



**Australian Government**  

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**Australian Research Council**

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**SUBMISSION  
TO THE  
PRODUCTIVITY COMMISSION**

**PUBLIC SUPPORT FOR SCIENCE AND INNOVATION**

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**August 2006**





## SUMMARY

Every modern technology-based country supports its science and innovation system. In common with other OECD countries, Australia has invested over a long period in the people, the knowledge, the networks, the institutions and the technologies that comprise the diverse elements of its own innovation system. Research and development (R&D) is a major component of that system.

While both the public and the private sectors support the growing R&D effort, the business sector is the largest provider of funds for R&D conducted in Australia, and performs the greatest proportion of it. Together, the public and private sectors support R&D activities that vary substantially in duration, risk, prospect of commercial benefit, beneficiaries and gestation period to impact.

Much is now demanded of the science and innovation system. It is viewed as the major driver of continued productivity growth, a vehicle to address the nation's priority issues and challenges and a means of sustaining Australia's competitiveness and enhancing its place in the global order now emerging. The Australian Research Council (ARC) welcomes the opportunity offered by the Productivity Commission's study to examine the structure and performance of the system in its totality, as it is the system as a whole that must deliver against these expectations.

With the National Health and Medical Research Council (NHMRC), the ARC occupies a unique place within the science and innovation system. The ARC allocates a large proportion of its funding to non-directed, investigator-led expansion of the knowledge base. It funds research projects, research facilities, research centres, research networks and research fellowships in universities and related institutions. It is one of the very small group of agencies to which a non-clinical researcher based in a university or similar institution can submit an application for 'blue sky' research. The competitive, peer-reviewed allocation process prioritises excellence and innovation in the funded research and ensures that researchers of excellence can be nurtured and rewarded. The ARC supports research across all fields and disciplines, other than clinical medicine and dentistry (which are supported by the NHMRC).

The very significant expansion of public support for Australian science and innovation that occurred following *Backing Australia's Ability* and its successor *Backing Australia's Ability – Building Our Future Through Science and Innovation* (hereafter *Backing Australia's Ability*) has increased the onus on the system to demonstrate its contribution to the Australian community. The measurement of research impact is particularly difficult in the case of publicly funded research, which typically includes research with long payoff periods and diverse beneficiaries. However, the estimates that have been made suggest that the return on investment in publicly funded research is generally high, and in some cases well in excess of that achieved in other forms of government expenditure. As these estimates tend to focus on identifiable economic impact, any social, environmental and cultural impacts, as well as indirect economic benefits, will add to that return.

Australia is also internationally competitive as a research provider. The country has been a net exporter of research and development services since 1996-97. The value of

those exports has accelerated since 2000-01, when exports of education services also accelerated.

The challenge is to increase the benefits from publicly funded research. The ARC's experience suggests that this is best done by:

- ensuring a diverse base of knowledge, so that Australia has the capability to respond to new challenges and opportunities as they arise and can identify and make use of knowledge generated elsewhere,
- building on areas of current strength (especially in those areas that support existing or emerging export excellence) while also developing capability in identified priority areas,
- supporting and rewarding excellence in the funding arrangements for research and developing indicators and incentives to achieve this,
- developing processes, institutional arrangements and funding mechanisms that enhance the links across the innovation system - among researchers themselves, between researchers and users, in the transition of ideas to products, and with global research activities and networks, and
- improving coordination across the system to ensure that it operates efficiently and effectively.

Continued public support will be necessary to achieve this. While private investment sustains the largest component of spending on R&D, it cannot, by itself, deliver all the desired attributes of an efficient, well-functioning innovation system. Training researchers is a long process. Excellent designers, technologists and implementers are needed if new knowledge and ideas are to be translated successfully into new processes, products and services. Strategic research needs commitment over a long time horizon. International links will be most effective if they link to a whole-of-government approach to international collaboration.

Australia's science and innovation system is one of its greatest assets. Its value will be greatest when public support complements the activities of private sector players and supports them where they will produce benefits for the community as a whole. The Productivity Commission's study will assist in understanding where those areas currently are, and where they may emerge.

## INTRODUCTION

The Australian Research Council welcomes the opportunity to make a submission to this important study.

The Productivity Commission has defined a large number of issues in its *Issues Paper*. While all these issues constitute critical questions for the study, and for the science and innovation system itself, the ARC intends to focus its comment on the following areas:

- The role of the ARC in Australian science and innovation,
- The contribution of ARC-funded research to Australian science and innovation,
- The outcomes and impacts of ARC-funded research,
- The challenges posed by the emerging research environment, and
- The means of increasing the returns to research.

The ARC notes that the Productivity Commission has indicated that the focus of the study will be on the physical and biological sciences, including engineering, with the social sciences (and the arts and humanities) excluded except to the extent they are relevant to innovation (Productivity Commission 2006, p 5). The ARC submits that the humanities and social sciences do, indeed, play an integral role in Australia's science and innovation system and that their influence cannot easily be separated from that of the physical and biological sciences and engineering. The National Research Priorities, for example, which were announced by the Australian Government in 2002 (Howard 2002) and further enhanced in 2003 (Nelson 2003), give explicit recognition to the cross-disciplinary nature of many problems and the knowledge and innovation that are needed to understand and address them. For this reason, the ARC's approach to this submission includes consideration of public support for all forms of research and development relevant to the innovation system.

## PART 1 – CONTEXT

### 1.1 The rationale for government intervention

It is now undisputed that government intervention is critical to the development of a strong science and innovation system in a competitive economy. The role of science and innovation in increasing the potential for growth and increasing the productivity of a country's human, physical and technological resources is well-accepted in public policy, following the development of endogenous growth theories. There is also increasing recognition of the role of research and development in improving a country's ability to achieve economic and social transformation and its readiness to take advantage of emerging trade and development opportunities.

Also well accepted in the public policy literature is the conviction that reliance on private investment in R&D is likely to be sub-optimal in magnitude from a whole-of-society viewpoint. Such 'market failure' may arise in a number of ways.

For example, some techniques and types of knowledge, once used, cannot readily be withheld from others, and there will be, in consequence, little or no private incentive for any individual firm or group to invest in generating them, even if they are expected to be valuable. Processes, approaches and ideas that are difficult to protect under intellectual property law and that can be quickly reproduced by competitors are likely to fall into this category.

Other forms of research and innovation, while valued by private investors and therefore able to attract private investment, are likely to be under-produced in private markets if they also generate spillover benefits to others which are not valued by the initial investor and hence not taken into account in the initial investment decision. While the extent of spillovers in research and innovation is difficult to establish empirically, public support is frequently – and in the ARC's view, legitimately – justified on the grounds that the nation's interests will best be served by undertaking more of some types of research, research training and innovation than would be generated by private sector activity alone.

Research training is one such example, and is of major system-underpinning importance. A firm will be less inclined to commit to a lengthy and expensive development program for a junior researcher if that researcher is able to move his or her newly-acquired skills to another company without compensation of the original training costs. The benefit obtained by the researcher's subsequent employer is not valued by – and may even detract from the profitability of – the firm incurring the original training cost. Public support will be necessary to ensure the availability to the science and innovation system as a whole of qualified, talented researchers, educated in an environment of research excellence.

Without public support, investment in science and innovation is also likely to be sub-optimal in *mix*. This is because some scientific and innovative activity has benefits that are not primarily commercial in nature and so will not be valued at all, or will be undervalued, by private investors compared with society as a whole. Much discovery

research falls into this category. In addition, certain scientific and innovative activities (including basic research) represent a high risk to individual investors, but will be justified from the point of view of the country as a whole. The risk could derive from the early stage nature of the research, the time it will take to generate any commercial benefit and/or uncertainty about the extent of that benefit. For example, despite the obvious commercial benefit to (and later the considerable commercial success of) pharmaceutical companies in developing an insulin product, it was the university-based laboratories in the United States which played the major early role in cloning the genes for human insulin (Stern 1995). In cases such as these, the community at large can be expected to rate the risk of early stage development differently than would an individual investor.

The Productivity Commission's predecessor organisation, the Industry Commission, reviewed these elements of the rationale in depth in the report of its inquiry into research and development (Industry Commission 1995).

Two further reasons for government involvement in science and innovation may be identified. They are:

- The State, Territory and Australian governments are clients for scientific and research services and innovators in their own right, in the areas of activity for which they have responsibility, and
- There is a clear conviction that few countries can rely on purchasing from the international market all the knowledge and skills required to underpin their science and innovative activity, and that research, research skills and technology must also be domestically produced.

The question therefore is not whether there should be public support for science and innovation, but how that support can best be configured to enable the innovation system to operate as a powerful driver of future prosperity in this country.

## **1.2 The objectives of public support for science and innovation**

Because public support for science and innovation involves all State and Territory governments and a number of Commonwealth Government agencies, the objectives of that support are diverse. They reflect the particular responsibilities, circumstances and priorities of each of those governments. Within those levels of government, individual agencies may have highly specific functions in, and objectives for, science and innovation. The extent to which those functions and objectives are integrated and complementary then becomes a matter of importance.

At the Commonwealth level, a whole-of-government approach to articulating those objectives was adopted in the 2001 announcement of the ambitious, cross-portfolio program, *Backing Australia's Ability* (Australian Government 2001), and its successor, announced in 2004, *Backing Australia's Ability – Building our Future through Science and Innovation* (Australian Government 2004) (henceforth, *Backing Australia's Ability*). Those programs jointly provided for an additional \$8.3 billion in funding over the ten years from 2001-02 to 2010-11, bringing the total investment

over that period to more than \$50 billion. They represent a commitment to pursue excellence in research, science and technology through three key themes:

- The generation of new ideas (research and development),
- The commercial application of ideas, and
- Developing and retaining skills.

The objectives for particular components of the national innovation system are canvassed in a range of policy statements, the missions and visions of particular Australian Government agencies and, in the case of research and research training, in the 1999 policy statement by the Minister for Education, Training and Youth Affairs, *Knowledge and Innovation* (Kemp 1999), and in the National Research Priorities (Howard 2002 and Nelson 2003). Other reviews of elements of the science and innovation system have subsequently been held. The role of research in the national innovation system is considered in Section 1.5 below.

### **1.3 Australia's investment in science and innovation**

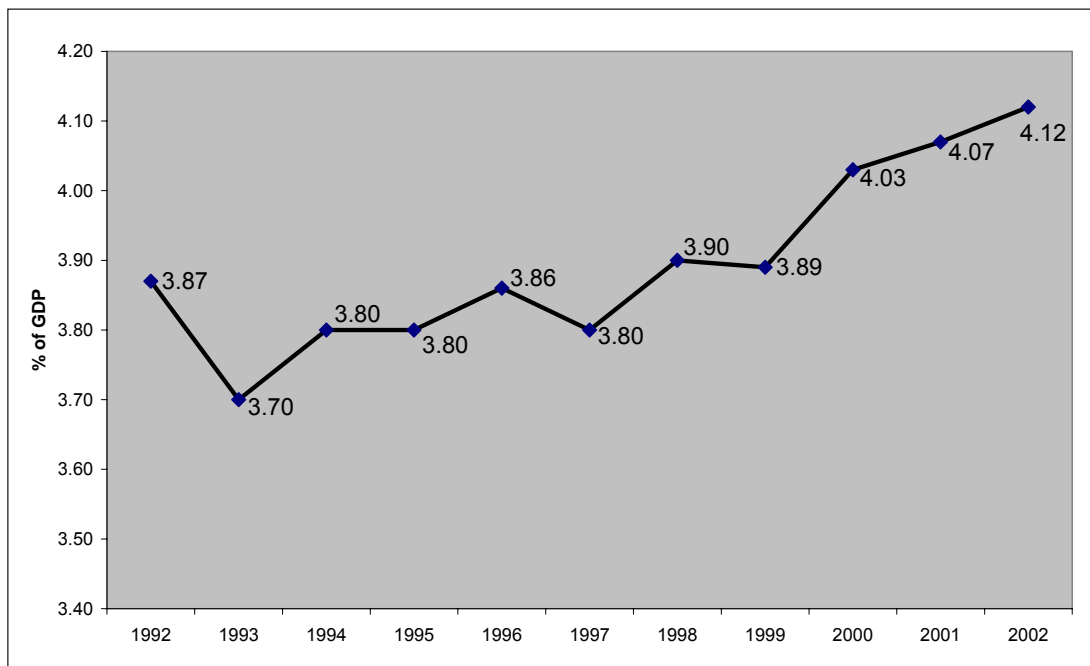
Australia makes a significant investment in science and innovation. In 2002-03, the latest year for which comparable data have been released by the Organisation for Economic Cooperation and Development (OECD), investment in knowledge (defined by the OECD to include research and development, education and training, and software) reached 4.12 per cent of GDP, the highest level since such statistics have been compiled (see Figure 1).

This placed Australia among the top 50 per cent of OECD countries, but below the average of 5.2 per cent of GDP recorded by the OECD as a whole (see Figure 2).

The investment is diverse. It crosses the spectrum of the science and innovation system, from basic research and research training to applied and collaborative research and experimental development (see Figure 3).

