the basis of research excellence. Such funding gives the community greater assurance that public funding is being allocated to support research of the highest quality and at internationally recognised standards.
  - Enhanced national data collections. ERA has led to improvements in the level of access governments, universities and other stakeholders have to national data on Australian research. ERA has also had a positive impact on the accuracy, timeliness and quality of these data collections.
  - Better monitoring of progress against performance indicators and targets. ERA delivers governments and universities baseline data from which conclusions about institutional performance can be drawn.
- ERA has positively informed a diverse number of plans, strategies, reviews and policies by providing:
  - Reliable data about research quality across all FoRs. This data can then be used to understand the distribution, strengths, vulnerabilities and opportunities of Australia's university research system. It can also be used to assist in benchmarking Australia's performance against comparable systems and research sectors.
  - A framework (with associated processes) that can help to drive future policy agendas about research quality. ERA provides a policy lever for supporting high quality research beyond the universities and has raised interest in research quality in Australia's other publicly funded research agencies.

These benefits are discussed in further detail below.

5.2 Improved accountability, transparency and monitoring

By accountability, transparency and monitoring, we refer to ERA's positive impact on:

- research funding;
- national data collections; and
- monitoring of progress against performance indicators and targets.

Consultations with the higher education sector, funding agencies and policy departments have identified that ERA delivers improved accountability across a range of funding and policy areas. The survey of universities showed that 61 per cent agree ERA has had a positive impact on the level of accountability and transparency surrounding Australian university research.

Analysis of these positive impacts and the associated benefits are outlined below.

Allocation of funding based on research excellence

The allocation of university funding on the basis of research excellence means that more funds are awarded to institutions that generate the highest quality research. It also means that universities have direct financial incentives to improve their research performance, and ultimately their accountability for public research.

Since 2011 the Government has specifically used ERA data to assist in the allocation of research funding. The SRE provides grants on a calendar year basis to universities to ensure that these institutions are better placed to meet the indirect costs of research activities that are not entirely met by the various competitive grant programs.[5]

The SRE has three elements that include a baseline, a first threshold and second threshold based on a university's ERA ratings. Only those institutions that agree to participate in Transparent Costing (TC) and ERA processes are eligible to be included in calculations for Threshold 2.[6] Box 10 identifies how calculations for Threshold 2, the ERA-relevant aspect of the funding, were undertaken for universities in 2013.

[5] SRE's specific objectives are to: address an identified shortfall in the funding available to meet the indirect costs associated with Australian competitive grant research; and support HEPs to build and maintain research excellence through the implementation of best practice financial management, performance and reporting frameworks.

[6] ERA's base element is determined by calculating each institution's share of the Base performance index, which comprises Category 1 Australian Competitive Grants research income and uses data averaged over two years.

BOX 10 **SRE'S ALLOCATION OF RESEARCH FUNDING BASED ON ERA**

Threshold 2 element

- Only Higher Education Providers (HEPs) that agree to comply with the ERA process and to participate in the TC process, including compliance with requirements set out in the Other Grants Guidelines (Research) 2010, are eligible for funding under the Threshold 2 element of SRE.
- From 2012, the Threshold 2 element of SRE has two pools: the TC pool and the Excellence Index (Ei) pool.
- The SRE Threshold 2 funding amount is split between the two pools:
- TC pool is equal to 40% of the Threshold 2 funding amount.
- Ei pool is equal to 60% of the Threshold 2 funding amount.
- The department determines each HEP's SRE Threshold 2 grant amount by summing each HEP's final Threshold 2 TC grant amount and final Threshold 2 Ei grant amount.
- For all eligible HEPs, their allocation for the SRE Threshold 2 amount is rounded down to the next whole dollar. The difference between a HEP's rounded and unrounded SRE Threshold 2 amount is the remainder. The sum of all remainders is the unallocated dollars of the SRE Threshold 2 element.
- Each HEP's remainder is ranked in descending order based on closeness to one. One dollar is assigned to each HEP according to its ranking until all unallocated dollars are exhausted.
- Each HEP's SRE Threshold 2 grant amount is equal to the rounded SRE Threshold 2 allocation plus any whole dollars assigned.

SOURCE: DIICCSRTE WEBSITE

Table 6 provides a summary of the Threshold 2 funding allocated to each university since the first Threshold 2 funding was allocated in 2011.

Analysis of this funding shows:

- the Government has allocated approximately $305 million in Threshold 2 SRE ERA-based funding to Australian universities undertaking research — this translates into more than 50 per cent of the total SRE funding being allocated on the basis of research excellence;
- some 32 out of 41 eligible universities have received this funding on at least one occasion. Some 29 of these 32 institutions have received funding on all three occasions where Threshold 2 payments have been made;
- two institutions that did not receive funding in 2011 and 2012 received Threshold 2 funding in 2013 — this suggests that some universities have not only become more research active, but that ERA has provided the incentives necessary to improve the level of research quality being delivered by some Australian universities; and
- the large majority of Threshold 2 allocations to universities grew across the three funding rounds.

National data collections

The ABS collects data from individual universities for publication in national data collections.[7] These data are used to inform a broad range of policy, funding, investment and management decisions by government. They are used by a broad range of non-government stakeholders to understand the scope, activities and complexity of Australian university research. Through the publication of these collections, the ABS provides the community with an important source of transparency and accountability about all facets of Australian university research.

The ABS has acknowledged the role of ERA in improving record keeping within higher education institutions and its influence on more accurate reporting, stating:

> Additional reporting requirements for Excellence in Research for Australia have led to improved record keeping within higher education institutions. Since 2008, this resulted in more accurate reporting of data by a number of institutions for some R&D items.
>
> ABS 2010b, Technical Note 8.

[7] A list of these publications can be located at ABS and DIICCSRTE websites (under the links to research and higher education).

TABLE 6 **ALLOCATION OF THRESHOLD 2 SRE FUNDING TO UNIVERSITIES (2011-13)**

University	2011 Threshold 2 ($)	2012 Threshold 2 ($)	2013 Threshold 2 ($)	Total ($)
NSW				
Charles Sturt University	253,745	242,235	182,558	678,538
Macquarie University	1,095,062	1,000,761	1,139,185	3,235,008
Southern Cross University	0	0	28,683	28,683
The University of Sydney	11,038,516	15,146,029	16,648,178	42,832,723
University of New England	216,561	113,998	124,618	455,177
University of New South Wales	8,747,129	12,618,262	11,454,198	32,819,589
University of Newcastle	1,834,086	2,183,844	2,589,641	6,607,571
University of Technology, Sydney	632,180	618,821	747,613	1,998,614
University of Western Sydney	536,521	426,241	426,431	1,389,193
University of Wollongong	1,373,882	1,145,103	1,576,713	4,095,698
VIC				
Deakin University	586,643	604,631	727,173	1,918,447
La Trobe University	777,184	822,197	731,564	2,330,945
Melbourne College of Divinity	0	0	0	0
Monash University	7,530,627	10,737,295	11,170,891	29,438,813
Royal Melbourne Institute of Technology	514,922	458,283	682,797	1,656,002
Swinburne University of Technology	369,642	379,669	437,789	1,187,100
The University of Melbourne	13,559,948	19,224,556	17,605,054	50,389,558
University of Ballarat	0	0	0	0
Victoria University	0	0	1,708	1,708
QLD				
Bond University	0	0	0	0
Central Queensland University	0	0	0	0
Griffith University	1,065,951	1,281,809	1,268,705	3,616,465
James Cook University	849,390	949,992	1,032,821	2,832,203
Queensland University of Technology	1,287,475	1,303,028	1,215,553	3,806,056
The University of Queensland	7,724,534	13,579,796	15,314,004	36,618,334
University of Southern Queensland	0	0	0	0
University of the Sunshine Coast	0	0	0	0
WA				
Curtin University of Technology	994,328	798,549	904,431	2,697,308
Edith Cowan University	2,160	15,491	12,942	30,593
Murdoch University	410,710	446,335	412,886	1,269,931
The University of Notre Dame Australia	0	0	0	0
The University of Western Australia	5,081,637	6,054,238	7,600,337	18,736,212
SA				
The Flinders University of South Australia	990,112	860,358	940,782	2,791,252
The University of Adelaide	5,198,940	6,655,519	6,479,504	18,333,963
University of South Australia	922,156	892,312	959,303	2,773,771
TAS				
University of Tasmania	1,576,850	1,547,091	1,942,452	5,066,393

University	2011 Threshold 2 ($)	2012 Threshold 2 ($)	2013 Threshold 2 ($)	Total ($)
NT				
Bachelor Institute of Indigenous Tertiary Education	0	0	0	0
Charles Darwin University	479,273	632,351	752,023	1,863,647
ACT				
The Australian National University	5,997,339	8,782,206	8,681,782	23,461,327
University of Canberra	38,497	0	0	38,497
Other				
Australian Catholic University	0	0	0	0
Totals	***81,686,000***	***109,521,000***	***113,792,319***	***304,999,319***

SOURCE: HERDC DATA 2011-2013

Consultations with the ABS supported this view, identifying that ERA has resulted in an improvement in the quality, accuracy and timeliness of data returns from some universities. Consultations suggest this has occurred in the following ways:

- ERA data collection occurs at the same time as the ABS survey of higher education expenditure on R&D. Universities give ERA returns higher priority, but this helps to inform the ABS returns — when the ABS has a query about data in a return, the universities are now better able to provide detail.
- There are three related data collections (the third is done by DICCSRTE for the calculation of indirect costs) and the ABS would like to see the three collections combined. ERA's data collection tool is more intuitive than the tool currently used by the ABS and they are interested in achieving efficiencies in data collection.
- The ABS receives aggregated returns from some universities. However others send in multiple returns from different schools/departments. This makes it difficult to ensure that double counting does not occur. It also makes it difficult to ensure that all research has been captured in the returns. Some universities are still operating legacy systems that are not suited to current reporting requirements. ERA data collection does not appear to suffer from these problems and a combined survey would bring more discipline to returns.
- Because ERA collects data at a finer detail (classification) than the ABS, information from ERA has allowed the ABS to identify opportunities to improve the Australian and New Zealand Standard Research Classification. This is a significant benefit in that ERA is informing changes to Australian and New Zealand Standard Research Classification codes and the development of new codes.

Consultations with a representative from Elsevier Science & Technology suggested that as a result of ERA, gaps and errors in the company's database have been addressed, resulting in a more robust data set. This has occurred through the inclusion of a number of additional research outputs (such as the inclusion of an additional 1,000 conference titles) as well as revisions made to the data set based on feedback received through participation in ERA. This has given a wider and more accurate representation of Australian research output, increasing Australia's global presence in the data set and resulting in greater awareness of Australian researchers for Elsevier Science and Technology's customers. In addition, it was reported that such customers use the data set to identify potential partners and collaborators and as such this could enhance collaboration with Australian researchers.

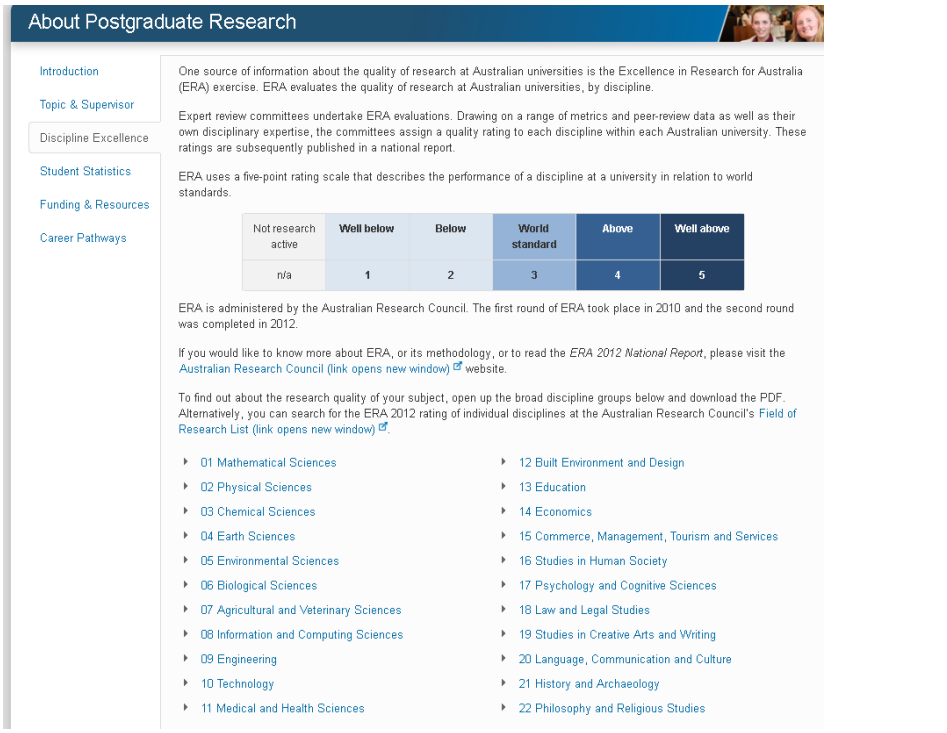
MyUniversity website

2012 ERA results have been incorporated into the Australian Government's *MyUniversity* website. The website provides prospective Higher Degree by Research students with

information about courses, research topics, supervisors, career pathways, scholarship opportunities and student numbers.

By clicking on the links (organised by FoR), students gain access to four-digit ERA results for each Australian university. Figure 22 provides a screenshot of the *MyUniversity* website and illustrates how potential students can gain access to information about research excellence.

FIGURE 22 **USE OF ERA ON THE MYUNIVERSITY WEBSITE**



SOURCE: MY UNIVERSITY 2012, HTTP://CONTENT.MYUNIVERSITY.GOV.AU/SITES/MYUNIVERSITY/PAGES/ABOUTPOSTGRADUATERESEARCH#DISCIPLINE

Consultation with managers of the *MyUniversity* website identified that data on the extent of the use of this website is not currently available. However, the *MyUniversity* website is currently being updated with an enhanced capacity to monitor the viewing of individual webpages. This will allow an assessment of website traffic in the future and provide direct evidence of the extent to which ERA results are being viewed as part of student decision-making on where to study.

The *MyUniversity* website managers consider that providing ERA information on the *MyUniversity* website is a benefit to students when choosing between the different research degrees offered by universities. Some stakeholders consider that ERA results also influence the choices of other students (i.e. ERA's impact is not limited to students interested in research).

Improved national data collection covering all FoRs

Prior to ERA, analysis of the quality of Australian university was often undertaken using citation and publication indices that typically focused on ranked outlets (in the form of journals and refereed conference publications). This meant that quantitative analysis and international benchmarking of research quality, prior to ERA, was often limited to those disciplines where citation and publication data was sufficient to conduct an analysis.

According to some government stakeholders, this provided those disciplines in science, technology and engineering (where research outputs are more likely to be in the form of traditional publications, such as articles in ranked journals) with additional opportunities to demonstrate research quality at national or international levels. It also meant that some of those disciplines (such as those in the arts and humanities which rely more heavily on producing non-traditional research outputs) were, over time, being under-represented in analysis and evidence about research quality.

The introduction of ERA fundamentally changed the way research quality in all FoRs could be analysed. ERA was specifically designed to capture the full spectrum of research quality in Australia, and provide a public repository of this information.

In addition to traditional output measures such as relative citation impact and the distribution of papers based on relative citation rate bands (ARC 2008, p. 8), ERA captures a range of non-traditional research outputs, outputs within portfolios, applied measures and esteem measures. Table 7 provides a list of the non-traditional and other measures used in ERA 2010 and 2012.

TABLE 7 **NON-TRADITIONAL OUTPUT MEASURES USED IN ERA (2010-12)**

Output group	Measures
Non-traditional outputs	Curated or exhibited event Live performance Original creative work Recorded / rendered work Portfolio of non-traditional outputs
Output types within portfolios	Curated exhibited event Live performance Recorded / rendered work
Applied measures	NHMRC endorsed guidelines Patents Registered designs Plant breeder's rights
Esteem measures	Editor of a prestigious work or reference Membership of a learned academy or AIATSIS Membership of a statutory committee Recipient of an Australia Council Grant or Fellowship Recipient of a nationally competitive research fellowship

SOURCE: ARC 2012a, ERA 2012 NATIONAL REPORT, P. 16

Improved accountability through Mission-Based Compacts

Compacts between Government and universities are formal agreements that demonstrate a shared and mutual commitment to providing students with high quality education experiences and outcomes, and building research capabilities and international competitiveness (Deakin Compact, p. 3).

Compacts recognise the autonomy of universities and their distinctive missions, and operational contexts. Compacts provide a strategic framework for the relationship between the Government and universities. They set out how university missions align with Government goals and objectives, which includes information on funding provided by Government to the universities.

Analysis of Government-university Compacts for 2011-13 highlights the role of ERA in helping universities to realise research performance and research capability strategies. All Compact documents use ERA FoR ratings as the basis of their performance indicators and targets for research. These indicators and targets are used by Government to monitor the progress of each university against its priorities and objectives to improve research quality.

An example of ERA's use in setting the Principal Performance Indicators for a research-active university with ambitions to improve its research performance is provided in Table 8.

TABLE 8 **PERFORMANCE INDICATORS AND TARGETS – RMIT UNIVERSITY'S COMPACT (2011-13)**

Principal Performance Indicators (Required)	Baseline 2010	Target 2013
Number of disciplines, as defined by two-digit Fields of Research (FoR), performing at world standard or above (3, 4 or 5)	10	12
Number of disciplines, as defined by four-digit FoR, performing at world standard or above (3, 4 or 5)	24	28
Disciplines the university commits to demonstrating substantial improvement in as defined by two-digit FoR	N/A	2
Disciplines the university commits to demonstrating substantial improvement in as defined by four-digit FoR	N/A	4

SOURCE: MISSION-BASED COMPACT BETWEEN THE COMMONWEALTH OF AUSTRALIA AND RMIT UNIVERSITY 2011

An example of ERA's use in setting the Principal Performance Indicators for a university with lower levels of research intensity is provided in Table 9.