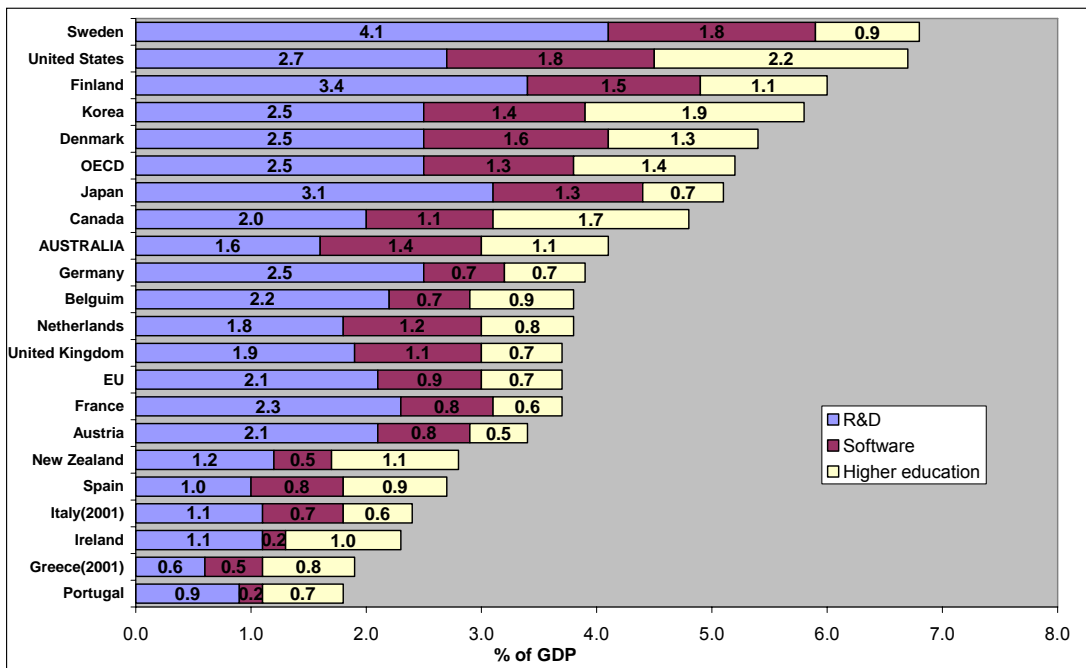
Science and innovation in Australia are conducted by and for the Australian, State and Territory governments, the higher education sector, groupings of academic and business organisations, private businesses, overseas-based clients and non-profit and community organisations (see Figure 4). 'Science' may be categorised in simple terms as the development and dissemination of new knowledge, while 'innovation' encompasses the application of knowledge to develop new or improved products, services, processes or organisational or operational arrangements. Recent ABS statistics indicate that much of the innovation undertaken by business enterprises in Australia, while new to the particular organisation or industry implementing it, does not necessarily constitute the transforming change implied by innovations that are new to Australia or new to the world (ABS 2006). Nevertheless, incremental, non-transformational innovation, by its very frequency and broad distribution, is a key means by which Australian businesses and industries typically gain or retain competitive advantage and remain in contact with markets, suppliers and customers in other countries, by which governments make adjustments to policy and regulatory

**Figure 1**  
**Australia's investment in knowledge as a percentage of GDP, 1992 to 2002**



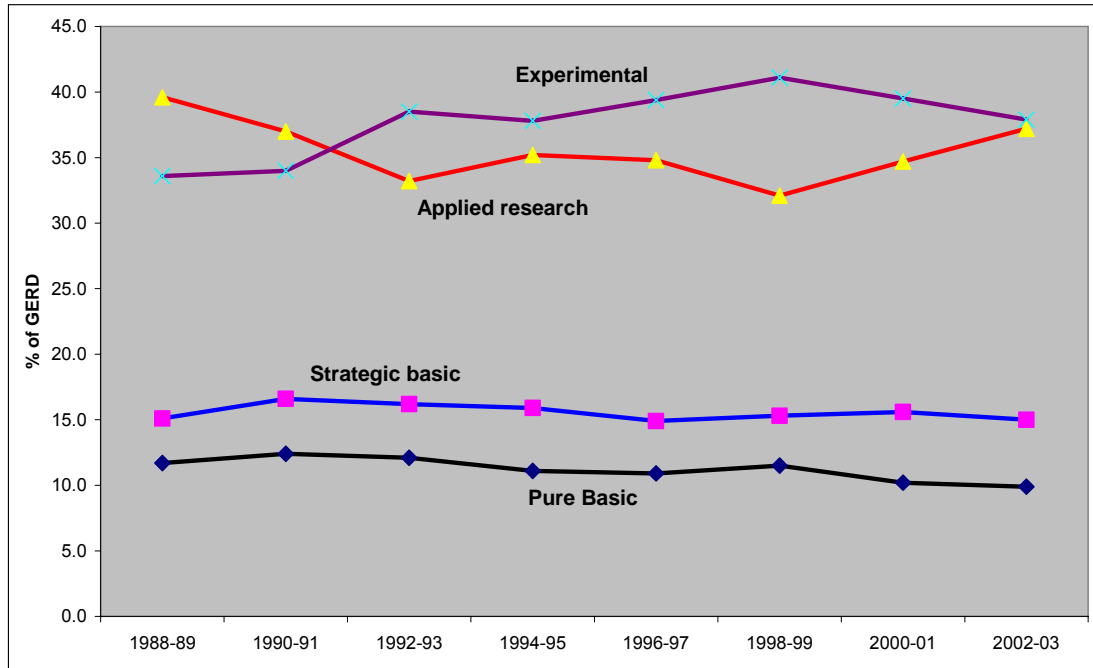
Source: DEST 2005b, p.2

**Figure 2**  
**Investment in knowledge as percentage of GDP by key element – by OECD country, 2002**



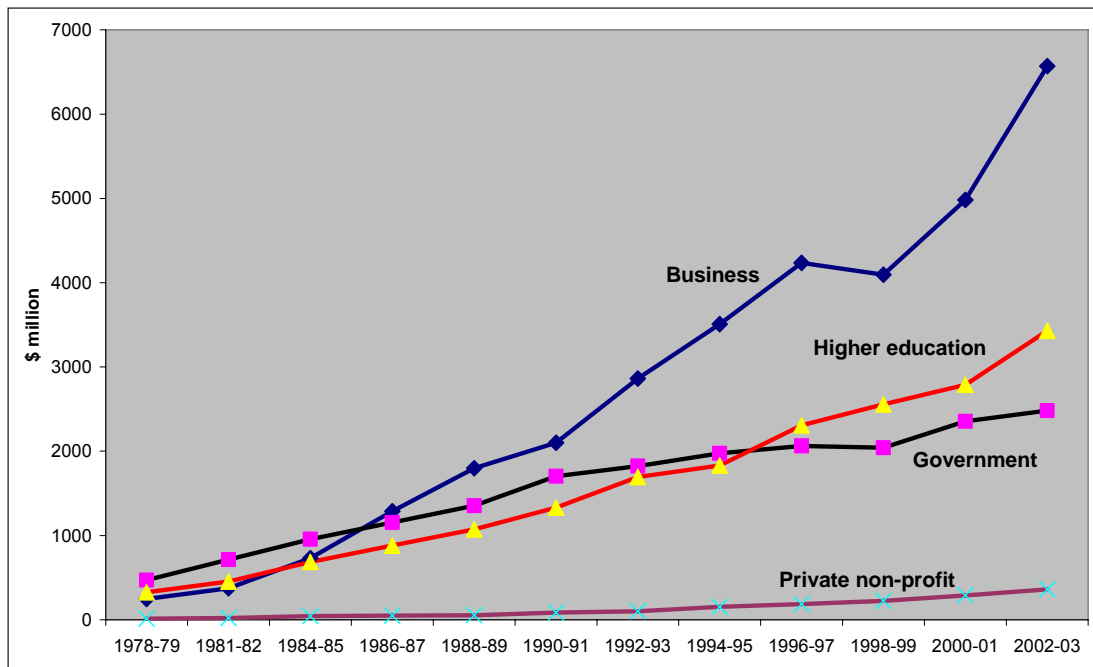
Source: DEST 2005b, p.3

**Figure 3**  
**Gross domestic expenditure on research and development,**  
**by type of activity, 1988-89 to 2002-03**



Source: DEST 2005b, p. 59

**Figure 4**  
**Overview of Australia's gross domestic expenditure on research and**  
**development, by sector of performance, 1978-79 to 2002-03**



Source: DEST 2005b, p. 51

settings and by which societies are exposed to new opportunities and develop and change.

#### **1.4 Public investment in science and innovation**

As noted in the Industry Commission's 1995 report, the public sector is not just a provider of funds for science and innovation, but also a critical influence on the environment within which science and innovation are conducted, a regulator of the ethical and other standards with which publicly funded research and related activities must comply, and a consumer of research services in its own right. In any and all of these capacities, it influences the magnitude and mix of scientific research and innovative activity undertaken within the economy.

Fundamental to this effort is the focus on research and development.

#### **1.5 The role of research and development in the national innovation system**

Research and development constitutes the largest (39 per cent) and – perhaps because of the substantial, direct involvement of government - the most visible component of the national investment in knowledge, as defined by the OECD (see Figure 2 above).

Support for projects, career development, centres and networks was depicted in *Mapping Australian Science and Innovation* (DEST 2003) as the foundation of the national innovation system in Australia (see Figure 5).

Research has long been recognized as underpinning major areas of structural capability in the economy (ARC 2002; OECD 2004 p 17). The ability to produce good people and good ideas provides not only a powerful local base from which to pursue economic, social and environmental improvement, both in business and in government, but also helps to ensure that research produced in other countries (which constitutes the vast bulk of the global research effort) is accessible to Australians and can be adapted to assist in solving Australian problems. It contributes directly to the wellbeing of Australians and to the strategic, economic and social security of Australia when its outputs result in improvements in the nation's consumption possibilities (new, better or cheaper products, services and processes), better-informed government activity and investments, higher quality higher education (teaching and research training), enhanced quality of Australian life and culture (the dissemination of new knowledge and understanding) and improved means of addressing economic, social and environmental issues.

The breadth of these possibilities was captured by the then Minister for Education, Training and Youth Affairs, the Hon Dr D.A. Kemp, MP, in his 1999 policy statement on research and research training, where the objectives of the research and research training system were stated as:

- To ensure Australia is able to maintain and develop its research competence and international credibility across a wide range of fields of knowledge,



- To make more effective and visible the impact of research and research training on national economic competitiveness, social problem solving and community wellbeing (Kemp 1999, pp 3-4).

The Prime Minister reinforced the Government's high expectations of the research system when, in December 2002, he announced the national research priorities that would guide the allocation of research effort across the Australian Government. In that statement, he highlighted the link between excellent research and Australia's ability to improve policy outcomes in areas of particular economic, social and environmental importance to Australia (Howard 2002). The priorities, which were developed following an extensive consultative effort, and subsequently updated (Nelson 2003), indicate clearly the role that research is expected to play in achieving both a stronger innovation system and broader policy goals in Australia.

Recent work commissioned within the Australian research sector (as yet unpublished) has also highlighted the role of research and research training in increasing a country's readiness to seize new opportunities and respond to identified threats, and in creating options for future directions.

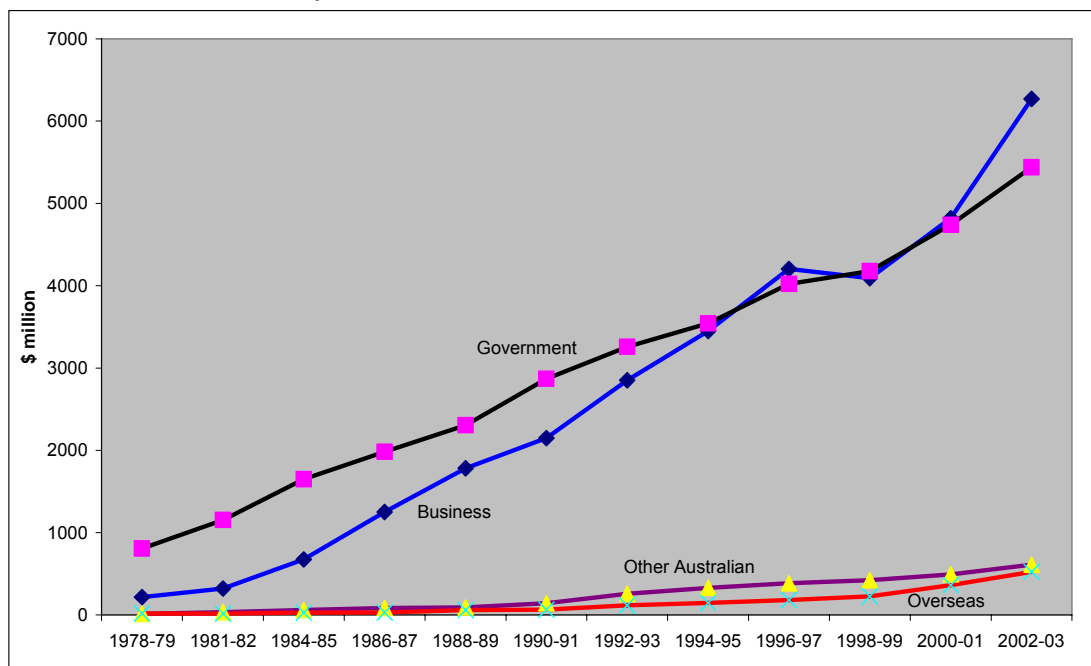
The ARC regards this as a significant new direction in analysing the role of research and research training and in identifying decision 'rules' to assist in the allocation of funding to research. This is because the focus is on the dynamics of national growth and transformation and on recognising the range of decision trajectories that face business and community decision-makers, rather than conceptualizing welfare maximization in the traditional but more limited framework of known objectives, resources and constraints.

The approach emphasises the uncertainty that surrounds future states of the world and the value of possessing options for responding to these uncertainties. It focuses on the need to protect as well as generate wealth, and on the value of having the capacity to do both. In the ARC's view, this constitutes an important additional objective for the science and innovation system.

### ***1.5.1 Investors in research and development***

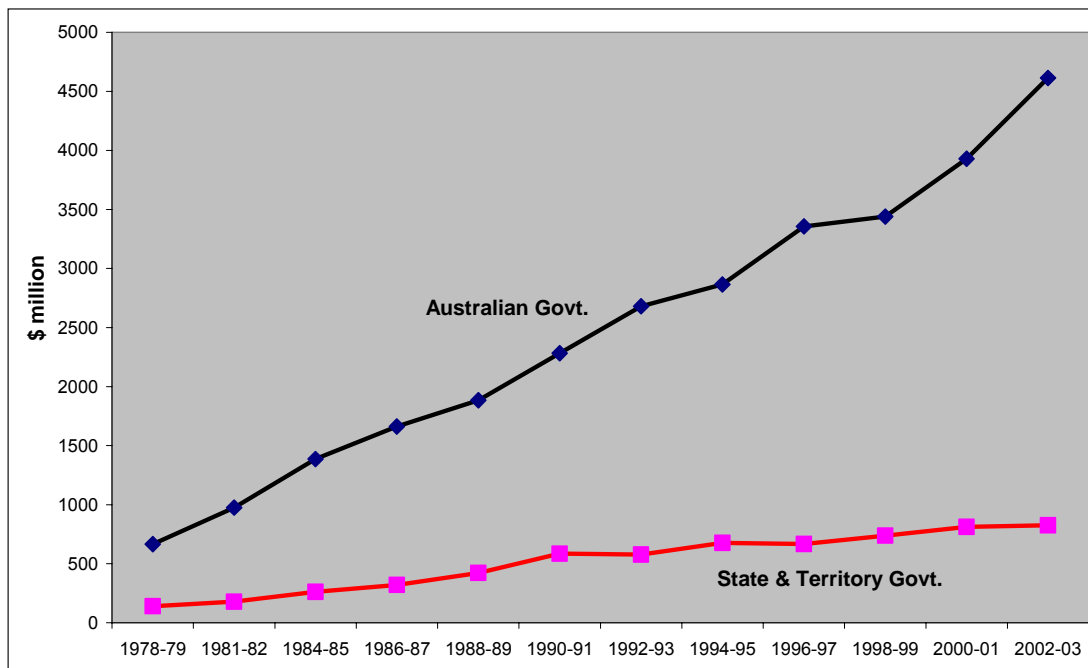
The business sector is the largest investor in research and development in Australia, contributing just under half (48.8 per cent) of this total in 2002-03. Business expenditure on R&D in Australia has grown rapidly since 1998-99, and overtook government expenditure in 2000-01, during the period of substantial injection of public funding that began with *Backing Australia's Ability* in that year (see Figure 6). The Australian, State and Territory governments contribute a further 42 per cent of the total, while other Australian sources and overseas sources account for, respectively, 4.7 per cent and 4.1 per cent. Philanthropy accounts for a relatively small proportion of research funding in Australia, and is likely to be confined mainly to health and medical research fields. This contrasts strongly with the situation in other countries, including the United States, where the Gates Foundation alone distributed US\$1.36 billion in grant payments in 2005, many of which were for research (Bill and Melinda Gates Foundation 2006).