TABLE 9 **PERFORMANCE INDICATORS AND TARGETS – EDITH COWAN UNIVERSITY'S COMPACT (2011-13)**

Principal Performance Indicators (Required)	Baseline 2010	Target 2013
Number of disciplines, as defined by two-digit Fields of Research (FoR), performing at world standard or above (3, 4 or 5)	5	6
Number of disciplines, as defined by four-digit FoR, performing at world standard or above (3, 4 or 5)	4	7
Disciplines the university commits to demonstrating substantial improvement in as defined by two-digit FoR and/or four-digit FoR	NA	7

SOURCE: MISSION-BASED COMPACT BETWEEN THE COMMONWEALTH OF AUSTRALIA AND EDITH COWAN UNIVERSITY 2011

Consultations with DIICCSRTE officials supported conclusions that ERA has been widely used to inform the development of Compacts from the time of their introduction in 2010 and 2011. ERA provides a baseline (as seen in the tables above) from which improvements in the quality of a university's research can be defined as targets for the period to which the Compact applies.

By monitoring the outcomes achieved, governments and funding agencies are better able to identify systematic issues within the sector and take remedial action where performance is below national and internationally accepted standards.

ERA also assists Government in setting performance indicators that are consistent across institutions and academic disciplines. Through the presence of performance indicators (underpinned by a universal set of metrics), Government can objectively evaluate the quality of university research that is being undertaken in institutions that have different missions, capabilities, funding levels, infrastructure requirements and locations.

Prior to negotiating Compacts for 2014-16, DIICCSRTE sent universities a Compact template. Part 5 of this template addresses research and research training. The Government's strategy in this regard is, broadly defined, to encourage excellence and to strengthen research capability. ERA underpins this. The template seeks information on university strategies, making explicit reference to ERA results. And, as noted above, ERA results continue to be a key element of performance indicators and targets. Thus ERA underpins the research funding relationship between the universities and the Government. The availability of ERA results to do this is a major benefit to both the Government and the universities. Without ERA results, the negotiation of the research funding element of the Compacts would be more difficult.

In addition, universities can use ERA metrics for internal management purposes. Universities can (and have increasingly) used ERA to monitor the performance of research centres, faculties, schools and disciplines to ensure alignment and progress against the provisions of their Compact Agreement. Stakeholders report that, where high ERA scores are being achieved, university managers are looking to see which staff members are contributing to these results, with a view to ensuring that they receive the recognition that they deserve.

The presence of ERA means that the Government and universities can establish a relationship between the plans and priorities of the Government and those of individual universities, and indeed, researchers. Such arrangements give the Australian community confidence that the allocation of public funding for research is targeted towards delivering high quality research outcomes by international standards.

5.3 Better-informed government policy

Some 60 per cent of university stakeholders surveyed for this project consider that ERA has been important or very important in influencing government policy. Consultations with Government officials have identified a number of examples where ERA has been influential.

Consultations with the ARC, DIICCSRTE (including the Office of the Chief Scientist) and the ABS have highlighted the impact of ERA on policy development, implementation and review/evaluation. These consultations also identified benefits that have flowed from the availability of ERA data.

Analysis of this impact on key government strategies, polices and reviews is outlined below.

ERA's use in developing the National Research Investment Plan

The National Research Investment Plan (NRIP) establishes a national framework and a process for delivering Government support to research. It takes account of the relationship between the inputs to research, and coordinates investment across the entire Government. The NRIP was developed by the Australian Research Committee (ARCom), comprising a senior Commonwealth Officials Group, Expert Advisory Group and Research Sector Group. It was publicly released in 2012.

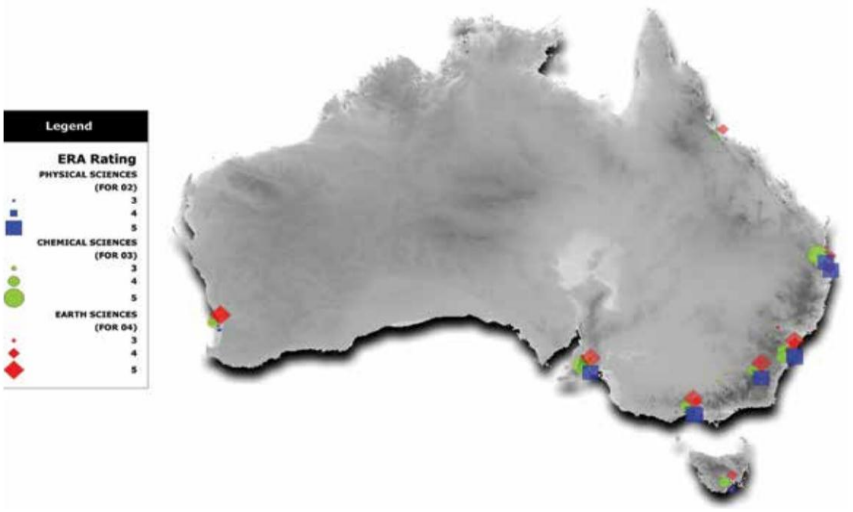
The NRIP used ERA data to map the location of 'excellent research capability' across Australia. The NRIP shows the location of higher education institutions that received a rating of 3, 4 or 5 in each of the 22 two-digit FoRs evaluated under ERA.

ERA data was used to demonstrate that high quality research is concentrated in the five mainland state capital cities, plus Canberra. The data was also used to demonstrate the proximity of research excellence to natural resources and related business activity. For example, the NRIP showed that capability in earth science research is located in Perth near the mining industry, while capability in environmental science is located in Townsville (adjacent to the Great Barrier Reef) (NRIP 2012, p. 40).

Figure 1 illustrates how ERA data was used to demonstrate the location of research excellence for two FoRs. Information about other FoRs is provided in the Appendix to the NRIP.

FIGURE 23 **LOCATION OF RESEARCH EXCELLENCE AS IDENTIFIED IN THE NATIONAL RESEARCH INVESTMENT PLAN**

A: Location of Excellent University Research in Physical, Chemical and Earth Sciences



B: Location of Excellent University Research in Biological, Environmental and Agricultural Sciences

Note: Chart originally developed by ANU Research Office in 2012 and re-created in the NRIP report

SOURCE: NATIONAL RESEARCH INVESTMENT PLAN 2012, P. 40-41

NRIP also used ERA data to discuss the impact of Australian research. Through ERA data, the NRIP was able to benchmark the quality of research in Australian universities against world standards. It was able to demonstrate that at the two-digit level there is evidence of excellent research (ERA ratings at world standard and above) in 10 out of the 12 FoRs analysed for the 2010 ERA evaluation.

Consultations with DIICCSRTE and other Government stakeholders suggest that ERA was an important source of data for analysing and then mapping of Australia's research capability. Consultations suggest that ERA provided data which:

- covered research undertaken in all FoRs across Australia – as described above;
- was reliable and accurate (i.e. ERA is generally accepted to be an accurate reflection of Australian research quality and an appropriate data source for the development of public policy); and

— is current or up-to-date, allowing NRIP to develop longer term investment actions that were based on timely data about research excellence.

Mapping of capabilities and capacities to research priorities

As part of the NRIP's implementation, the ARCom has developed a new set of strategic research priorities to drive investment in areas that are of immediate and critical importance to Australia and its international competitiveness. The priorities were released in June 2013.

The new priorities are aimed at complementing Government support for research and fostering a more coordinated and strategic approach to investment in research infrastructure. The headline priorities are (DIICCSRTE 2013, pp. 1- 3):

— *Living in a changing environment*. Research outcomes will identify strategies to develop resilient natural (ecosystems) and human environments (people, communities and their utilities and industry) that can all thrive in a changing environment.
— *Promoting population health and wellbeing*. Research outcomes will help to build resilient communities and achieve a state of physical, mental and social wellbeing, and not merely the absence of disease, or infirmity, for all Australians in whichever part of Australia they live.
— *Managing our food and water assets*. Research outcomes will identify new food production practices and systems that can accommodate competing demands for soil and water while ensuring the long-term sustainability of these assets.
— *Securing Australia's place in a changing world*. Research outcomes will identify ways to improve Australia's capacity to deliver national security and identify the means by which personal security in Australia will be safeguarded. This challenge should be considered in the context of global uncertainty and changes in the Asia Pacific region.
— *Lifting productivity and economic growth*. Research outcomes will identify the challenges and opportunities in a changing world economy, particularly in the context of the economic rise of Asia, and help to build a resilient new economy so that Australia can thrive, while also identifying the means to enhance the wellbeing of all Australians.

DIICCSRTE officials advised that ERA was a highly important and reliable set of data for mapping Australia's research capabilities and capacities against each of these research priorities. Such mapping would not have been possible in the absence of the ERA. In particular, DIICCSRTE reported that ERA was a valuable source of data about the location of Australia's research workforce that can (through careful analysis) be linked to funding, investment and policy priorities. This is another example of the benefits that ERA provides to policy makers.

ERA's use in developing the Health of Australian Science Report

In June 2011 the Office of the Chief Scientist commenced an assessment of the health of Australian science. The assessment's primary aim was to profile the strengths and vulnerabilities of Australia's current science capability.

The assessment examined science education in secondary schools and universities and scientific research in both the university and the government sectors. Using publicly available data, the assessment examined all natural and physical sciences, most engineering and technology fields, and many of the health and medical science fields. The final report (*Health of Australian Science Report)* was publicly released by the Office of the Chief Scientist in May 2012.

A review of the final report shows the extensive use of ERA by the Office of the Chief Scientist. In particular, ERA was used to:

- Demonstrate research output and performance against selected FoRs. Analysis of research performance was undertaken using a mixture of traditional, esteem, and applied measures from the 2010 ERA data.
- Analyse the strengths, vulnerabilities and opportunities for Australian science. This analysis showed:
  - Most fields of the natural and physical sciences indicate research performance at or above international standards.
  - Australia has produced a high and growing proportion of global publications relative to our population, with higher than global average impacts. This historical pattern continues.
  - The Australian research community is increasingly connected to the global science community through collaboration in relation to grants and large-scale international projects, co-authorship on papers, and other forms of interaction such as international visits, student enrolment and symposia.
  - The academic staffing profile could pose challenges to maintaining capability in research areas when senior researchers at Level E begin to retire; particularly if there is an insufficient proportion at Level C to take up research leadership roles (Office of the Chief Scientist 2012, p. 162).

Consultations with the Office of the Chief Scientist support the conclusion that ERA has been valuable in developing a better understanding of the performance of Australia's research and innovation systems. In particular, ERA provides an opportunity to link the location of research staff (by FoR) to a discussion about research quality. Such linking would not have been possible in the absence of ERA.

ERA's use in developing Australia's Research Workforce Strategy

Data from ERA were a feature of the Australian Government's 2011 Research Workforce Strategy, *Research Skills for an Innovative Future.* Analysis of the Strategy shows that ERA was used to demonstrate Government's long term commitment to improving the quality of Australia's research base, through funding and publication of ERA data.

Analysis of the Strategy also demonstrates how a program, like ERA, can be used to progress a broader agenda regarding the quality of Australian research. For example, 'Priority 6.2: Investigation of metrics for measuring excellence in applied research and innovation' states that the Government will investigate metrics for measuring excellence in non-university research to provide incentives for non-academic research and innovation contributions.

The use of ERA in this context is consistent with feedback from Government officials. This feedback suggests that ERA has provided a policy platform to consider quality in all research sectors and parts of the national innovation system. Through ERA, the Government has a "good starting point" for the development of a long term national agenda about research quality.

Use in other policy reviews, reports and documents

There are also a number of reviews (evaluations) and reports that have drawn on ERA data or ERA processes since 2010. A sample of these reviews and reports (and how ERA has been used within them) is provided in Table 10.

Table 10 shows that ERA has been used in many different contexts and in a number of different ways. These uses include submissions to the Senate, occasional papers to generate public debate, and reviews and evaluations which offer policy reform options.

TABLE 10 **SUMMARY OF ERA'S USE IN SELECTED REVIEWS AND REPORTS SINCE 2010**

Document	Author	Type	How used
Focusing Australia's Publicly Funded Research: Review. Maximising the Innovation Dividend, 2011	DIICCSRTE	Review	ERA was used to assess research performance, by discipline, and to demonstrate Australia's performance against international benchmarks. ERA was also used to assist the review in identifying the benefits of collaboration
Australian Innovation Systems Report (2011 and 2012 reports)	DIICCSRTE	Report	ERA data was used to demonstrate the performance of the Australian Innovation System, and, in particular, Australia's performance against national targets and priorities for research
Strategic Roadmap for Research Infrastructure, 2011	DIICCSRTE	Report	ERA was used as a framework for developing 'excellence' in research infrastructure
Smarter Manufacturing for a Smarter Australia, 2011	Prime Minister's Taskforce on Manufacturing	Review	ERA data was used as a platform to advocate for more meaningful and robust analysis of research impact
National Collaborative Research Infrastructure Strategy Evaluation Report, 2010	DICCSRTE	Review	ERA processes were used for developing a narrative of excellence in research infrastructure
Collaborations between the Public and Private Sectors: The Role of Intellectual Property, 2011	Advisory Council on Intellectual Property	Report	ERA was used as a framework to develop recommendations aimed at improving Government-private sector research collaboration
Review of Higher Education Access and Outcomes for Aboriginal and Torres Strait Islander People: Final Report, 2012	DIICCSRTE	Review	ERA was used as a framework to advocate for the addition of a new FoR
Benchmarking Australian Science Performance, 2013	Office of the Chief Scientist	Paper	ERA citation analysis was used as a framework to undertake an international benchmarking exercise
Australia's Position in the World of Science, Technology and Innovation, 2012	Office of the Chief Scientist	Paper	ERA citation analysis was used as a framework to undertake an international benchmarking exercise
House of Representatives Submission – Fisheries and Aquaculture, 2012	Office of the Chief Scientist	Submission	ERA data was used to demonstrate research excellence within the aquaculture industry
Mathematics, Engineering and Science in the National Interest, 2012	Office of the Chief Scientist	Submission	ERA data was used to support the case for increased budget funding for mathematics, engineering and science. ERA results have also been used to target funding for the training of maths and science teachers through the *Enhancing the Training of Mathematics and Science Teachers* Program. This Program encouraged applications from institutions whose ERA 2012 ratings in mathematics, physics, chemistry, biology, earth science, environmental science or education was 4 or above.
Senate Inquiry Submission – Engineering, 2012	Office of the Chief Scientist	Submission	ERA data was used to demonstrate research excellence within Engineering
Senate Inquiry Submission – Agriculture	Office of the Chief Scientist	Submission	ERA data was used to demonstrate research excellence within Agriculture

SOURCE: VARIOUS

6 Conclusions

This chapter summarises the findings of the Benefits Realisation Review. It outlines the key effects of ERA and the potential impacts on universities and the Australian community that result.

Investment in Australia's university research effort is significant, and an emphasis on research quality is vital to ensuring an 'innovation dividend' is derived from this investment.

A number of performance-based funding systems for university research have been established around the world in recent years. They are based on the premise that rewarding higher performing institutions will result in improved output, as well as increase productivity, improve global competitiveness and enhance accountability and transparency.

In Australia, ERA provides the mechanism to assess research quality and incentives for universities to improve their performance over time. Importantly, it has been recognised that this form of performance measurement is state of the art, with the OECD (2010a, p. 43) stating 'departmental level performance-based research funding systems using peer judgment based on indicators seems to be the state of the art and is being implemented in ERA'.

This study has found that ERA has increased the social rate of return of research, generated costs savings, increased university revenue, enhanced economic activity and improved accountability, transparency and policy-making.

Increasing the social rate of return

In relation to research performance, ERA has:

- improved the quality of research;
- focused research effort;
- enhanced collaboration;
- improved resource allocation; and
- informed human resource decision-making.

The benefits associated with each of these areas are summarised in Table 11. Ultimately, these improvements contribute to a higher return on investment in research, as measured by changes in the social rate of return of research. With the large amount of funding involved (an estimated total of $4.77 billion), small improvements in the social rate of return generate significant monetary benefits. For example, a one percentage point increase in the social rate of return (such as an increase from 25 to 26 per cent) would generate a $47.7 million increase in GDP per annum.

Over time, it would be expected that improvements to the social rate of return due to ERA's influence on the five benefits listed above would be increasingly evident and, as a result, monetary benefits would increase in the future.

TABLE 11 **IMPROVING RESEARCH PERFORMANCE**

Influence of ERA	Benefit
Better quality research	— attract and retain international students and academic staff — generate economic benefits to regions where universities are located — increase the absorptive capacity of businesses — encourage new partnerships with other researchers and with industry — enhance Australian researchers' access to international networks — enhance the economic, social, cultural and environmental benefits of research
Focusing research effort	— enhance coordination and improve resource allocation — enhance the concentration of research resulting in increased financial returns, greater collaboration with industry and gaining an influential role in international research collaboration — avoid research duplication as a result of streamlining programs — increase the number of high-quality publications (and attain greater international recognition)
Enhancing collaboration	— resolve complex problems, share knowledge, develop skills, stay up-to-date with new developments, expand market reach and achieve economies of scale — spread risk, build critical mass and capacity and drive innovation — enhance the capacity of innovators to absorb new knowledge, recruit new students/personnel and subsequently develop new skills — reduce costs by removing duplication, realising economies of scale and improving access to expensive infrastructure
Improving resource allocation	— ensure resources are used to their best effect — lead to the realisation of goals in a faster and more efficient manner — improve operational efficiencies
Informing human resource decision making	— enhance skills utilisation, productivity and innovation — increase efficiency of resource utilisation — enhance collaboration

SOURCE: *ACIL ALLEN CONSULTING*

Cost savings, increased university revenue and enhanced economic activity

ERA has enhanced university planning, strategy and operation through:

— improved coordination and management;
— enhanced strategic planning; and
— recognition and promotion.