**Figure 6**  
**Australia's gross domestic expenditure on research and development, by source of funds, 1978-79 to 2002-03**



Source: Compiled from data in DEST 2005b, p.52

**Figure 7**  
**Contribution to Australia's gross domestic expenditure on research and development by Australian and State Governments, 1978-79 to 2002-03**



Source: Compiled from data in DEST 2005b, p.52

### ***1.5.2 Public support for research and development***

Public support for research and development is dominated by the Australian government, which contributed almost 85 per cent of total government expenditure in 2002-03 (see Figure 7). State and Territory governments contributed the remainder. The Australian government's share increased in 2000-01 following the introduction of *Backing Australia's Ability* (DEST 2005b), and was estimated to reach \$5 973.9 million in 2006-07 (Australian Government 2006b, Table 1).

The expenditure funds a diverse mix of programs across the full spectrum of research and development. Traditionally, it centres on the funding of research capability, of longer-term and basic research and of research directly related to its own areas of jurisdiction - the areas in which 'market failure' is most likely to be apparent. University-based research and research related to industrial production and technology, health, geosciences, agriculture and defence account for the largest components of Australian government expenditure (see Figure 8).

This diversity is reflected in the different forms in which government support is provided - competitive grants and loans, tax concessions and other subsidies, competitive tenders against pre-defined objectives, formula-related block grants, mission-driven block grants (including support for publicly funded research agencies such as CSIRO) and peer-reviewed competitive grants (see Figure 9).

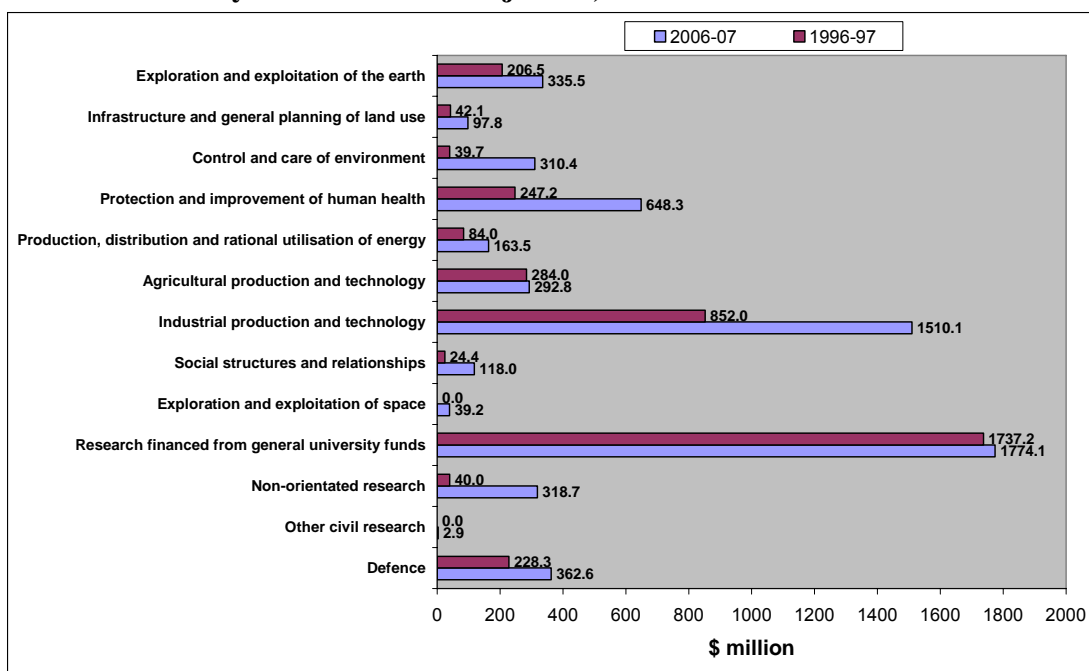
### ***1.5.3 Changes in public support for research and development***

The mix of Australian government support for research and development has changed over recent decades. The changes appear to reflect a combination of direct policy intent (to ensure that more of the research that is undertaken is conducted directly by or for users) and responses to changes in the research environment itself. Among the changes are:

- A reduction in the proportion of direct Australian government R&D expenditure channeled to government-owned research agencies (from 51 per cent of total expenditure in 1981-82 to 23.9 per cent in 2005-06),
- Variations over that period in the proportion allocated to business R&D and innovation (with increases in the late 1980s and early to mid 1990s, followed by a subsequent decline),
- An increase in the proportion allocated to higher education research and research training, and
- An increase in the proportion allocated to science and technology programs (see Figure 10).

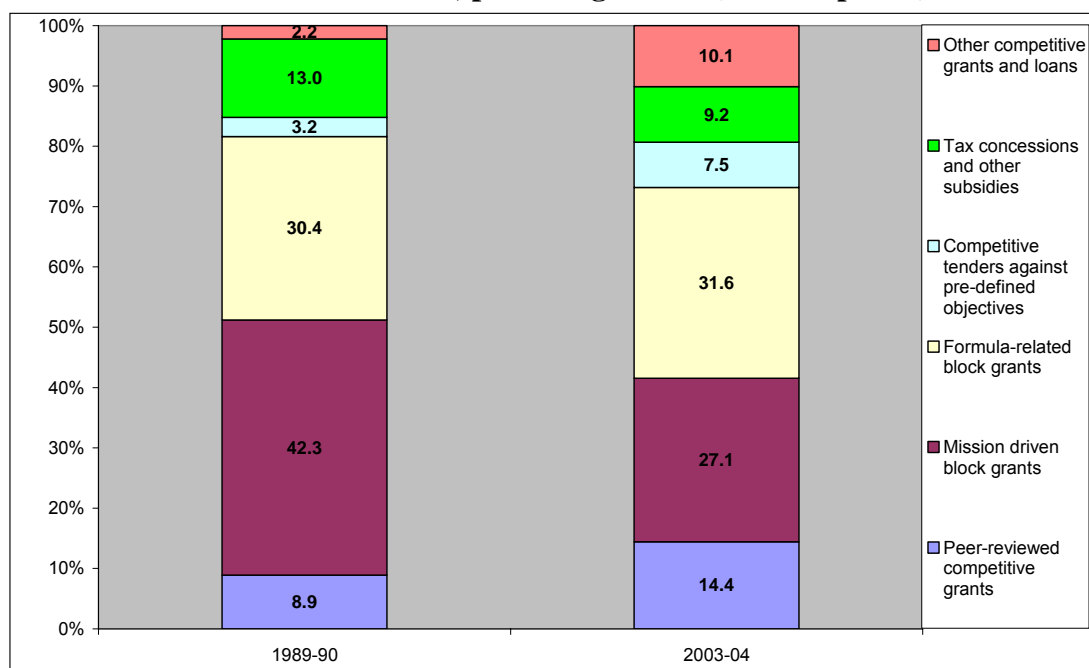
These changes have combined to produce greater contestability in government research expenditure. It can no longer be assumed that government-commissioned research will be undertaken predominantly by publicly funded research agencies, or even in Australia. However, there seems to have been little overall change in the

**Figure 8**  
**Australian Government support for science and innovation,**  
**by socio-economic objective, 1996-97 and 2006-07**



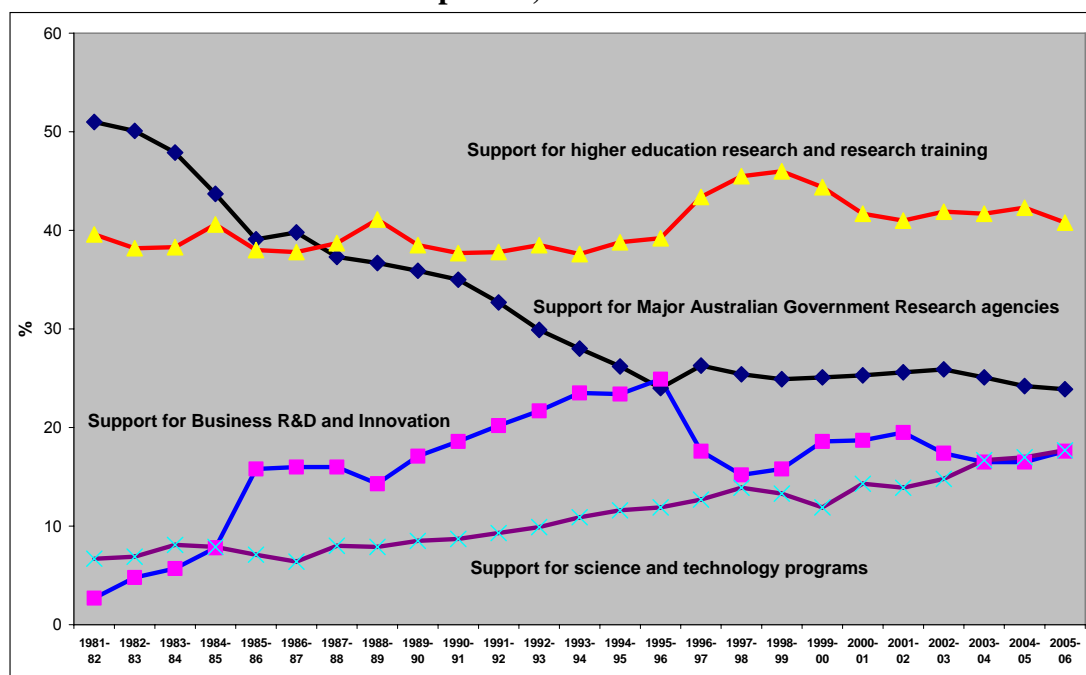
Source: Compiled from data in DEST 2005b, p 26 and Australian Government 2006, p 7

**Figure 9**  
**Commonwealth funding for science and innovation by mode of delivery,**  
**1989-90 and 2003-04, percentage share (2000-01 prices)**



Source: DEST 2003, p. 398

**Figure 10**  
**Distribution of Australian Government support for science and innovation, by main component, 1981-82 to 2005-06**



Source: DEST 2005b, p 23

national balance of expenditure among pure basic research, strategic basic research, applied research and experimental development (see Figure 3 above).

#### ***1.5.4 The impact of government-funded research and development***

Government funding has supported such a diverse range of research over the years that insights and breakthroughs of global significance have occurred in a large number of fields and disciplines. Australians can be justifiably proud of the Australian Nobel Prize winners and other eminent individuals working in the fields of immunology, plant and animal sciences, space science, philosophy and geosciences, where researchers have achieved world standing for their work and altered ways of thinking about, or progressing, issues of major significance for humankind. A study by the UK Chief Scientific Adviser, Sir David King, showed that Australia is among a number of countries that achieve a relatively high scientific impact, as measured by citations of their published outputs, relative to their wealth (King 2004).

Over the five years from 2001 to 2005, Australia's share of science and social science papers was 2.91 per cent of the world total (Thomson Scientific 2006). Australia's largest share was in the research area of education, where Australian papers comprised 5.44 per cent of the world's research publications in this field (see Table 1). The impact of this output is likely to reflect the rate at which it is cited by other researchers and the impact factor of the journals in which it is published. The average number of citations per paper, relative to the world average, is notably high in the fields of geosciences, plant and animal sciences, agricultural sciences, and ecology/environmental sciences (among others).

It is no coincidence that these fields relate to areas of the economy where international competitiveness and exports are very strong (mining, agriculture) or emerging as strengths (education).

**Table 1**  
**Australia's share<sup>1</sup> of world research papers by discipline, 2001–2005**

Field	Percentage of papers from Australia	Relative citation impact compared to world average
	(%)	(%) <sup>2</sup>
Education	5.44	+4
Plant & animal sciences	5.30	+15
Geosciences	5.02	+25
Ecology/Environmental	4.67	+11
Psychology/Psychiatry	4.61	-9
Social sciences	4.46	+1
Space science	4.42	+38
Economics & business	4.11	-24
Agricultural sciences	4.01	+15
Immunology	3.66	+9
Clinical medicine	3.12	+16
Microbiology	2.94	+9
Biology & biochemistry	2.91	+5
<b>AUSTRALIA, ALL FIELDS</b>	<b>2.91</b>	
Neurosciences and behaviour	2.81	-11
Molecular biology	2.79	-4
Computer science	2.41	Even
Pharmacology	2.36	+4
Engineering	2.27	+8
Mathematics	2.19	+23
Materials science	1.80	-12
Chemistry	1.69	+4
Physics	1.60	+14

<sup>1</sup> Between 2001 and 2005, Thomson Scientific indexed 114 047 papers that listed at least one author address in Australia.

<sup>2</sup> Percentage difference between the Australian and world average citations-per-paper in a given field.  
*Source:* Thomson Scientific 2006

Within areas of strength, it is individual breakthrough discoveries, rather than the totality of publicly funded research, that tend to capture the public imagination. Certainly, a single breakthrough may, by itself, deliver benefits that vastly outweigh the direct costs of achieving it. Professor Ian Frazer declared in a speech at Parliament House earlier this year that:

All the health research that ever has been done ... has been paid for by the single invention of the poliovirus vaccine, and the increased productivity and reduced health care costs consequent upon the abolition of paralytic polio in most communities world wide. (Frazer 2006)

The Jameson Flotation Cell, developed with ARC funding by Professor Graeme Jameson at the University of Newcastle during the 1980s, provides a highly efficient, compact and robust technology for the treatment of both industrial and municipal effluents. The process extended the conventional and generally accepted process envelope for removing suspended solids, oils and other material by generating air bubbles in a 'bubble column' without the need for compressed air or blowers. The process was developed initially for the mining industry for the recovery of valuable minerals in mineral processing plants where solids concentrations can be as high as 250,000 mg/L. Subsequently, the technology was adapted for waste-water treatment in which the water becomes the valuable resource to be recovered for recycle and re-use. The technology has been proven in various applications from dairy through to algae treatment, with over 30 applications worldwide. It has been estimated that the commercial value of the technology is in excess of \$500 million in export coal each year (The Allen Consulting Group 2003, p 87).

Breakthroughs such as these are frequently used to justify government involvement in high-cost and risky areas, where a few successes can 'carry' a large number of other risky, but potentially beneficial, initiatives.

The return on the *portfolio* of government investment in research is more difficult to estimate. Conceptual and practical difficulties plague any attempt to measure research impact in any aggregated way, and are exacerbated in the case of research undertaken by or for government agencies, whose focus tends to be on research with diffuse benefit streams and/or longer time horizons than that of the private sector. These difficulties, and the range of methods that might be employed, are well canvassed in the national and international literature.