The benefits associated with each of these areas are summarised in Table 12. It is anticipated that as a result of enhanced university planning, strategy and operation cost savings can be expected from improved coordination, management and planning. In addition it is likely that there will be an increase in university revenue and enhanced economic activity associated with improved recognition and promotion.

Small percentage changes in costs generate significant monetary benefits. For example, if ERA's effect on coordination and management and strategic planning led to cost savings of half a per cent of total research funding, savings of $23.85 million per annum would result.

In addition, there are significant benefits related to increasing the number of international higher education students. For example, if ERA increased international higher education enrolments by half a per cent, an additional 1,151 students would study in Australia per annum. This would result in an increase in international student expenditures in Australia of

$58.5 million, comprising of just over $21 million in university fees and just under $37.5 million in expenditure on other goods and services.

TABLE 12 **IMPROVING UNIVERSITY PLANNING, STRATEGY AND OPERATION**

Influence of ERA	Benefit
Improved coordination and management	— maximise research capabilities — allocate resources effectively — alleviate challenges related to the limited availability of funding — avoid overlapping efforts and duplication
Enhanced strategic planning	— improve labour productivity and mobilisation of resources — enhance decision-making, competitive advantage and enable a greater focus on achieving desired goals — reduced the cost of products and services — improve awareness of gaps in products and services to achieve operational efficiencies
Recognition and promotion	— recruit international students and academics — increase research commercialisation — enhance industry collaboration

SOURCE: *ACIL ALLEN CONSULTING*

Improved accountability, transparency and policy-making

ERA has led to better accountability, transparency and policy-making through:

— improving the level of accountability, transparency and monitoring associated with Australian university research; and
— positively informing a diverse number plans, strategies, reviews and policies.

Table 13 outlines the benefits which result from these improvements.

TABLE 13 **BETTER ACCOUNTABILITY, TRANSPARENCY AND POLICY-MAKING**

Influence of ERA	Benefit
Accountability, transparency and monitoring	— increase research funding — enhance national data collections — improve the monitoring of progress against performance indicators and targets
Better informed government policy	— provide reliable data about research quality across all Fields of Research — provide a framework (with associated processes) that can help to drive future policy agendas about research quality

SOURCE: *ACIL ALLEN CONSULTING*

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Appendix B Eligible institutions

ERA evaluates the quality of the research undertaken in eligible higher education providers (institutions). Institutions evaluated as part of ERA are:

- Australian Catholic University
- Batchelor Institute of Indigenous Tertiary Education
- Bond University
- Central Queensland University
- Charles Darwin University
- Charles Sturt University
- Curtin University of Technology
- Deakin University
- Edith Cowan University
- Flinders University
- Griffith University
- James Cook University
- La Trobe University
- Macquarie University
- Melbourne College of Divinity
- Monash University
- Murdoch University
- Queensland University of Technology
- RMIT University
- Southern Cross University
- Swinburne University of Technology
- The Australian National University
- The University of Adelaide
- The University of Melbourne
- The University of New England
- The University of New South Wales
- The University of Newcastle
- The University of Notre Dame Australia
- The University of Queensland
- The University of Sydney
- The University of the Sunshine Coast
- The University of Western Australia
- University of Ballarat
- University of Canberra
- University of South Australia
- University of Southern Queensland
- University of Tasmania (incorporating Australian Maritime College)
- University of Technology, Sydney
- University of Western Sydney
- University of Wollongong
- Victoria University

Appendix C Methodology

The BRR's methodology included:

- a review of documentation to gather relevant information;
- stakeholder consultation including a survey of DVCRs and a series of targeted consultations;
- analysis of the data and information gathered;
- the development of case examples; and
- the benefits assessment.

Each aspect of the methodology is detail below.

Information gathering

A range of both publicly available and confidential information was used to support the review's analysis and findings. The information sources used for the BRR included:

- ERA reports and supporting documentation and raw de-identified data. This included the results of a 2009 pilot study and background information to the pilot study.
- Data and analysis from key reports published on the DIICCSRTE's website,[8] including: the *2010-2012 National Innovation System Report*; *the 2012 National Research Investment Plan*; and a 2013 report titled *Assessing the Wider Benefits Arising from University-based Research*.
- Comparative information relating to Australia's innovation and research performance from the OECD and the UK Department of Business, Innovation and Skills (UK BIS).
- Findings from national reviews into the research performance of Australian universities and the national innovation system, including the PC's 2007 Research Report on *Public Support for Science and Innovation.*
- Research publications from domestic and international universities on the value of research and innovation, including reports from the University of Melbourne (2000) and the University of Wyoming (USA) (undated).
- Academic publications on the benefits of research, including: a discussion on the various benefits generated by government-funded research by the Chairman of the US Board of Governors of the Federal Reserve System (Ben Bernanke) (2011) and a 2007 research paper from Science and Technology Policy Research on *The Benefits from Publicly Funded Research*.
- Confidential and publicly available information from selected universities and stakeholders. This information was used to support case examples and the review's findings.

Stakeholder consultation

Stakeholder consultation formed a key element of the BRR. Consultation was undertaken in two forms

- a survey of university DVCRs; and
- targeted consultations with key stakeholders.

The online survey questionnaire was distributed to ERA contacts and DVCRs at all universities participating in ERA. Survey questions were structured to gain feedback on

[8] Formerly the Department of Industry, Innovation, Science, Research and Tertiary Education.

ERA. The survey provided opportunities for universities to answer fixed questions as well as open ended questions.

The review team received 36 completed surveys – representing a response rate of approximately 88 per cent. A list of universities which responded to the survey is at Appendix F.

Consultations with a range of university, Government and other key stakeholders were also undertaken for this review. Consultation questions mirrored those asked in the survey, but provided greater scope to explore issues about ERA's impact at the university level.

Consultations were undertaken with 37 individuals from a variety of organisations via teleconference and face-to-face settings. Consultations were generally between 45 minutes and one hour in length. The outcomes of consultations are reported in Chapters 3, 4, and 5 using thematic and de-identified techniques. A list stakeholders consulted is at Appendix F.

Case examples

Four case examples were developed in consultation with universities. The case examples have been used to illustrate definitive examples of the outcomes achieved as a result of ERA.

The responses to the online survey were used to identify a number of potential case examples. Subsequently, the review teamed worked with universities to develop the case examples. Where confidential information was provided, case examples were de-identified. All case examples were approved by the universities involved.

Benefits assessment

The survey of DVCRs is an important evidence base for the analysis of benefits. Survey results were supported by a review of empirical evidence and a high-level analysis of ERA ratings in 2010 and 2012, as well as the targeted consultations.

Outcomes of ERA were identified using these sources. The outcomes were then linked to impacts on universities, the government, businesses and the Australian community, as identified in stakeholder consultations and the literature. The benefits arising from these impacts have been described. Where possible, the potential monetary value of these impacts has been estimated.

Appendix D The benefits of publicly funded research

The wellbeing of a population is reflected in its health and lifestyle, and the sustainability of its environment. Enhanced living standards are increasingly dependent on innovative and efficient technologies and processes that are developed and implemented across all sectors of an economy. Innovation allows business and non-business sectors to operate more efficiently. The majority of significant productivity gains have been the result of technical innovation and research (DIISRTE 2012a, pp. 5-6).

Innovation deploys potential production opportunities and increases the scope for productivity enhancement and potential economic growth over the long term. Although some types of research, such as basic or blue-sky research, may not lead directly to innovative processes or original goods and services, it allows for a stock of knowledge that individuals in the present and the future can use to conduct innovation (DIISRTE 2012a, pp. 5-6).

This appendix identifies the benefits of publicly funded research by initially focusing on importance of research for economic growth and productivity. It then explores the social and environmental benefits generated from research and innovation.

It is important to note that research may generate outcomes that have economic, social and environmental benefits. As such some benefits outlined under specific categories below have aspects which could be classified in other categories.

D.1 Economic benefits from research and innovation

While the range of economic benefits generated from research is extensive, Martin and Salter (2000, p. 520) have suggested the main benefits of publicly funded research that lead to economic growth are:

- increasing the stock of useful knowledge;
- training skilled graduates;
- creating new scientific instrumentation and methodologies;
- forming networks and stimulating social interaction;
- increasing the capacity for scientific and technological problem solving; and
- creating new firms.

These benefits are discussed in the subsections below.

Increasing the stock of useful knowledge

A long-established justification for publicly funded research is that it develops the scientific information available for companies to use in their technological activities. Research has shown that companies rely heavily on publicly funded research as a key source of new ideas or technological knowledge. Both public and private research processes have traditionally complemented each other and are interlinked by common interests, personal connections and institutional affiliations (Martin & Salter 2000, pp. 520-522).

Firms use publications and knowledge to network and to develop contacts. Although accessing relevant knowledge is crucial to the development of new processes, products and services by firms, accessing this knowledge is a costly and time consuming exercise. However, publications generated from government-funded research can reduce the costs of accessing this knowledge (Martin & Salter 2000, pp. 520-522).

Training skilled graduates

A key economic benefit of publicly funded research is the flow of skilled graduates to firms. New graduates that enter an industry bring knowledge of recent scientific research and the capability to solve complex issues, perform research and produce ideas. As graduates provide a mechanism for benefits of public funding to be transferred to industry, government-funded basic research and student training are encouraged to be conducted at the same institution (Martin and Salter 2000, p.522 and the University of Melbourne 2000, pp. 8-29).

New instrumentation and methodologies

The production of new instrumentation and methodologies is a key output of government funded research. New instrumentation is used by firms and scientists to capitalise on the new tools to expand their research. The introduction of new instrumentation has led to the development of new FoRs in the past, such as artificial intelligence. Studies have shown that instrumentation would largely not have been developed without government funded research (Martin and Salter 2000, pp. 522-523).

Networks and social interaction

Government funded research has a key role in providing an entry point into networks of expertise and practice. Public funding allows individuals and organisations the capabilities to participate in global research communities. Although the economic benefits of networks are difficult to estimate, studies and evidence indicate that firms establish informal methods of networking as an important means of learning about public research and technological activity.

Studies have shown that successful public-private sector linkages can result in additional economic benefits. For example, good personal relationships between firms and public-sector scientists are integral to successful collaboration between the two sectors. Such relationships encourage the development of understanding and trust by which long-term contractual relationships can be established (DIISRTE 2012a, pp. 78-82). Networks may also facilitate access to complex instrumentation and equipment for relatively smaller firms (Commonwealth Government 2009, p.8).

Technological problem solving

Publicly funded research contributes to the economy by assisting industry and individuals to confront complex problems (UK BIS 2011a, pp. 4-9). Firms in technologically-demanding industries often combine a range of technologies in complex ways. Publicly funded research produces a broad pool of resources that firms can access. Studies have shown that advanced engineering has indirectly benefitted from publicly supported research via access to trained problem-solvers and their supplies of knowledge (Martin & Salter 2000, pp. 524-526).

Creation of new firms

Studies have shown that researchers and students from universities can collaborate to explore new ideas and technologies and establish start-up companies (Martin & Salter 2000, p. 526). This process involves transferring skills, tacit knowledge, and problem-solving capabilities from an academic to a commercial environment. A 2005 study showed for example that in the biotechnology sector, spin-off firms play a significant role in the access, application and discharge of knowledge developed by universities (STPR 2007, p.12).

D.2 Social, cultural and environmental benefits of publicly funded research

Research and innovation also provides a means of confronting global and social challenges. For many of these challenges, market failures act to limit investment and the production of products and services. Complex worldwide challenges require collective attention through bilateral and multilateral cooperation at the international level for the development of relevant solutions. These challenges can rarely be addressed by one nation alone or via any one particular policy solution.

Research and innovation are increasingly being recognised as key elements to confront social and global challenges. For example, increasing greenhouse gas (GHG) emissions have worldwide consequences and any solutions to decrease these emissions can benefit all countries. Infectious diseases similarly can have global consequences and innovation to develop new treatments or medicines can have a significant impact in countries if they are accessible and affordable. This section considers the role of publicly funded research in helping to address several social and global challenges.

Environmental challenges

Research and innovation provides society with the capability to confront a range of environmental challenges, including (Commonwealth Government 2003, pp. 49-50):

- sustainable water use;
- land degradation and soil salinity;
- climate change; and
- efficiency of energy production systems.

Due to the significant externalities generated from environmental research, the majority of basic and applied science occurs in, or is funded by, the public sector. Government support can be in the form direct investment in basic research, provision of tax credits for private R&D expenditures and financial support for public/private research partnerships (OECD 2010b, p.167).

A range of studies have highlighted the environmental benefits created from these efforts. Features of improved environmental health include protection of biodiversity, sustaining natural ecosystems and improved recreational enjoyment of the environment (Commonwealth Government 2003, p. 50).

Publicly funded R&D on climate mitigation technologies is also important addressing environmental challenges. An example of research and innovation into new technologies to confront environmental issues is outlined in Box D1.

BOX D1 **ENVIRONMENTAL BENEFITS RESULTING FROM RESEARCH**

In the early 1980s, Professor Boger, jointly funded by the ARC's predecessor organisation and Alcoa Australia, developed a more effective red mud waste disposal system. The research yielded a revolutionary 'dry disposal' scheme. By identifying the properties of the red mud, Professor Boger made the sticky residue into a fluid by draining and stirring the residue until it became liquid enough to be pumped down a pipe to a disposal area where it would dry and resolidify.

Much of the caustic waste was recovered, the dry solid stacked until it formed a stable surface, overlaid with soil and planted with grass and trees. The major environmental benefits of this new technology were decreased land use and much reduced long-term environmental liabilities. The technology has also been adopted in the nickel and gold sectors.

SOURCE: THE ALLEN CONSULTING GROUP 2003, A WEALTH OF KNOWLEDGE, P. 62

Publicly funded research (and support) can generate benefits for the environment and the market economy concurrently. The PC (2007, pp. 155-156) has identified these benefits as including:

- increased agricultural productivity through decreased pesticide use, reductions in salinity and invasive weeds and pests;
- improved understanding about the consequences of climate change by government owned utilities and businesses alike;
- increased understanding of energy efficiency simultaneously increasing abatement of carbon and sulphur dioxide with environmental benefits. This benefit, in particular, can generate significant gains in a carbon constrained economy;
- enhanced knowledge of biodiversity which can lead to unexpected benefits. For example, the discovery of an antimicrobial protein in Tammar wallaby milk was discovered by the Victorian Government; and
- cost savings through properly timed investments in water infrastructure via an enhanced understanding of water management and flows.

Research and innovation into new technologies and processes to address environmental challenges can have the effect of improving the daily lives of Australians in several ways. These include (DIISRTE 2012a, p.10):

- low emissions industrial processes, enhanced natural resource management and improved forms of energy generation;
- better marine environment monitoring and energy efficient heating and lighting systems for buildings; and
- improved management of the environment to successfully combat climate change.

The value of environmental impacts arising from publicly funded research in was estimated by the PC in 2007, as shown in Table D1.

TABLE D1 **ENVIRONMENTAL BENEFITS FROM PUBLICLY FUNDED RESEARCH**

Organisation	Investment	Types of impacts
CRCs in the environmental sector	$242.1 million	Outputs largely involve the provision of information and policy influence via: expert advice, publicly available research, journal articles, influence over policy documents and public awareness activity.
Antarctic Division	$94.6 million	Output leads to knowledge of Antarctic ecosystems, resources and climate change. The Antarctic Division is responsible for producing 150-200 refereed publications annually.
GHG Abatement Program	$16 million	A projected outcome of a reduction in GHG emissions of 17.9 million tonnes over the period 2008-2012.
Bureau of Meteorology Research Centre	$11.8 million	Impacts include information in relation to climate change, atmospheric modelling, and air quality analysis. These impacts are used as the basis for public and private investment decisions such as land-use decisions, insurance-premium settings and technology decisions.

SOURCE: PC 2007, PUBLIC SUPPORT FOR SCIENCE AND INNOVATION, P. 158

Social and cultural benefits

Research and innovation contribute significantly to Australia's social wellbeing in terms of education, health and quality of life. The following discussion explores challenges to health, food, education and national security that can be addressed through research and innovation.

Health challenges

Health challenges, such as the prevalence of chronic diseases are increasing in both developing and developed countries. In responding to these challenges, governments aim to contain the costs of treatment and seek to develop new approaches for prediction and prevention. Infectious diseases including tuberculosis and malaria threaten large portions of the global population. Emerging infectious diseases, such as the H1N1 influenza virus, combined with a mobile population, increase the potential of global pandemics (OECD 2010b, pp. 171-172).

Funding research into biotechnology and genetics delivers researchers the capacity to explore the causes of disease and develop new or improved tests and treatments. This form of research can enhance the options available to the medical profession for recognising and subsequently treating disease (ALRC 2012). In recognition of this opportunity, National Research Priorities were established in 2009 of which some focused on health. *National Research Priority 2: Promoting and Maintaining Good Health* encompassed the role of health protection and pandemic disease. The other health priority included *National Research Priority 4: Safeguarding Australia,* which incorporated *protecting Australia from invasive diseases and pests* (Commonwealth Government 2009, p. 37).

Australia's largest research effort (measured by number of publication outputs) is in health and medical research. The benefits from this research, as well as international research, are realised through reduced burden of disease and increased longevity (Commonwealth Government 2003, pp. 52-53).

Food security

International organisations including the United Nations Food and Agriculture Organisation (FAO) and the International Food Policy Research Institute have increasingly expressed their concerns on food security in recent years. Their concerns largely relate to growing trends of increases in food prices and rising food demand globally. The FAO outlined their projects for world food demand and found that by 2050 demand is expected to increase by 70 per cent. The majority of this expected increase in international food demand is likely to originate from greater incomes in Asia, Latin America and Eastern Europe (Department of Agriculture, Fisheries and Forestry 2012, p. 1).