The studies that have been done tend, as a result, to focus on the sub-set of the possible benefits that comprises more immediately realised benefits and those captured by a relatively small number or range of beneficiaries. These include, among others, the development of new products, services or processes, which result in lower costs or higher returns in commercial enterprises, and the development of policy advice leading to the introduction or amendment of programs or legislation, which result in lower or more effectively targeted government spending. Most studies specifically exclude benefits and beneficiaries outside commercial markets or government transactions, as well as longer term benefits. Social, cultural and some environmental benefits are typically in this group. As a result, such studies are more likely to underestimate than to overestimate the final benefits of government funded research.

Nevertheless, a number of studies have yielded estimates of the rate of return to government investment in research that appear satisfactory, and even high, by most standards. The Australian Council for International Agricultural Research has published estimates based on impact assessments undertaken since 1998 indicating that benefit-cost ratios of at least 1.31 and up to 3.06 were achieved from its bilateral R&D investments (ACIAR 2005). The Allen Consulting Group, in a report for the Cooperative Research Centres (CRC) Committee (2005), estimated the quantifiable economic impact of government investment in CRCs between 1992 and 2005. Significantly, the Group benchmarked this return against estimates of the return on

government expenditure in general, providing explicit recognition of the opportunity cost of allocating government funds to research and development. It concluded that the rate of return to investment in the CRCs exceeded that of general government expenditure by a factor of 1.60.

A study conducted by the Allen Consulting Group on the economic impact of ARC-funded research also found high rates of return (The Allen Consulting Group 2003). That study and its results are discussed in detail below (section 2.4).

Other impacts may also be observed. These include:

- the capacity to connect to international research networks and research findings, which is possible only when high-level expertise exists locally,
- the ability of high-performing research units to attract and retain staff trained in other countries,
- the flow-on effects of excellent research on teaching,
- the potential for business, industry and other potential users to engage with the research community without all the costs of establishing and maintaining a comprehensive research 'infrastructure', and
- the achievement of business, productivity, government and social gains that will ultimately benefit the Australian economy and community.

### ***1.5.5 The additionality of government investment in research and development***

Government funding agencies and research users traditionally have different objectives in funding research and fund different *kinds* of research. However, the increased focus of governments in many countries on improving links between academic researchers and final users (particularly business users) appears to be reducing those distinctions. The potential for government funding to replace, rather than complement, the efforts of private investors in research is now widely canvassed. Such substitution, if substantial, could undermine returns to public investment by subsidising research that would otherwise be undertaken by those most likely to capture its benefits (creating little or no 'additional' research) and diverting funds from areas where the public return is likely to be greater.

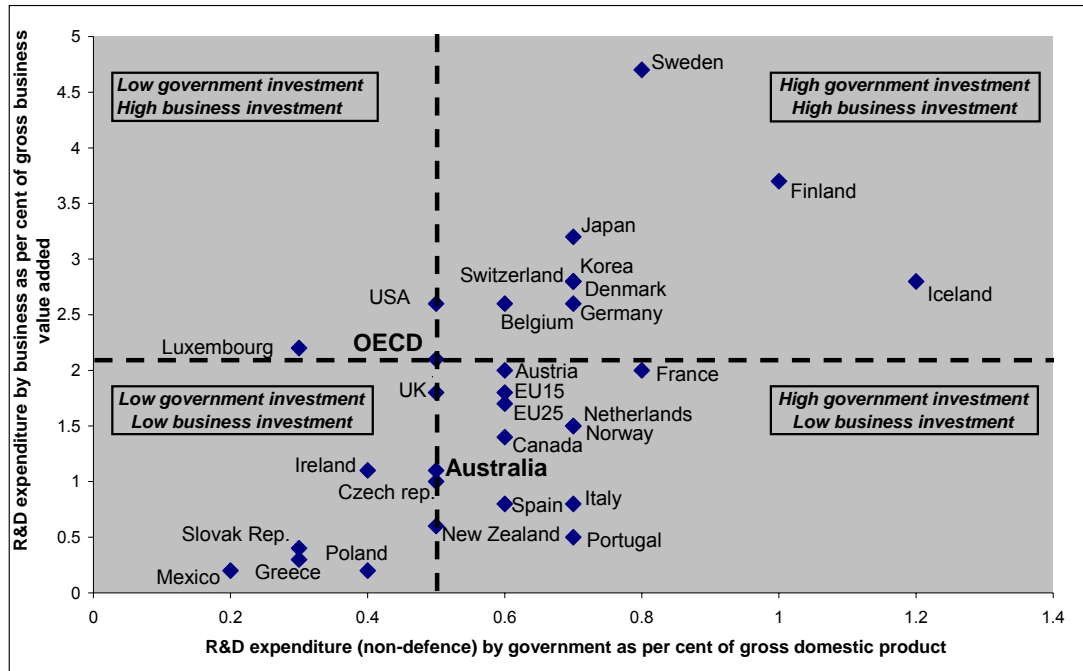
It is difficult to test additionality hypotheses. However, were some crowding out of private investment by public investment to occur, then it could be predicted that countries with relatively high levels of government expenditure on R&D relative to GDP would have relatively lower levels of business expenditure on R&D relative to business value added, other things being equal. Data published by the OECD do not support this hypothesis. Among a sample of 34 countries, high rates of government expenditure on (non-defence) R&D in 2002 are associated with varying levels of business expenditure on R&D (see Figure 11). Low rates of government expenditure tend to be accompanied by below OECD-average rates of business expenditure. Where the rate of government expenditure is above the OECD average, the rate of business expenditure is also above the business average in some cases, but below it in others.

The low-government/high-business quadrant of the distribution is almost unpopulated, suggesting that business is less willing to invest in R&D when the government commitment is low.

A further hypothesis might be tested in the case of Australia. If substitution of government research funding for business funding were indeed occurring across significant components of the research spectrum, then the increase in government expenditure on research and development in recent years, along with increased government commitment to industry-linked research programs and expenditure, might be expected to have been associated with a decrease in business outlays on research and development.

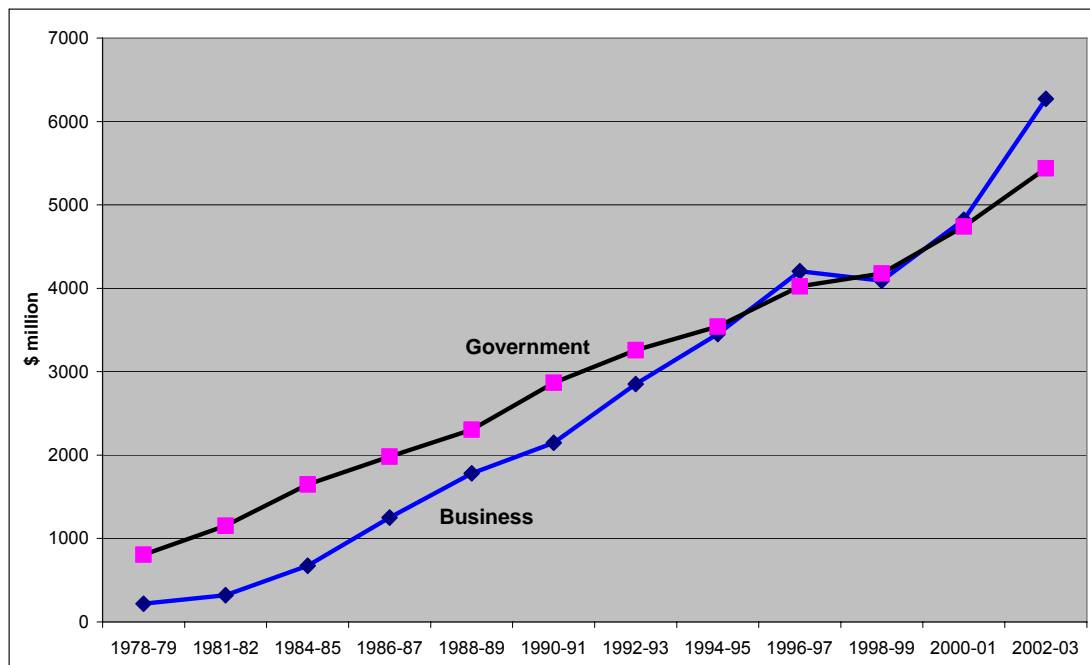
This does not appear to have been the case. Rather, the increased government investment has coincided with an *increase* in business investment (see Figure 12, which depicts the source of funds for R&D in Australia). This suggests the possibility that, when government expenditure results in an increase in the knowledge base, it is attractive for industry to invest more. Australia's experience with the Research and Development Corporations, where government funding levers considerable industry funding (generally on a dollar-for-dollar basis), supports this hypothesis. For example, the Grains Research and Development Corporation attracts industry contributions well beyond the level at which matching contributions are available from government.

**Figure 11**  
**Investment in R&D, business and public sectors, OECD, 2002**



Source: Compiled from data in OECD 2005, Tables A11.1 and A5.1

**Figure 12**  
**Australia's gross domestic expenditure on research and development, by source of funds, business and public sectors, 1978-79 to 2002-03**



Source: Compiled from data in DEST 2005b, p.52

## **PART 2 – THE AUSTRALIAN RESEARCH COUNCIL AND SCIENCE AND INNOVATION IN AUSTRALIA**

### **2.1 The Australian Research Council**

The Australian Research Council was established in its current form by the *Australian Research Council Act 2001*. That Act gave effect to the intent expressed by the then Minister for Education, Training and Youth Affairs in his 1999 policy statement on research and research training, *Knowledge and Innovation*, to establish the ARC as an independent body within the Education, Training and Youth Affairs portfolio, to recast its governance and structure, and to expand its funding, consolidate its programs and raise its profile within the Australian research community.

The ARC is responsible for administering the National Competitive Grants Program (NCGP), under which funding is made available for research conducted in universities and other eligible organisations in all disciplines other than clinical medicine and dentistry. The NCGP supports two main streams of research funding – *Discovery*, under which funding is made available for investigator-initiated research and research fellowships, and *Linkage*, under which research projects, infrastructure, fellowships, centres and networks are funded jointly with partner organisations in the private sector, government or the community. Schemes in both streams generally provide for proposals to be submitted to the ARC and assessed and ranked in comprehensive peer review processes. The Minister for Education, Science and Training receives the ARC's recommendations for funding under each scheme and must approve a proposal before it may be funded.

The role, responsibilities and operations of the ARC are described in more detail in Attachment 1.

In 2006-07, \$570.3 million will be disbursed by the ARC under the NCGP (Australian Government 2006a, p 226). This is expected to constitute around 9.5 per cent of the Australian Government's support for research and development in Australia in that year (Australian Government 2006b, p 2).

### **2.2 The role of the ARC in Australian science and innovation**

With the National Health and Medical Research Council (NHMRC), the ARC occupies a unique place in the Australian science and innovation system. Together, the two agencies constitute the greater part of the competitive funding arm of the dual funding model for higher education research. That model provides for both competitive funding and block funding, and so provides incentives for excellence in higher education research as well as scope for higher education institutions to develop particular research strengths and specialties.

The substantial funding allocated by the Australian government to investigator-initiated research (a total of over \$1.2 billion in 2006-07<sup>1</sup>) recognizes the importance – and the effectiveness – of providing a means by which excellent researchers of conviction and curiosity in any field of research can take forward innovative lines of inquiry. It provides researchers of excellence, at all stages in their careers, the opportunity to gain support for their research activities, regardless of the particular institution or discipline in which they are located. As one member of the academic community has observed, schemes such as those of the ARC enable a researcher to be judged as an individual, irrespective of the standing of his or her institution (personal communication reported by Professor Høj). As such, investigator-initiated research is a major means by which new discovery can arise and a critical mechanism for creating a high quality research training environment. When the interests and expertise of higher education-based researchers are linked with those of user organisations, as occurs under the ARC's *Linkage* schemes, a direct and powerful channel for the application of such new discovery is created.

As noted above, the activities of the ARC and the NHMRC were depicted in *Mapping Australian Science and Innovation* as the foundation of the Australian innovation system, enabling research capability to be built and connections to be established through support for projects and career development (see Figure 5 above). While the structure and focus of both organisations have altered over time, these fundamental functions have not. They are mirrored in similar arrangements throughout the developed world.

The ARC's mission is to:

*Advance Australia's research excellence to be globally competitive and deliver benefits to the community.* (ARC 2006)

As such, it incorporates a specific objective (advance research excellence), an intended outcome (to be globally competitive) and an overarching rationale (the expectation of community benefit). The ARC approaches this mission within the constraints of its responsibilities and its budget and the need to pay regard to the national research priorities, any particular Ministerial directions concerning its operations and priorities and the Government's overall economic, social and cultural objectives (Kemp 1999). At the same time, it has considerable flexibility to recommend changes in the mix and focus of its schemes and its funding in response to changes in the research environment.

The principle of peer review underpins all the ARC's advisory processes. It is the single most important element in the processes developed by the ARC to ensure that it can satisfy its mission. Peer review assists in ensuring that proposals are assessed by experts in their fields, that excellence and innovation can be identified, that the final recommendations are accepted as the best of those presented for assessment, and that the awards are prestigious and raise the esteem of recipients in the view of their peers.

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<sup>1</sup> Australian Research Council and National Health and Medical Research Council administered appropriations 2006-07 (Australian Government 2006a).

## 2.3 The outcomes of ARC-funded research

### 2.3.1 Funding

ARC funding is, of itself, an important source of research income to universities and other organisations. As noted above, the ARC will distribute a total of \$570.3 million in 2006-07 for research activities approved under the NCGP. This is around 2.5 per cent higher than in 2005-06, and is more than double the total of \$265.8 million allocated in 2001-02, the first year following the ARC's creation as a separate body, the introduction of *Backing Australia's Ability* and the commencement of the NCGP.

**Table 2**  
**ARC appropriations – administered funds, 2000-01 to 2006-07**  
**(current prices)**

2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
\$m	\$m	\$m	\$m	\$m	\$m	\$m
247.8	265.8	298.3	394.4	481.4	556.5	570.3

Source: *Portfolio Budget Statements 2006-07, Education, Science and Training Portfolio*

Details of ARC funding by scheme and over time are included in Attachment 2 (Table 2).

However, ARC funding also drives other funding in the research sector. The funding allocated to each university under the Research Training Scheme (pre-safety net component), the Institutional Grants Scheme (pre-safety net component) and the Research Infrastructure Block Grants is determined according to a formula in which research income (Category 1 of which is Australian Competitive Grants Income) constitutes (up to) 40 per cent, 60 per cent and 100 per cent of the total respectively (DEST 2006a and 2006b). In 2004, the most recent year for which data are published, Commonwealth competitive grants accounted for 43.5 per cent of research income in Australian universities. This suggests that ARC funding determined the direction of more than \$100 million in pre-safety net funding for research, research infrastructure and research training in that year.