Australia is well-positioned to respond to strong demand for food in Asia due to its strong capabilities in agriculture and its distinct climate. Investments in R&D can potentially lead to greater opportunities in exporting agricultural technologies to reduce environmental degradation, decrease water use and enhance yields for example. Progress in these technologies can enhance food security within the Asian region (Australian Government 2012, p. 124).

The current global capacity to produce food is mainly due to productivity-enhancing innovations resulting from public and private investments in agricultural research, extension and education. However, increases in the prices of major food crops in 2008 raised global concerns worldwide on the vulnerability of food supply in both underdeveloped and developed countries. In 2009, the FAO determined that the number of hungry and malnourished individuals in the world was higher than ever before (OECD 2010b, p. 175).

Greater investments in R&D, technology transfer and extension services can potentially increase productivity and food output. For example, the increasing focus on genetically modified organisms now offers the capacity to enhance productivity, improve the attributes of crops and to improve the resilience of crops against challenges like drought (OECD 2010b, p. 176).

Educated and skilled workforce

An educated and skilled workforce is able to participate in public discussions and efficiently contribute to a democratic and multicultural society. Australia currently faces significant social policy issues in relation to demographic change and population ageing. Research and innovation have key roles in managing the direct and indirect consequences of these issues on health and medical care as well as enhancing the capability of the economy to support a greater number of dependent individuals (Commonwealth Government 2003, pp. 50-51). It is noted that there are also economic benefits that result from a more educated and skilled workforce in addition to these social benefits.

National security

Research and innovation have a key role in supporting national security and safety in Australia. One of Australia's National Research Priorities includes 'Safeguarding Australia' (Australian Government 2009, p. 37), with a priority aim of protecting individuals from terrorism and crime. This aim is to be achieved via the promotion of a diverse R&D system that supports core competencies in fields such as data protection and personal identification. Strengths in fields such as engineering, science and technology are deemed as key factors in ensuring Australia remains pro-active to the threats rather than reacting to challenges as they occur (Commonwealth Government 2003 pp. 50-51).

Other social and cultural benefits of research

Research and innovation in new processes and technologies can positively impact on the breadth and severity of social challenges in a variety of ways. These include (DIISRTE 2012a, p. 10):

- research into advanced materials and manufacturing provides the basis for high value, knowledge-intensive and globally competitive industries;
- research into the development of community values and behaviours assists in understanding adaptation to environmental, social and cultural change, which has applications in fields such as immigration, sustaining regional communities, water and energy management;
- research into telecommunications and online technology provides access to information, news, and a variety of services such as electronic banking and online access to government services; and
- research into the use of new media provides applications in the delivery of online education and policy frameworks relating to privacy, moral rights and intellectual property, consumer information.

An example of a social and cultural benefit occurring as a result of research can be found in Box D2.

BOX D2 **EXAMPLE OF SOCIAL AND CULTURAL BENEFITS RESULTING FROM RESEARCH**

The following provides two unique examples of social and cultural benefits generated from ARC-funded research.

Social benefit

AustLII, the Australasian Legal Information Institute, provides free on-line access to Australian and international legal material. With over 1.5 million searchable documents, AustLII is one of the largest sources of legal materials on the net. AustLII users include educational institutions (25 per cent), the legal profession & business (35 per cent), community organisations (10 per cent), government (10 per cent), and overseas users (20 per cent). It provides a major database for research in Law and Justice Studies.

The argument for free access to AustLII runs parallel to the arguments for publicly funded research. For AustLII, 'maximising access to the law supports the rule of law and a transparent legal system enhances the nation's economic and global competitiveness'. The ARC has provided over funding to support the development of AustLII since 1994.

Cultural benefit

The University of Melbourne Conservation Service commenced operation at the Ian Potter Art Conservation Centre in 1989. The Service was established in recognition of the University's need to provide for the preservation and conservation of its extensive and significant collections of cultural material.

The University of Melbourne Conservation Service through the School of Fine Arts, Classical Studies and Archaeology, and the School of Physics, Earth Sciences and Chemistry has received numerous grants from the ARC since 1990. Central to these studies has been the investigation of artists' materials and techniques and the strengthening of art historical, cultural and scientific knowledge. This information and data are key to improved conservation practice.

SOURCE: THE ALLEN CONSULTING GROUP 2003, A WEALTH OF KNOWLEDGE, P. 63

Appendix E Further information on ERA

This appendix provides further details of ERA including an overview of the ERA process, indicators used for data collection, UoEs and volume thresholds and the treatment of interdisciplinary and multidisciplinary research. The changes to ERA since its introduction are also discussed here.

E.1 ERA process

ERA 2012 consisted of four distinct phases: Submission, Assignment, Evaluation and Reporting. The phases of the ERA 2012 Evaluation process are outlined in Table E1.

TABLE E1 **ERA PHASES AND ACTIVITIES**

PHASE	ACTIVITY
Submission	Submission of data by eligible institutions to the ARC
Assignment	Assignment of UoEs to REC members
	Assignment of UoEs to Peer Reviewers
Evaluation	*Stage 1*: preliminary individual evaluation of UoEs by REC members at the four-digit level, including Peer Review (where Peer Review is an identified indicator) of research outputs; evaluation of all assigned UoEs by Peer Reviewers
	Stage 2A: REC members moderation of four-digit evaluations and preliminary independent evaluation of UoEs at the two-digit level *Stage 2B*: REC members moderation of two-digit evaluations *Stage 2C*: REC members review of moderated four-digit and two-digit evaluations in preparation for the Stage 3 meeting
	Stage 3: meeting of all RECs to finalise recommended evaluation outcomes
Reporting	National Report published

SOURCE: ARC 2012C, ERA 2012 EVALUATION HANDBOOK, PP. 14-17

Each of these phases is composed of a number of stages or activities. During the **Submission** phase, universities are granted access to the ERA IT system, the System to Evaluate the Excellence of Research, to upload their relevant ERA data. This information is subsequently verified and validated to guarantee that they align with ERA requirements. The data is then used to compile UoEs for each four-digit and two-digit FoR code that includes all relevant indicators for evaluation in addition to relevant domestic and overseas benchmarks.

On conclusion of the Submission phase, the **Assignment** phase commences where UoEs are assigned to Research Evaluation Committee (REC) members by the REC Chair for evaluation. The exception to this process is where identified conflicts of interest necessitate the appointment of an Acting Chair for the purposes of Assignment.

All four-digit UoEs are assigned to three REC members who are further assigned two-digit UoEs based on their initial and correlating assignments. Each UoE has a REC member selected as a Principal Reviewer who leads discussion of the UoE at the REC meeting. Assignments are normally made to committee members within a single committee, although cross-REC assignments are made where it is necessary to draw on the expertise of members of other committees.

In instances where Peer Review is identified as an indicator, external Peer Reviewers are engaged to construct the Peer Review indicator. Assignment of these reviewers is the task of the Principal Reviewer for the UoE. All assignments are required to take account of identified conflict of interest and workload.

The **Evaluation** phase is undertaken online in order to access relevant data, indicators and Peer Review outputs for each assigned UoE. REC members are required to access all relevant indicators to reach an initial view relating to each UoE and to subsequently note

that view in the system prior to the REC meeting. The Peer Review process follows a similar procedure.

Evaluations are undertaken by REC members independently in the first instance which is followed by an exchange of views among the three assigned REC members for the purposes of moderation. Preliminary evaluations at the four-digit and two-digit levels are undertaken independently by REC members in the initial stages. Evaluation is split across several stages. Moderation is a key process across all stages in Evaluation. Moderation guarantees that each evaluation is undertaken as a discussion between discipline experts and their colleagues in other disciplines. At the conclusion of the online evaluation stages the RECs convene to consider all of the preliminary evaluations and agree to final evaluation outcomes for each unit of evaluation.

In the **Reporting** phase, the ARC produces a National Report that includes aggregated submission data across the range of indicators and FoRs at the national level. It further includes the final ratings for each evaluated UoE.

Each REC undertakes a detailed evaluation process, which includes the use of moderation and conflict of interest procedures, to arrive at an assessment of research quality using the five point scale shown in Table E2.

TABLE E2 **ERA RATING SCALE**

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

SOURCE: ARC 2012C, *ERA 2012 EVALUATION HANDBOOK*, P. 22

E.2 ERA indicators

ERA Indicator Principles guide the development of the indicator categories. Indicator principles were developed in accordance with international best practice and underwent analytical testing of data from the Australian higher education sector by the ERA Indicator Development Group (ARC 2012a, p. 5)

To identify and develop relevant indicators for each discipline, the ARC created eight Indicator Principles suggesting that the indicators should be (ARC 2012b, p.1):

- quantitative;
- internationally recognised;
- comparable to indicators used for other disciplines;
- able to be used to identify excellence;
- research relevant;
- repeatable and verifiable;
- time-bound; and
- behavioural impact.

Using the Indicator Principles, data is collected using four broad categories of indicators for each of the eight discipline clusters of research. These categories include:

- research quality;
- research volume and activity;
- research application; and
- recognition.

E.3 Units of Evaluation and low volume threshold

For the purposes of ERA, discipline clusters are defined as two-digit and four-digit Field of Research (FoR) codes as identified in the *Australia and New Zealand Standard Research Classification 2008*. ERA evaluations occur at the two-digit and four-digit FoR codes for UoEs that equal or exceed the low volume threshold (as explained below). These UoEs do not correlate to particular departments or research groups located within an institution (ARC 2012, p. 6). Rather, they include the contributions of researchers across an institution.

Universities were evaluated in ERA only if the number of their research outputs submitted equalled or exceeded the low volume threshold in 2012. The low volume threshold was 50 apportioned indexed journal articles for disciplines where citation analysis was used.

Alternatively, the low volume threshold was 50 apportioned weighted outputs where citation analysis was not employed and peer review was undertaken instead. In these instances, books were accorded an effective weighting of 5:1 relative to other research outputs within these disciplines. Where there was insufficient research volume to conduct valid analysis at the four-digit FoR levels but sufficient research volume at two-digit levels, evaluations were undertaken at the two-digit level only (ARC 2012a, pp. 6-7).

Where universities did not meet the low volume threshold, the UoE was treated as 'not assessed due to low volume'. Therefore the university was not considered as research active for that particular discipline for ERA 2012 (ARC 2012a, pp. 6-7).

E.4 Interdisciplinary and multidisciplinary research

Both interdisciplinary and multidisciplinary research is disaggregated based on their discipline components. RECs, however, are granted access to data that shows the extent of interdisciplinary and multidisciplinary research for each UoE. All research outputs are assigned to a maximum of three four-digit FoRs. RECs are able to view a 'Discipline Profile' for each UoE that displays the extent to which research outputs of a UoE have also been assigned to additional four-digit FoRs. The purpose of this is to provide complementary information to assign UoEs to REC members and to provide contextual information for REC members when conducting their evaluation (ARC 2012c, p. 6).

REC members can potentially be assigned between RECs where multidisciplinary and interdisciplinary work is being considered in order to bring relevant expertise to the evaluation. All eight RECs meet simultaneously at the final REC evaluation meeting to allow for cross-REC expertise during the finalisation of evaluations (ARC 2012c, p. 6).

E.5 Changes to ERA

Since its introduction in 2008, modifications have been made to the ERA process. There were several key modifications from the 2009 ERA trial evaluations that focused on two discipline clusters (Physical and Chemical Sciences, and Humanities and Creative Arts) and the 2010 ERA full evaluation that addressed all eight discipline clusters.

ERA 2012 features several changes relative to ERA 2010. These modifications were introduced following consultation with members of the Australian higher education research sector, ERA 2010 REC Members, and members of the public. These changes include the following (ARC 2012a, pp. 8-9).

- **Reassignment Exception —** for journal articles, institutions allocated an article to any or all applicable FoR codes assigned to the journal in the ERA 2012 Journal List. For ERA 2012, the ARC introduced an exception to this rule. The exception noted: "where a journal article has significant content (66 per cent or greater) that could be described by a particular FoR code that is not available for the journal it is published in (as assigned in the ERA 2012 Journal List), the institution may assign that FoR code to the article to a minimum of 66 per cent".
- **Low Volume Threshold Change for Peer Review Disciplines —** an increase in the low volume threshold to 50 apportioned weighted outputs. As a result, Peer Review disciplines were brought into line with the threshold for citation disciplines of 50 apportioned indexed journal articles. To calculate the low volume threshold, the 5:1 weighting for books in Peer Review disciplines was maintained.
- **Movement from Citation Analysis to Peer Review Disciplines —** all four-digit and two-digit codes in Information and Computing Sciences used peer review in place of citation analysis for ERA 2012. This allowed for conference publications to be included in the calculation of the low volume threshold. In particular, the four-digit codes 1005 and 1006 were moved to Peer Review.
- **Non-Traditional Research Outputs —** this category was made available to all disciplines in two-digit FoR codes for Economics and Studies in Human Society (and all four-digit FoR codes underneath them). This was in addition to those offered in ERA 2010 and allowed institutions to submit research outputs such as policy documents for these disciplines.
- **Attribution of Applied Measures to Individuals as well as Institutions —** Applied Measures including Patents, Plant Breeder's Rights and Registered Designs assigned to individual eligible researchers as well as those assigned to institutions became eligible for submission for ERA 2012.
- **Esteem Measures —** One particular Esteem Measure, editor prestigious works of reference, became eligible to be submitted in the four-digit FoR codes Building (1202) and Engineering Design (1204).

The range of indicators used to evaluate research quality in 2009 were reduced and consolidated for the 2010 ERA. ERA's 2010 indicators remained unchanged for 2012 with the exception of some minor changes to the assessment of ranked outlets relating to journals and conference papers. This decision was based on a number of factors, including (ARC 2012c, pp. 7-8):

- the 2010 ERA evaluation revealed that REC members relied on detailed drilldowns of the individual journal article level detail more often; and
- there was evidence that ratings were being used inappropriately for reasons outside of ERA.

Table E 3 outlines the indicators used for the 2009 trial, 2010 ERA and 2012 ERA.

TABLE E 3 **CHANGE IN ERA'S INDICATORS (2009-12)**

2009 trial ERA indicators	2010 ERA indicators	2012 ERA indicators
Ranked outlets: - journals; and - refereed conference publications.	**Indicators of research quality** Research quality was considered on the basis of a publishing profile, citation analysis, ERA peer review, and peer reviewed Australian and international research income.	**Indicators of research quality** Research quality was considered on the basis of citation analysis, the 'refined' journal indicator (frequency table), ERA peer review, and peer-reviewed Australian and international research income.
Citation analysis: - relative citation impact (assessed against world and Australian average for the field); - distribution of publications based on: comparison to world centile thresholds; and comparison to the field; and - distribution of papers against relative citation rate bands.	**Indicators of research volume and activity** Research volume and activity was considered on the basis of total research outputs, research income and other research items within the context of the profile of eligible researchers.	**Indicators of research volume and activity** Research volume and activity was considered on the basis of total research outputs, research income and other research items within the context of the profile of eligible researchers.
Volume and activity analysis: - total research publication outputs (by type); and - FTE of eligible researchers by academic level and overall headcount profile.	**Indicators of research application** Research application was considered on the basis of research commercialisation income and other applied measures.	**Indicators of research application** Research application was considered on the basis of research commercialisation income and other applied measures.
HERDC Research Income ERA provided HERDC categories of research income (where relevant), including: - number of grants (Category 1 only); research income per grant (Category 1 only); - total research income; - total research income per FTE; and - ratio of total research income per FTE against discipline benchmark.		
Esteem: - editorial roles at A* and A ranked journals; - contribution to prestigious work of reference; curatorial role (head curator, membership of curatorial board) of a prestigious event; elected Fellowship of Learned Academies (national/ international); - nationally competitive research fellowships (Category 1 only); and - prestigious awards and prizes (national/ international).	**Indicators of recognition** Research recognition was considered on the basis of a range of esteem measures.	**Indicators of recognition** Research recognition was considered on the basis of a range of esteem measures.
Applied: - standard patents sealed; - plant breeders' rights; - registered designs; and - research commercialisation income.		

DATA SOURCE: AUSTRALIAN RESEARCH COUNCIL 2010, *ERA NATIONAL REPORT*, AND 2012, *ERA 2012 NATIONAL REPORT*.

Appendix F Stakeholder consultation

TABLE F1 **SURVEY RESPONDENTS**

University
Australian Catholic University
Bond University
Central Queensland University
Charles Darwin University
Charles Sturt University
Curtin University of Technology
Deakin University
Edith Cowan University
Flinders University
Griffith University
James Cook University
Macquarie University
MCD University of Divinity
Monash University
Murdoch University
Newcastle University
Queensland University of Technology (QUT)
Southern Cross University
Swinburne University of Technology
The Australian National University
The University of Adelaide
The University of Western Australia
University of Canberra
University of Melbourne
University of New England
University of Notre Dame Australia
University of NSW
University of South Australia
University of Southern Queensland
University of Sydney
University of Tasmania
University of Technology, Sydney
University of the Sunshine Coast
University of Western Sydney
University of Wollongong
Victoria University

A total of 37 individuals were interviewed from the following organisations for the purposes of this study:

- Academy of Science;
- Australian Bureau of Statistics (various);
- Australian Council of Deans of Science;
- Australian Research Council (various);
- Central Queensland University;
- CRC Association;
- DIICCSRTE (various);

- Elsevier Science & Technology;
- Griffith University
- Group of Eight;
- HEFCE (UK);
- Office of the Chief Scientist;
- Queensland University of Technology;
- RMIT University;
- The University of Sydney;
- Times Higher Education Rankings (UK);
- Universities Australia (various);
- University of Adelaide; and
- University of Queensland (various).