Under *Linkage* arrangements, ARC funding also drives funding and other inputs from industry and other collaborating partners. Since its introduction in 2001, *Linkage Projects* has elicited research proposals from a total of 9 026 partner organisations from all sectors of the economy and community. A total of \$1 436 million was pre-committed to those proposals by those partners. The proposals that were ultimately funded by the ARC delivered cash contributions of up to \$242 million and substantial in-kind contributions to research in Australia's higher education system. In 2006, these represented up to \$1.53 in cash and in-kind contributions for every \$1 provided by the ARC. Further details are provided in Attachment 2 (Tables 22 to 25).

As the salaries of investigators on ARC-funded projects are met by their institutions, those institutions also must commit to the research.

Indirect funding implications also follow. An institution or discipline group within an institution that performs well in competitive grants is likely to develop a reputation for excellence that will attract further research income and/or collaborations. Partner organisations developing research proposals with academic researchers may retain the links they develop – and possibly commit funding to the research – even if their proposals are not successful in obtaining ARC *Linkage* funding. Anecdotal evidence (soon to be tested more formally by the ARC) suggests that the ‘demonstration’ effect on both parties of developing and defending research proposals is itself likely to foster further research collaboration among the providers and users of research.

It follows that the decisions made by the ARC and other competitive grant funding bodies will affect the distribution of funding for research and research training in ways that will tend to reinforce the selection criteria applied by those agencies. As the ARC’s selection criteria are intended primarily to identify excellence in the researchers and proposed research, the funding will benefit those institutions identified under the ARC’s criteria as excellent. At the same time, ‘safety net’ and other funding arrangements for higher education providers enable institutions performing less well against those criteria to retain funding in order to build up their capabilities. The ARC believes that funding criteria that reward excellence and impact provide the incentives most likely to support and enhance Australia’s science and innovation system.

### **2.3.2 Research activities**

ARC schemes fund individual research projects, research fellowships, infrastructure acquisition, research centres and research networks. They also contribute to activities that support research (such as the Australian and New Zealand Council for the Care of Animals in Research and Teaching) and to Australian participation in the development and operation of international facilities and activities (such as the Anglo-Australian Observatory and the Gemini Observatory).

The ARC is funding a total of over 5 300 projects and other research grants in 2006, in all major disciplines and almost every university in the country. Details are included in Attachment 2 (Table 7).

#### *Research quantum and quality*

The volume of ARC-funded research activity is such that it adds substantially to the quantum of research undertaken in Australia. It does this either by making possible activity that could not otherwise be undertaken, or by increasing the scope, scale, depth or integration of that activity. More significantly, the strong competition for ARC grants (under which, for example, fewer than one in four proposals submitted under *Discovery Projects* in 2005 was approved for funding) (see Attachment 2, Table 3) ensures that ARC-funded research is among the more significant research undertaken in Australian higher education institutions.

The number of projects funded in any year reflects the budget available to the ARC, the funding sought by applicants and the proportion of the funding sought that is actually approved. While the ARC’s budget is now at its highest level ever, following the large boost provided under *Backing Australia’s Ability*, its rate of growth has

slowed over the last year, limiting the ARC's capacity to continue increasing its forward commitments. At the same time, the number of proposals and the average amount of funding sought in those proposals have risen. The ARC has therefore faced a trade-off between continuing to recommend increases in the number of research activities funded, and funding a relatively high proportion of the value of proposals selected for funding. In proposals assessed in 2005, the ARC's selection advisory committees recommended a smaller number of proposals for funding in most schemes, while increasing the average grant size (see Attachment 2, Table 6). This reflected their assessment that the quality of proposals received was particularly high and warranted funding at a level sufficient to enable their objectives to be achieved.

The ARC believes that the quality of proposals in all schemes is such that many highly rated projects of potentially great benefit to Australia are excluded from ARC funding because they fall below the funding 'line'.

### *Research mix*

ARC-funded research crosses all discipline areas, other than clinical medicine and dentistry. ARC selection criteria do not generally prioritise particular disciplines or types of work, although the ARC has responded to particular Ministerial directions when given. For example, in response to a January 2002 direction from the Minister for Education, Science and Training, the ARC targeted over 33 per cent of funds in the 2003 new funding round to four areas of research priority: nano-materials and bio-materials; genome/phenome research; complex/intelligent systems; and photon science and technology. Funding for these areas was provided through the *Discovery* and *Linkage* elements of the NCGP and through *ARC Centres of Excellence* and *ARC Centres* established in 2003. The ARC earmarks a proportion of funds under *Discovery Projects* each year to early career researchers, and also targets at least 50 new Australian Postgraduate Awards Industry each year to research training in the field of ICT, and 20 per cent of funding under *Linkage Projects* to research that will directly benefit regional and rural communities.

The policy of supporting excellence in whatever discipline and whatever location it is found supports the development of a broad range of capability within Australia. It does not exclude a focus, when required, on areas of identified national priority. The majority of proposals submitted to the ARC are nominated by applicants as relevant to at least one national research priority (see Attachment 2, Table 26). Nor does it exclude the development of areas of particular strength. However, it does ensure that, when new needs or opportunities are identified, a core of knowledge – and accompanying links to international effort in that field – will be accessible.

It is worth observing that, when the NHMRC examined the mix of its (largely non-targeted) research funding against the ten disease areas accounting for the greatest disease burden in Australia, it found that the major part of its funded research was, in fact, related to those diseases (NHMRC 2005, Chapter 1). Research needs and research effort were converging, even without specific direction. The ARC has recently found that the terms 'biodiversity', 'globalisation', 'gene expression' and 'climate change' are among the keywords now most commonly cited in ARC applications.

Details of the discipline mix of ARC funding, by scheme and over time, are contained in Attachment 2 (Tables 4 and 5). The discipline mix of funded projects reflects, among other things, the discipline mix of the proposals and the relative costs of research in different disciplines

The ARC is aware that innovative research often occurs at the intersection of established disciplines, and has developed procedures for assessing cross-disciplinary proposals which cross its essentially discipline-based (if broadly configured) selection advisory committees. These procedures were outlined in the ARC's response to the *Research Quality Framework: Preferred Model* (2005b). The ARC neither prioritises nor penalises cross-disciplinary proposals relative to single-discipline proposals, and selection outcomes indicate that they achieve broadly comparable success rates. The incidence and success rates of cross-disciplinary proposals in the major ARC schemes are shown in Attachment 2 (Tables 8 and 9).

#### *Activity mix*

The funding of individual projects remains the main focus of the ARC's activity. It cannot be emphasised too highly that providing the opportunity for researchers to follow a course of research which they have initiated and about which they are passionate is one of the best ways of eliciting commitment, perseverance and hence excellence in research outcomes.

Nevertheless, the mix of funding distributed by the ARC has broadened since the introduction of *Backing Australia's Ability*. The opportunity to fund a broader range of activities reflected Government preferences articulated in a number of statements (Kemp 1999, Australian Government 2001, 2004) and a number of reviews of research and innovation funding.

The outcome has been an increased emphasis on supporting researchers, research infrastructure and collaborative research arrangements. These are, in the view of the ARC, complementary activities, all of which are required in order to achieve an effective research system.

#### **2.3.3 Research training and careers**

The ARC believes that the single most important objective of any research system is the development of researchers of insight and excellence. Without a skilled and diverse base of people, other objectives for science and innovation will be impossible to achieve.

ARC schemes therefore place great emphasis on research training and career development in an environment of excellent research. They provide support directly, through awards and fellowships to selected individuals, and indirectly, through other ARC-funded research projects (including *ARC Research Networks*, *Discovery Projects* and *Linkage Projects*, *Linkage International Awards* and *Research Centres*). Data extracted in 2004 from the final reports of *Large Research Grants* recipients indicated that, on average, each grant supported four to six research personnel (ARC 2004, p 244).

ARC grants currently support 2 286 Australian researchers under individual awards and fellowships. Details of the number of researchers and the awards and fellowships under which they were appointed are shown in Attachment 2 (Table 10). ARC grants awarded for commencement in 2006 involve over 4 000 investigators and partner investigators (Attachment 2, Table 16). Grants awarded in earlier years and still in progress involve many thousands more.

Taken together, these numbers account for a non-trivial proportion of the population of research-active staff in Australian universities. DEST statistics indicate that in 2005 there were 11 933 full-time and fractional full-time staff in research-only positions in Australian universities, and 28 148 in teaching and research positions (DEST 2005a). ARC-funded activity underpins many of these positions.

With the augmentation of ARC funding following the introduction of *Backing Australia's Ability*, the number of projects, investigators and research fellowships supported under ARC schemes increased substantially. Only a minority of these have received multiple awards. Around 60 per cent of investigators on ARC-funded projects and over 90 per cent of fellows have been involved in only one successful proposal since 1998, suggesting that ARC funding has been sought by, and awarded to, a wide range of research-active staff in Australian universities. Details are included in Attachment 2 (Tables 13 and 17). All but a handful of the 101 researchers who have held more than one fellowship since 1998 have progressed from postdoctoral or other early career awards to higher-level fellowships.

The stipends associated with ARC awards have also increased. The remuneration associated with Federation Fellowships is now at a level capable of attracting the interest of researchers with international reputations.

This investment in people is significant on a number of levels:

- It provides incentive and reward to emerging and established researchers of excellence. Excellent researchers are a pre-requisite for excellent research, which in turn is almost invariably a necessary condition for that research to find applications generating community benefit,
- It assists in retaining in Australia researchers of excellence and attracting to Australia foreign-trained or foreign resident researchers who can complement and further develop research capability within Australia, and
- Industry placements enable industry and other community partners to access more easily the skills of university-based researchers.

Australia is now a clear destination for foreign-trained researchers. The ARC's Centres of Excellence attract researchers from many parts of the world, including Australia's own region. In 2004, the relatively small Australian Wine Research Institute described its own 'united nations', as its research scientists were drawn from 13 nations (AWRI 2004). The recent Audit of Science, Engineering and Technology (SET) Skills highlighted the mobility of SET professionals, but concluded that migration to Australia had offset losses in most skill sets over the last five years (DEST 2006c, p 45).

The introduction of the ARC's *Federation Fellowships* scheme in 2001 provided a direct and very visible focus on researchers of excellence, and on their value to Australian science and innovation. The ARC regards this as a means of rewarding researchers of excellence, accessing their skills for the benefit of their host institutions and those who work with and within those institutions, and inspiring others not only to achieve, but also to pursue careers in research.

Of the 115 Federation Fellowships newly announced or in progress in 2006, 27 were awarded to expatriate Australians who returned to Australia to take up the Fellowship, and 11 were to foreign nationals (see Attachment 2, Table 15).

### **2.3.4 Infrastructure**

ARC-funded research infrastructure, equipment and facilities are now supporting research activity in a wide range of disciplines and universities. The need for a framework to provide support for investment in research infrastructure of national or international significance was identified in the *Knowledge and Innovation* white paper (Kemp 1999, 2.4). The ARC subsequently incorporated its research infrastructure funding arrangement as an identifiable component of the *Linkage* element of the NCGP (*Linkage Infrastructure, Equipment and Facilities*) (LIEF) to encourage individual universities to share infrastructure and facilities. LIEF supports the acquisition of major items of infrastructure and equipment, with a minimum ARC grant value of \$100 000.

Since its commencement in 2001, LIEF has provided funding for 373 separate infrastructure projects valued at \$148 million and engendered in the sector a culture of collaboration in the acquisition and use of high-cost infrastructure and facilities. Applicants for funding under this scheme must demonstrate (among other things) the need for the facilities sought in the location proposed – including lack of availability of, or access to, similar facilities at organisational or national level – and the strength and benefits of the collaborative arrangements proposed.

The collaborative nature of infrastructure acquisition and use under LIEF increases the access of researchers to required infrastructure and equipment by aggregating demand and sharing costs across a number of research groups or institutions. This increases the net benefits derived from the equipment, making effective an investment which would be uneconomic for any individual research group or institution to undertake.

Funding for the purchase of equipment, maintenance and operating costs, where this forms part of the project budget, is also available under other ARC schemes.

Other Australian Government initiatives, including the Systemic Infrastructure Initiative, the Major National Research Facility Program and the activities foreshadowed under the National Collaborative Research Infrastructure Strategy (NCRIS), provide strategic coordination for the funding of research infrastructure of greater scale.

### 2.3.5 Collaborative research arrangements

Ensuring that researchers are linked with each other and with potential users is a goal of every good science and innovation system. Good links foster alignment of research effort with research need, ensure that researchers can build on the knowledge of others without unnecessary duplication, provide effective knowledge transfer and promote the application of research findings in ways that will generate community benefit. The links between the various elements of the science and innovation 'infrastructure' enable it to operate as a system. Strengthening those links may be expected, in turn, to strengthen the system.

All ARC schemes foster collaborative arrangements. More than one-fifth of all proposals funded in 2006 indicated an intention to collaborate with researchers or research groups in different universities, and over half indicated an intention to collaborate with researchers in at least one other country. *Linkage* schemes, under which research collaboration and financial commitment occurs with specified collaborating partners, and *ARC Centres of Excellence* and *Research Networks*, are collaborative by definition.

Collaborative arrangements in ARC schemes are reported in detail in Attachment 2.

A wide range of businesses, government agencies and not-for-profit organisations collaborate in ARC-funded research. A listing of all partner organisations named in funded grants for *Linkage Projects* commencing in 2005 and 2006 is provided in Attachment 4. Private organisations are the largest contributors, providing approximately 57 per cent of the total funds contributed by partner organisations to grants awarded for commencement in 2006. Non-profit organisations contributed 13 per cent of the partner organization funding to committed projects, while State, local and Federal government organisations provided 30 per cent. Overseas-based businesses and government agencies also participate as collaborating partners in *Linkage* schemes. The collaborating partners are involved in research across all discipline areas, and frequently support research at the 'pure basic' end of the spectrum as well as more applied research. For example, the large *Linkage Projects* grant awarded in 2005 to the Australian Mineral Science Research Institute based at the University of South Australia to work with AMIRA International and Primary Industries and Resources SA includes elements of mathematics, materials science and environmental sciences and is intended to transform Australia's existing resource-based industries through the application of new technologies.

*ARC Centres of Excellence* build collaborative activity alongside scale and focus. Centres constitute the ARC's longer term investment strategy in research, enabling continued support for productive research. Nineteen ARC Centres of Excellence have been funded, with a further three co-funded with other Australian and State Government bodies and other agencies. The Centres act as a focus for research activity in their fields of expertise and have attracted researchers of international standing. They cross all disciplines and many operate in identified National Research Priority areas. All are expected to engage with potential research users and collaborators and to conduct research of international standard. A large number of Centre staff have undertaken at least part of their training overseas, highlighting the

attractiveness of the Centres as workplaces for otherwise mobile researchers and their ability to lever foreign expertise in a 'brain gain'.

A list of ARC Centres of Excellence, together with their directors and partner organisations, appears as Attachment 4.

While collaborative arrangements developed under *Discovery*, *Linkage*, *Centres of Excellence* and *Research Networks* are generally investigator-initiated, a number of ARC schemes involve collaborative agreements. Some projects funded by the ARC were involve collaboration with other Australian, State and Territory agencies. Examples include the co-funded Centres of Excellence (funded jointly with other Australian Government agencies and other bodies), two schemes co-funded by the ARC and the NHMRC (*Thinking Systems*, which is administered by the ARC, and *Ageing Well, Ageing Productively*, which is administered by the NHMRC) and five research networks co-funded by the same agencies. As noted earlier, the ARC is also a member of a number of consortia supporting collaborative ventures and facilities including the Anglo-Australian Observatory, the Gemini Observatory and the Global Biodiversity Information Facility, among others.

Some ARC-funded research is undertaken under formal agreements with other countries or with counterpart organisations in other countries. Examples include a range of agreements to fund reciprocal fellowships under *Linkage International*, and the initiative between the ARC and the US National Science Foundation to fund collaborative research under the Materials World Network. The ARC is currently reviewing the way in which it provides support for international linkages and is committed to improving the effectiveness of its international engagement. The possibility of establishing International Centres of Excellence is under active consideration.

### **2.3.6 Corporate activities**

In addition to the research it funds, the ARC contributes to the research sector through a variety of corporate activities.

The structure of the ARC, under which the Chief Executive Officer and the six executive directors are eminent researchers seconded from the research sector and supported by a College of Experts drawn from all disciplines, enables the organisation to play a unique role as a catalyst and broker to create opportunities. For example, the ARC has been involved in the establishment by the Department of Education, Science and Training of an e-Research Coordinating Committee. That Committee has been charged with the task of developing a policy and implementation strategy to encourage the takeup of e-Research in Australia.

ARC Executive Directors have also been able to use their close links with the research sector to broker mutually beneficial collaborations among researchers and agencies seeking specialized expertise. For example, following the tsunami disaster of 2004, the ARC was able to recommend experts able to assist Australian Government agencies responsible for coordinating Australia's response to the disaster.

The ARC contributes to excellence in research across the spectrum of research providers and disciplines by participating in the development of research policy, programs and procedures. In 2005, for example, the CEO of the ARC was a member of the Expert Group advising the Minister for Education, Science and Training on the development of the Research Quality Framework (RQF). The ARC continues to take an interest in this important initiative, as its experience in, and systems for, research assessment are clear points in common with the RQF. The ARC participates actively in the Coordination Committee on Science and Technology and contributes to the work of the Prime Minister's Science, Engineering and Innovation Council (PMSEIC). ARC Executive Directors are involved in groups developing the NCRIS, examining issues such as open access and intellectual property management, and developing strategies for the development of particular disciplines or fields of study (such as nanotechnology), among many others.

The ARC also participates in the development of research codes and ethics. ARC staff regularly participate in reference groups and steering committees established by other agencies and stakeholders to undertake particular research or research development tasks, and act as advisers and referees on particular issues where invited and where this would not result in any conflict of interest.

## **2.4 The impact of ARC-funded research**

Australia's investment in ARC-funded research is substantial. Demonstrating that the investment generates net benefits for the community is critical to ensuring community support for the continuation of that investment.

As observed in section 1.5.4 above, the measurement of research impact is beset by a range of conceptual and practical difficulties, which are heightened in the case of public investment which traditionally focuses on research with more diffuse and less-readily commercialised benefits and longer time horizons than are likely in private sector investments. The ARC has sought to establish the returns to the investment in ARC-funded research, and also regularly seeks and records data on innovation resulting from ARC-funded research. Grant recipients completing their final reports are also required to comment on the outcomes and impact of their research at that point.

### **2.4.1 *The return on investment in ARC-funded research***

In 2003 the ARC commissioned a study to examine the return on investment to the Commonwealth, and through it to the Australian community, of research funded by the ARC (The Allen Consulting Group 2003). The study found that the ARC's activities generate benefits in the following six areas:

- Building the basic knowledge stock,
- Generation of commercialisable intellectual property,
- Improving the skills base,

- Improving access to international research,
- Better informed policy making, and
- Health, environmental, social and cultural benefits.

Taking account of the direct expenditure by the ARC on research, as well as the indirect expenditure by universities, other host organisations and partners on research sponsored by the ARC, the study generated credible estimates of the impacts on the Australian economy of the ARC's investment in research and the estimated return on that investment.

The findings of the study, based on both a 'bottom up' and 'top down' analysis, were that returns on investment from ARC-funded research were high, not only in absolute terms, but also relative to the average returns associated with all publicly funded research.

The evaluation found that, while financing the disbursements of the ARC in 2003 required the equivalent of an \$18 contribution from each person in Australia, the returns generated from the ARC's activities were forecast to be the equivalent of consumption being \$14 per capita higher in 2003 than it would have been if this contribution to the ARC had not been made – that is, the \$18 investment has been recouped and an additional \$14 in real consumption per capita generated.

This 'bottom-up' analysis identified a measurable total social rate of return on ARC investment in Australia of 39 per cent. The social rate of return is defined as the permanent increase in GDP as a percentage of the dollar cost of the investment that led to this increase. This estimate of returns does not capture fully all of the possible sources of benefit from ARC-funded research. Health, environmental, social and cultural benefits for instance were not quantified in the study.

The measured rate of return is strong, not only in absolute terms but also when compared with the average social rate of return on all publicly funded R&D. The 'top down' analysis of sources of economic growth conducted in the study suggested that the social rate of return on ARC-funded research is 50 per cent, compared with an average rate of return of all publicly funded R&D of 25 per cent.

That the measurement of benefits conducted through the 'bottom up' analysis, which does not fully capture all possible sources of benefit, showed a rate of return of 39 per cent suggests that the 50 per cent figure from the 'top down' analysis is highly plausible and that ARC funding does generate significantly higher returns than the average for all publicly funded R&D.

More indirectly, the ARC notes that the level of 'repeat business' among *Linkage* partners signifies actual as well as expected returns from those partners' co-investment in ARC-funded research. The ARC is currently analyzing patterns of multiple grantholding among partner organisations.

### ***2.4.2 The impact of ARC-funded research on disciplines***

Also in 2003, the ARC commissioned a study to assess the performance of publications attributable to ARC-funded research in attracting citations in the wider international research literature, to compare that performance with the impact of publications arising from elsewhere in the Australian research system, and to benchmark it against world performance (Butler 2004).

The study found that, in comparison to both Australian and world benchmarks, the performance of publications arising from ARC-funded research was very strong, that is, it exceeded the world and Australian rate by approximately 25 per cent. The ARC grant schemes producing the highest impact publications were the then Special Research Centres, the Australian Research Fellowships and the Queen Elizabeth II Fellowships.

Other findings of the study were that:

- In nearly every field or sub-field in which ARC researchers are active (i.e. produce more than 100 publications), the impact of ARC supported publications is above both the world average and the Australian average. In most cases the margin is large.
- Journal publications resulting from research funded by the ARC appears predominantly in journals classified as more basic in nature. This concentration is higher than for any of its comparator sectors.
- International collaboration and intra-institutional collaboration is stronger in ARC publications than for Australia in general, though national collaboration levels are slightly weaker. Single author publications are less common for ARC output than for Australian articles in general.

The ARC maintains bibliometrics and other statistics accepted as indicators of excellence in the outcomes of its funded research. These include the number (and, where possible, the location) of publications resulting from the research and the frequency with which the research is cited. The final reports of ARC-funded research initially funded in 2002 indicated that this research produced, on average, 15 academic outputs per research project (based on all types of output recorded in final reports other than commercialisation outputs). A detailed disaggregation of the academic outputs arising from ARC-funded research is included in Attachment 2 (Table 27).

The dissemination of research results in academic journals and their citation by others are direct impacts on disciplines. Beyond this, however, it is clear that a strong research base in Australia provides access to the international community of researchers and so can assist in sustaining and further developing discipline expertise.

### ***2.4.3 Innovation resulting from ARC-funded research***

High quality research has a high probability of resulting in innovation. A study conducted in 2000 by Chi Research found that the papers cited in US patents tend to be drawn from the most highly cited research. Specifically, a US paper in the most highly cited 1 per cent of scientific papers is nine times more likely to be cited in a patent than is a randomly chosen US paper (Chi Research 2000).

It follows that, other things being equal, if ARC-funded research is of generally higher quality than other Australian research, then it is more likely to be cited in patent applications and hence more likely to fuel innovation.

The number of invention disclosures, licences and patents arising from ARC-funded research is one measure of the level of activity of a research unit. Obviously, the measure has limitations in that some commercialisation activity is likely to occur well after the lodgement of the final report, commercialisation of intellectual property is not a necessary or desirable outcome in some forms of research, and even when inventions are patented they do not necessarily lead to new products or processes.

Final reports submitted within the last 12 months by recipients of ARC grants initially funded in 2002 indicated that those grants generated 28 invention disclosures, 9 licence agreements, 39 patents filed and 12 patents pending. (These data, together with results for earlier years, are shown in Attachment 2, Table 28). These results were obtained within the first six months of finalisation of the project, and can be viewed as early commercialisation outputs. The final results are therefore likely to be higher.

Five recipients indicated that start-up companies had been dependent for their formation or continued business activities on licensing or assignment of technology developed as part of the research undertaken through the grant.

As noted in the Allen report conducted for the ARC, analysis suggests that ARC-funded research is likely to be relatively successful in finding a 'route to use', but it is often difficult to identify these instances. Analysis of case studies remains one means of quantifying the benefits arising from the application of research findings from individual ARC-funded projects and of identifying the success factors or obstacles in such pathways. For example, while data are difficult to obtain, it seems likely that many people overseeing innovative activity in Australian companies were trained in ARC-funded environments.

### ***2.4.4 Other impacts of ARC-funded research***

Final reports submitted to the ARC by grant recipients provide insights into the outcomes and impacts of research activity funded by the ARC. The reports are submitted within six months of completion of the work and provide qualitative and quantitative information on the inputs to, and outcomes from, the research. Each report is read by, at minimum, the Executive Director managing the scheme under which the funding was provided and her/his Assistant Director.

Quantitative data from the reports are captured in the ARC's statistical databases and reported in the *Annual Report*. Some of this information (bibliometrics, commercialisation outcomes) has been referred to above. However, the qualitative information is more difficult to capture in aggregated form.

The ARC has recently initiated a project to enable it to develop a typology of research impacts and summarise against that typology the qualitative information provided in final reports lodged in earlier years. This will allow analysis, at an aggregated level, of the key reported outcomes and impacts of research projects by discipline, scheme and project type.

The ARC also expects to conduct a survey within the next few months to follow up a representative sample of grant recipients five years after lodgement of the final report. This will enable research outcomes and impacts of the research that were not apparent at the six-month milestone to be reported and analysed.

The ARC will make available to the Productivity Commission the results of this work.

#### ***2.4.5 The impact of other ARC activities***

The ARC also contributes to excellence in research across the spectrum of research providers and disciplines by participating in the development of research policy, programs and procedures. In 2005, for example, the CEO of the ARC was a member of the Expert Group advising the then Minister for Education, Science and Training on the development of the Research Quality Framework (RQF). The ARC continues to take an interest in this important initiative, as its experience in and systems for research assessment are clear points in common with the RQF. ARC Executive Directors were also involved in groups developing, respectively, the National Collaborative Research Infrastructure Strategy and policies on e-research and open access, as well as many other activities across government. Their research broking and facilitating functions add to the efficiency and effectiveness with which research policy and programs are developed.

The ARC's involvement in the development and maintenance of research codes and ethics is also significant. Such codes are pre-requisites to ensuring high standards of research practice and reporting, and may well provide a critical competitive advantage in the globalising research environment (see Section 3.3 below).

#### ***2.4.6 Beneficiaries of ARC-funded research***

Because the ARC funds such a wide range of research activity, its beneficiaries are diverse. The ARC has limited information on the direct beneficiaries of the research it funds. However, it is clear that the categories of beneficiaries include those directly engaged in the research and their institutions, industry and business users and collaborators, government and community collaborators and the community at large.

The ARC directs its funding to the administering organisations hosting the research activities approved for funding by the Minister. As noted earlier (Section 2.3.1), those organisations benefit from this direct supplementation to their own funding and also

from additional funding linked to the receipt of ARC funding, including block funding and funding from collaborating organisations.

*Linkage* collaborators are other direct beneficiaries of research funded under the various *Linkage* schemes. Their commitment of funding and other resources to the research indicates an expectation of gain from that investment. Indeed, the vast majority of the 341 partner organisations who had completed final report forms by early 2005 indicated that the collaborative research had been either ‘very beneficial’ (64 per cent) or ‘beneficial’ (34 per cent) to their organisation. Co-funding reduces the risk, and hence increases the incentive for investment in research activity with largely unknown returns.

Commercialisation outcomes are just one indicator of the economic benefit captured by collaborators. The opportunity to employ postdoctoral researchers under jointly funded arrangements is another. Where government agencies are the collaborating partners, the outcomes may include better-informed government policies and programs. Where community organisations are involved, a range of community functions and initiatives may be informed and improved. While the ARC does not require collaborating organisations to report on the outcomes of jointly funded research after a final report has been submitted, it is aware of many cases where research findings have resulted in considerable commercial benefit to industry and business. Case studies have been published in the ARC’s *Annual Reports*, its *Discovery* newsletter and its submission to the House of Representatives Standing Committee on Science and Innovation Inquiry into Pathways to Technological Innovation (ARC 2005a), and can be provided to the Productivity Commission.

Industry, business, government and community organisations also benefit from access to highly qualified personnel, whose skills may have been developed under ARC-funded fellowships or while participating in ARC-funded research projects. Commercial organisations, in particular, increasingly lack the time or the funding to invest in the training of highly qualified staff who may, on completion of that training, be attractive to competitors and anxious to develop their skills further in other organisations or countries. Access to fully trained staff with a range of experience, even for limited periods or on an ‘as needed’ basis, is particularly valuable to such firms and also creates an environment to which researchers trained overseas wish to migrate.

The outcomes of ARC research are typically published, although the need for protection of intellectual property is taken into account in determining the most appropriate means of disseminating research results. Published work is available to any firm, organisation or individual able to access the publication in question. The ARC is not able to quantify the extent to which research findings placed in the public domain in this way have been taken up by commercial or government users. However, it seems likely to be significant.

Non-commercial benefits from research are, by definition, more difficult to measure. A large proportion of ARC-funded research is expected to benefit Australians in non-commercial ways. Examples include research directed at social, environmental and cultural issues. Such research may, nevertheless, have substantial indirect economic benefits, as well as non-economic benefits.

There is little doubt that some beneficiaries of ARC-funded research include overseas-based businesses, governments, organisations and individuals. The ARC regards this as an inevitable, and not necessarily undesirable, indicator of the global research system. Australians benefit, in turn, from access to research findings generated by investments in other countries. Given the small size of Australia's research sector relative to that of the rest of the world, Australia must be, in total, a net beneficiary from such interactions.

#### *2.4.7 Community recognition of the benefits of ARC-funded research*

The ARC recently commissioned an external consultant to conduct a community awareness survey. The survey comprised two phases: a qualitative phase involving focus group discussions, and a quantitative phase involving 600 telephone interviews nationwide.

While the majority of the respondents had limited awareness of the ARC, once the role of the agency was explained to them the overwhelming majority saw it as important. Half reported viewing its role as very important, and a further 42 per cent as quite important. Almost all the respondents (98 per cent) had heard of at least one of the ARC-funded research projects cited in the survey.

The ARC expects to publish results from this survey once a counterpart stakeholder survey is completed later this year.

#### *2.4.8 Constraints on the achievement of research impact*

For public support for research to achieve its own objectives and for that research to contribute effectively to the innovation system, a number of conditions must be met. These include:

- considerable alignment between the broad needs of users and the ability of the research system to provide it, and
- mechanisms (formal and informal) by which users and researchers can interact.

Compared with other OECD economies, Australian business, industry and other private sector users do not, as a group, invest strongly in research (ABS 2006). Many reasons have been advanced for this, including Australia's industry structure and the relatively small size of many Australian firms (see, for example, Davis and Tunny 2005). However, it may also reflect, in part, the lack of a strong culture of research (as opposed to invention and innovation) in some sectors of private industry, and the difficulties sometimes encountered by individual firms in identifying and approaching researchers in particular fields in academic institutions. If this were indeed the case, the consequence would be an underestimation by some firms of the potential contribution of research to firm- and industry-level innovation and competitiveness. The shift of public support towards more user-focused research vehicles and the increasing attention being paid to knowledge transfer may assist in raising research

awareness, reducing perceptions of risk, facilitating industry-academic links and thereby increasing the value placed on research by private business.

The different incentives and motivations of academic groups and commercial enterprises, while generating obvious complementarities, can also frustrate potential users. Negotiations between business and academic partners can be time-consuming, and delays in commencing or commercializing research can reduce its ultimate value. The chief executive of the Energy Corporation of America, John Mork, was recently reported as telling the annual meeting of the Association of Pacific Rim Universities in Sydney that, in an ever more difficult business environment, corporations would increasingly rely on the intellectual input of research universities, but that the gulf between ‘uni speak and corporate speak’, the length of time typically required to negotiate a major research contract with a university and the pricing policies of universities for research services were challenges that needed to be surmounted (Slattery 2006).

On the supply side, constraints are also apparent. Participants in the ARC’s *Linkage Projects* schemes increasingly report an inability to find suitable postgraduate researchers to fill Australian Postgraduate Awards Industry (APAI) places, even after funding commitments have been made by both the collaborating organisations and the ARC. The problem appears to be worsening with each *Linkage Projects* round. Requests from grantholders for modification of grant conditions due to the inability to locate a suitable researcher have increased from 4.7 per cent of funded projects in the two rounds held in 2002 to 13.1 per cent and 14.0 per cent of funded projects in the most recent rounds. In addition, some investigators are forced to suspend or even abandon projects when their APAIs accept positions elsewhere before the project is completed. Anecdotal evidence suggests that the problem is intensifying as the demand for skilled professionals with Bachelor or Masters degrees increases.

In addition, the research workforce is ageing and mobile, and takes time to train to high levels of expertise. The demand for researchers is typically highly skill-specific. The cost of research – people and facilities – is also increasing, raising the ‘threshold’ level of expected benefit necessary to justify expenditure by individual firms or groups of firms.

#### **2.4.9 How good is the return on our research investment?**

Despite these issues, investment in research seems to generate good returns to Australians. The measured returns to public investment in research, where such estimates have been able to be made, appear relatively high in absolute terms. This is particularly the case given the conservative methods generally used in the task. They also appear to exceed the return on some alternative uses of government funding.

Of course, the existence of good returns does not necessarily imply they are optimal. Nor does it imply that additional investment would yield a similar rate of return, or that a different level or mix of investment would not improve the overall rate of return.

However, even if the current investment were optimal, the fact that Australia is likely to be facing a different environment in future means that changes will constantly be

needed. It is the ability of the science and innovation system to recognize and accommodate those changes that will determine its ability to sustain and improve Australian wellbeing.

## **PART 3 – THE EMERGING RESEARCH ENVIRONMENT**

The effectiveness of public support for science and innovation should be assessed not only by its demonstrated achievements to date, but by its capacity to meet public policy objectives into the future. That future will offer different challenges and possibilities than the past, some of which cannot even be foreshadowed at present.

Shifts in the direction of the global economy, in the response of Australia and other countries to those shifts and in the research landscape itself are already apparent.

### ***3.1 Changes in the global economy***

In its June 2006 report, the Working Group on Asia established by the Prime Minister's Science, Engineering and Innovation Council (PMSEIC) examined the implications for Australia of the continuing economic growth of China and India (Working Group on Asia 2006). It noted that India and China are using science, technology, innovation and education to drive the growth of their economies, and highlighted the rapidly increasing pool of skilled people and well-equipped facilities in those countries, the competitiveness of their industry and research sectors and Australia's own worsening trade position.

Other countries have made similar assessments. In the US, the Committee on Prospering in the Global Economy of the 21<sup>st</sup> Century, created by the National Academies and chaired by former Lockheed Chairman and CEO Norman R. Augustine, noted that multinational companies use criteria including the availability and quality of research and innovation talent, the quality of research universities and the fraction of national research and development supported by government in determining where to locate their facilities and the jobs that result. It recommended a range of measures to enhance the science and technology enterprise so that the United States could successfully compete, prosper and be secure in the global community of the 21<sup>st</sup> century (National Academies 2006).

### ***3.2 Changes in the Australian economy***

The PMSEIC report, along with other commentary, has drawn attention to the vulnerability of Australia's economy to changes in demand for its relatively limited range of exports. Others have highlighted the risks of relying on traditional industries for growth and prosperity, and the constraints imposed by limited population growth.

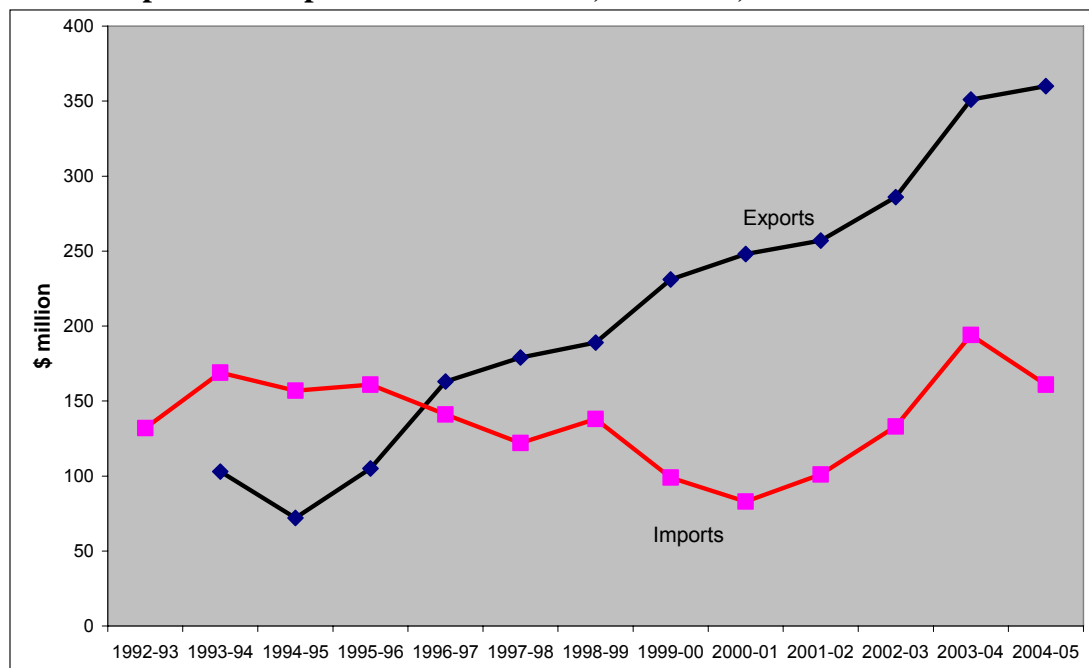
### ***3.3 Changes in the research environment***

Just as multinational companies can relocate their facilities, they can relocate their supply networks. A country's competitive advantage in the production of goods and services will be threatened by the emergence of lower cost and/or higher quality producers in other countries. Its competitive advantage as a supplier of research and development services, even to its own domestic customers, can be threatened in the same way. Research – and researchers - have become internationally tradeable items.

Australia is a net exporter of research services. Since 1993-94, when statistics on the export and import of research and development services were first reported by the

Australian Bureau of Statistics, Australia's exports of research services have increased from \$103 million per annum to \$360 million, while imports have followed a much steadier trend (see Figure 13).

**Figure 13**  
**Export and import of R&D services, Australia, 1992-93 to 2004-05**



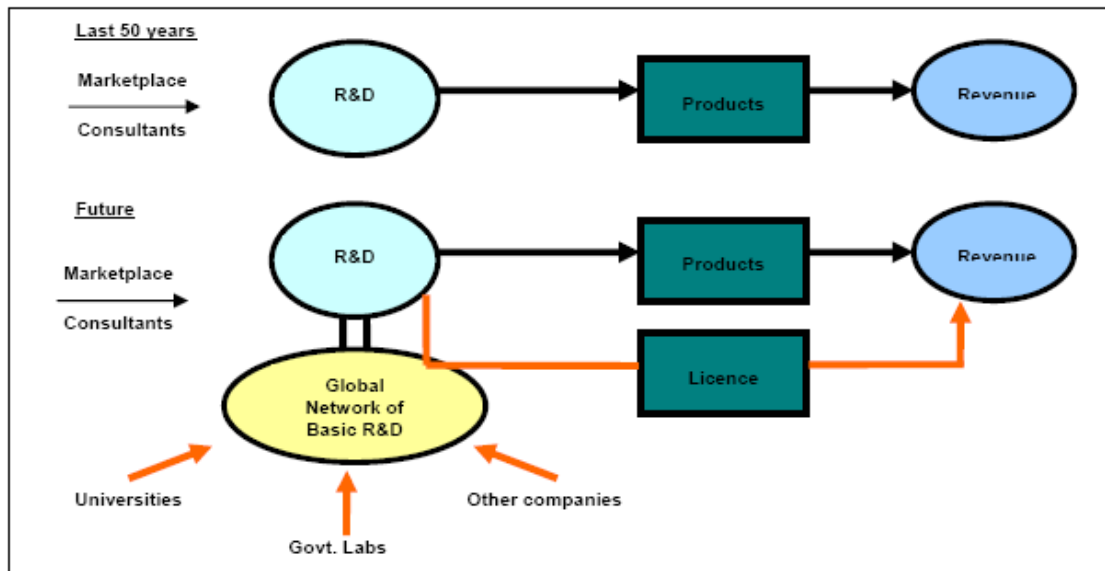
Source: ABS 2006, Tables 11a and 11b.

The reasons for this are likely to include the development of areas of particular research strength, increased research and other collaboration with other countries (including among universities) and the location in Australia of branches of a number of major multinational companies with high R&D spends. A number of technology-based companies have developed research and development arms which not only service their parent company but also market their services to others, generating additional revenue and allowing for the accumulation of a greater depth of expertise than would be warranted by in-house services alone. Vision Systems' Invetech, for example, is a high technology company which has operated for over 20 years, offering product development services to clients seeking to commercialise new products. More than 80 per cent of its business comes from international companies based in the USA, Europe and Asia. Bishop Innovation, a division of the Bishop Technology Group, develops and commercialises products and processes in new and/or emerging technologies. Both are recognized worldwide for their research and development expertise.

At the same time, new business models have emerged which are replacing traditional research sources – in-house and contracted consulting services – with more collaborative research arrangements. Such models were clearly in play when, in June 2006, business leaders at a meeting of the Association of Pacific Rim Universities forecast a 'golden era' for research partnerships between business and academic leaders as large corporations reduced in-house R&D budgets and relied increasingly on the intellectual input of research universities (Slattery 2006). An example of such

a model, produced by DuPont, was included in the ARC's submission to the House of Representatives Standing Committee on Science and Innovation Inquiry into Pathways to Technological Innovation (ARC 2005a), and is reproduced below (see Figure 14).

**Figure 14**  
**Changing paradigms for large company R&D**



Even within Australia, it is clear that the research investment is becoming more contestable. The balance of R&D expenditure by the Australian government has shifted away from intramural research (research conducted in its own agencies) towards higher education, private consultancies and support for business R&D (see Figure 10 above). A number of agencies – and the CSIRO in particular – are now expected to produce research services not only for their government stakeholder, but also for private clients. At the same time, agencies requiring research services have greater opportunity to outsource some or all of their needs, even when an in-house research facility exists. Australian companies, too, are reducing their reliance on internal research services by contracting research to specialist agencies or encouraging them to market their services to others. Universities now earn considerable income from the provision of research services to external clients, and are expected to continue doing so.

Australia's competitive advantage in producing exportable research services is likely to derive primarily from the knowledge, skills and links that have been developed in areas of research strength and the standards and ethics that researchers are required to respect. Biotechnology companies based in Australia, for example, are reported to have raised more than \$200 million in international capital markets during the past two years, with one foreign-based industry investor reported as saying that a number of Australia biotechnology companies are close to a major commercial breakthrough that would make Australia competitive globally (Byrne 2006).

However, the advantage also appears to be reinforced by lower research costs compared with some other countries – an advantage which is more vulnerable to erosion by the emergence of highly skilled but lower cost research systems elsewhere.

For the moment, however, it seems that a talent war for skilled researchers is escalating.

These changes, if well-handled, are likely to increase the depth of research skills in Australia and the efficiency with which they can be sourced and applied. Grouping researchers according to the skills they can supply, rather than within organisations that use those skills, makes the skills accessible to more users and hence adds to their value. It may be more efficient for a major company or government agency, for example, to contract highly specialized and hence infrequently required skills when they are required rather than to attempt to maintain in-house capability on a permanent basis.

In an environment of increasing research costs, research demand that is often highly skill-specific and an ageing and mobile research workforce, these trends may be expected to continue. And while Australia has areas of real strength in research and development – particularly in fields that support export-focused activity – it may be vulnerable to competition for the supply of research services in areas where expertise is more limited or developing more slowly than in other countries.

Research links between Australia and other countries are also growing. As noted earlier, in ARC-funded research, over half of all proposals now envisage collaboration with researchers in at least one other country. However, traditional patterns of collaboration appear to be slow to change, and collaboration with researchers, research organisations and collaborating organisations in China and India remain limited. The focus among some Australian businesses and universities on increasing their presence in Asia and in retaining contact with their Asian-resident graduates may raise the incidence of research and other collaboration in the future. Such links are, as the PMSEIC Working Group and others have observed, vital to ensuring that Australia does not lose the opportunity to participate in those countries' growth to the benefit of other OECD countries which are investing considerable effort in developing science and technology-based links. International Centres of Excellence may be a means of harnessing those opportunities while also developing knowledge in areas of mutual interest.

The expectations of Australia's research system are also changing. For a number of years, Australian governments have focused on the innovation system as a means of enhancing Australia's competitiveness and its ability to develop new sources of wealth. *Backing Australia's Ability* was introduced with the explicit objective of improving Australia's future prosperity by developing skills, generating new ideas through research and turning them into commercial success. The articulation of national research priorities further emphasized the link between research and national wellbeing and prosperity. Structures and programs facilitating cross-disciplinary approaches to research, including research that crosses the two broad fields of humanities and social sciences (HASS) and science, technology, engineering and medicine (STEM), are proliferating through broadly based research centres and programs and the incidence of cross-disciplinary research is increasing.

The potential of research and its application to differentiate the performance of firms, industries and countries as a whole is clear. Indeed, the returns to the national investment in research may increase, rather than decrease, as other means of

differentiating performance and raising productivity become more difficult and costly to apply.

## PART 4 – INCREASING THE RETURNS TO RESEARCH

The PMSEIC Working Group on Asia referred to above made a number of recommendations to improve the ability of Australian industry to capture the opportunities – and reduce the risk – accompanying the growth of the Chinese and Indian economies. Those recommendations highlighted the role of research in building a solid foundation in education, science and technology and improving the environment for innovation. They included:

- Government support for public-private R&D partnerships to facilitate Australian private sector investment in R&D,
- The development of a whole of government strategy to enhance linkages with China and India through engagement and investment in collaborative knowledge infrastructure, and
- Strengthening the foundations for science and technology through investment in higher education, improved science and maths teaching and curricula in schools, the attraction of higher quality students into science and engineering, and the attraction of higher quality doctoral students from China and India (Working Group on Asia 2006).

In the United States, the Augustine Committee, following its own analysis of changes in the global order, recommended, among other things,

- Sustaining the strengthening of the nation’s traditional commitment to long-term basic research that has the potential to be transformational to maintain the flow of new ideas that fuel the economy, provide security, and enhance the quality of life, and
- Making the United States the most attractive setting in which to study and perform research so that it can develop, recruit and retain the best and brightest students, scientists and engineers from within the United States and throughout the world.

New funding, new places in higher education courses, new means of ensuring that high-risk, high-payoff research is catalysed, new incentives to industry to provide continuing training to practicing scientists and engineers, affordable broadband access and revised regulatory arrangements (including in relation to tax policy, patents, immigration and visa arrangements) were proposed as means to achieve these objectives (National Academies Committee 2006).

Reviews such as these – and those that have underpinned earlier whole-of-government initiatives, including *Backing Australia’s Ability* – can only benefit the science and innovation system. An integrated approach to research and innovation, involving consideration of all the policy and regulatory instruments that affect investment decisions in those areas, is the best way to ensure that the science and innovation system can be structured and restructured to deliver the results Australians seek from it.

The ARC submits that public support for science and innovation, and particularly publicly funded research, should reflect the following principles:

***Invest in people***

As emphasised earlier, the ARC believes that investing in the development, attraction and retention of excellent researchers is an essential prerequisite and a necessary condition for achieving excellence in all components of the innovation system, but particularly research. Such investment begins at the school level, and requires excellent teaching, excellent research supervision, structures that support early career researchers and deliver attractive career paths, opportunities to pursue investigator-initiated, peer-reviewed research, opportunities to work with others of excellence, including overseas and in commercial environments, the ability to attract foreign researchers to work in Australia ('brain gain'), and awards (including fellowships) that encourage and reward achievement. Excellence is required in all skill areas necessary to the science and innovation system.

***Invest in excellent research***

Excellence in research is a precondition for beneficial impact, the achievement of which is the ultimate justification for public support. Excellence is best judged by a researcher's peers, and is generally predicted by the track record of the researcher, the innovation of the research content and the institutional and infrastructure support available. The codes, standards and ethics under which research is conducted must be maintained and enforced. Where new funding is made available for research and innovation, consideration should be given to its allocation on a competitive basis in order to assure that excellence is paramount. Active encouragement should also be offered to emerging areas or institutions of excellence.

***Identify and actively support areas of research priority***

Where particular research needs have been identified, they should be actively supported in addition to, rather than instead of, other research directions and should not compromise the objective of achieving excellence. Where areas of current weakness are identified as priorities or where there is a need to develop research capability in a particular region, special support arrangements should be developed to ensure that excellence can be developed. Appropriately framed policy networks will be needed to direct such funding to identified community needs.

***Continue to invest in basic research and high-risk research***

Public support is traditionally extended to basic research (pure and strategic), early stage development and high-risk research with potentially large benefits. The rationale for engaging in these areas relates not only to their typically longer pay off period and their capacity to add substantially to the knowledge base, but also to the richness of the training opportunities they offer to emerging and established researchers. Investment in basic research should, as elsewhere in the research system, be guided by excellence.

***Maintain a diverse discipline base***

While funding should, as a matter of principle, be directed to areas of research strength and national priority, Australia should also seek to maintain a diverse discipline base. This will maintain broad capability across the research system and

increase Australia's capacity to seize business, trade and other opportunities, or respond to emerging threats, that might be difficult to foresee.

***Develop and strengthen links to users, even in basic research***

While excellence in research is a necessary condition for achieving community benefit, research that is aligned with the needs of business, industry, government or the community *will* generate observable benefit. The experience of the ARC's *Linkage* program shows that many users recognize the importance and benefit of basic research (particularly strategic basic research) *and are prepared to contribute to it*. Collaborative research models that encourage knowledge transfer and takeup should continue to be supported.

***Engage with global research networks***

Australian researchers and the research system as a whole will benefit from the active maintenance and further development of links with researchers in other countries, including countries such as China and India where research capability and competitiveness are developing rapidly. Where collaborative arrangements generate net benefits, they should be encouraged in the development, operation and use of infrastructure as well as in research activities and structures. They need not necessarily imply formal collaborative agreements.

***Encourage efficiency in the organisation of research and research resources***

As in any activity, the returns from investment in research will be greater if that investment is well chosen and efficiently managed. Australia's research system should be structured to ensure that priorities are met, unnecessary duplication in research, research facilities and research programs is avoided and research findings are accessible to other researchers and to potential users in appropriately packaged and – where relevant – appropriately protected form. Where whole-of-government coordination would assist in delivering greater efficiency in the research system, or in removing barriers to the effective operation of all the elements of the innovation process, it should be encouraged.

## CONCLUSION

There is universal agreement that economies must innovate to retain and enhance their competitiveness. Public policy supports investment in all components of the innovation system in all advanced countries.

Excellence in research and in the training and development of researchers is key to building a sustainable innovation system. The competitive grants programs that fund research, researchers, infrastructure and collaborative arrangements in universities and related institutions are a relatively small component of Australia's total investment in science and innovation. Nevertheless, they occupy a uniquely important place within it, supporting the discovery side of innovation and the training of our ongoing base of researchers, but also providing for the development of strong, coordinated links between industry, government and research institutions. Such links drive innovation.

The Minister for Education, Science and Training, the Hon Julie Bishop MP, noted earlier this year that other countries are placing ever higher emphasis on innovation as a public policy objective and setting ever more ambitious targets for R&D spending as a proportion of GDP (Bishop 2006). While Australia must articulate its own objectives in the light of its own priorities, it cannot ignore either the opportunities or the threats in the emerging global environment. Ensuring continuing growth and competitiveness will require a continuing commitment to developing and sustaining excellence in all areas of the innovation system.

The ARC looks forward to contributing to that task.

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**ATTACHMENT 1****THE AUSTRALIAN RESEARCH COUNCIL****1.1 Legislative Framework and Governance**

The Australian Research Council (ARC) is established as a statutory agency under the *Australian Research Council Act 2001* (the Act). It consists of a Chief Executive Officer (CEO) appointed by the Minister under the Act, designated committees appointed by the Minister to assist the CEO, and staff engaged under the *Public Service Act 1999*. The ARC is a prescribed agency under the *Financial Management and Accountability Act 1997*. It is currently part of the Education, Science and Training portfolio.

Under the Act, the functions of the ARC are:

- To make recommendations to the Minister in relation to approval of proposals from organisations for funding of research programs;
- To administer financial assistance approved by the Minister for research programs; and
- To provide advice to the Minister on research matters.

Decisions by the CEO to make funding recommendations to the Minister are reviewable under the *Administrative Decisions (Judicial Review) Act 1977*.

On 1 July 2006, amendments to the Act came into force which reflected the Government's adoption of the principles of the Uhrig Report. The principal change was the abolition of the ARC Board, with the CEO now reporting directly to the Minister. The Minister has indicated her intention to appoint an Advisory Committee to provide advice to the CEO on the broad strategic direction of the ARC.

The Act requires the CEO to prepare a strategic plan at least once a year, with the plan to cover at least 3 years. Requirements of the plan include exposition of the goals, priorities, policies and strategies to be adopted in performing the CEO's functions, and performance indicators for assessment of the CEO's performance of those functions. The plan must be approved by the Minister and tabled in Parliament.

Funding caps for the ARC for the years 2001 to 2008-09 are specified in the Act. The cap for 2006-07 is \$560 569 000. Before the start of each year, the Minister must divide each year's funding cap between categories of research specified in the instrument which divides that year's funding.

The Act stipulates that the CEO must prepare, for the Minister's approval, funding rules for each year's funding proposals. The rules should cover matters such as eligibility criteria, method of application for funds, assessment processes, variation of funding approvals and accountability requirements.

## 1.2 Policy and Operational Framework

The ARC is based in Canberra, and at 30 June 2006 employed a CEO and 67 staff (ARC forthcoming). In 2004-05 the organisation allocated grants worth \$481m and incurred operational costs of \$12.78m (ARC 2006).

The policy framework for the ARC is shaped by a range of considerations, including:

- The Government's *Backing Australia's Ability* initiatives,
- The National Research Priorities identified by the Government in 2003,
- Overall Government policy priorities and specific Ministerial directives, and
- National and international developments in research and innovation.

The primary vehicle for the ARC's provision of research grants is the National Competitive Grants Program (NCGP), under which funding is made available for research conducted in universities and other eligible organisations in all disciplines other than clinical medicine and dentistry (these are managed by the National Health and Medical Research Council).

The NCGP supports two main streams of research funding – *Discovery*, under which funding is made available for investigator-initiated research and research fellowships, and *Linkage*, under which research projects, infrastructure, fellowships, centres and networks are funded jointly with partner organisations in the private sector, government or the community. The schemes in both streams are described in detail on the ARC website ([http://www.arc.gov.au/grant\\_programs/default.htm](http://www.arc.gov.au/grant_programs/default.htm)). They generally provide for proposals to be submitted to the ARC and assessed and ranked in a comprehensive peer review process. The Minister for Education, Science and Training receives the ARC's recommendations for funding under each scheme and must approve all funding commitments.

The programs covered by the NCGP are summarised below.

### NATIONAL COMPETITIVE GRANTS PROGRAM 2006-07

DISCOVERY INDIGENOUS RESEARCHERS DEVELOPMENT	
Frequency	One selection round each year.
Purpose	To: <ul style="list-style-type: none"> <li>■ develop the research expertise of Indigenous Australian researchers to a level competitive with mainstream research funding</li> <li>■ support fundamental research and research training by Indigenous Australian individuals and teams</li> <li>■ provide Indigenous Australian researchers with experience in the preparation of research funding applications</li> <li>■ expand Australia's knowledge base and research capability.</li> </ul>

<b>DISCOVERY PROJECTS</b>	
Frequency	One selection round each year.
Purpose	To: <ul style="list-style-type: none"> <li>■ support excellent fundamental research by individuals and teams</li> <li>■ enhance the scale and focus of research in the national research priorities</li> <li>■ assist researchers to undertake their research in conditions most conducive to achieving best results</li> <li>■ expand Australia's knowledge base and research capability</li> <li>■ foster the international competitiveness of Australian research</li> <li>■ encourage research training in high-quality research environments.</li> </ul>
<b>FEDERATION FELLOWSHIPS</b>	
Frequency	One selection round each year.
Purpose	To: <ul style="list-style-type: none"> <li>■ attract and retain outstanding researchers of international renown</li> <li>■ build and strengthen world-class research capability in Australia</li> <li>■ expand Australia's knowledge base by supporting ground-breaking, internationally competitive research</li> <li>■ forge strong links among researchers, industry and the international research community</li> <li>■ support research that will result in economic, environmental, social or cultural benefits for Australia.</li> </ul>
<b>LINKAGE INFRASTRUCTURE EQUIPMENT AND FACILITIES</b>	
Frequency	One selection round each year.
Purpose	To: <ul style="list-style-type: none"> <li>■ encourage organisations to develop collaborative arrangements among themselves, across the higher education sector and with organisations outside the sector, in order to develop research infrastructure</li> <li>■ support large-scale cooperative initiatives involving two or more organisations, thereby allowing expensive facilities to be shared</li> <li>■ enhance support for areas of research strength</li> <li>■ ensure that researchers in fields of recognised research potential have access to the support necessary for development.</li> </ul>
<b>LINKAGE INTERNATIONAL</b>	
Frequency	<ul style="list-style-type: none"> <li>■ Awards – three selection rounds conducted each year.</li> <li>■ Fellowships – one selection round each year.</li> <li>■ Internationally Coordinated Initiatives – there are currently two formal collaborative initiatives conducted between the ARC and overseas agencies each year.</li> </ul>
Purpose	To: <ul style="list-style-type: none"> <li>■ build collaborations among researchers, research teams and/or centres of excellence in Australia and overseas</li> <li>■ generate opportunities for researchers to participate in leading edge international research networks and strengthen their international research experience</li> <li>■ build Australian research capability by enhancing existing, and developing new, collaborations among researchers</li> <li>■ develop innovative modes of international collaboration</li> <li>■ foster participation in global innovation networks.</li> </ul>

<b>LINKAGE LEARNED ACADEMIES SPECIAL PROJECTS</b>	
Frequency	One selection round each year.
Purpose	To support projects undertaken by the Learned Academies which: <ul style="list-style-type: none"> <li>■ capitalise on their unique capabilities and assist programs of research undertaken institutions</li> <li>■ may be expected to have results of broad benefit for research and scholarship in the natural and applied sciences, technological development and applied technology, the social sciences and the humanities.</li> </ul>
<b>LINKAGE PROJECTS</b>	
Frequency	Two selection rounds each year.
Purpose	To: <ul style="list-style-type: none"> <li>■ encourage and develop long-term strategic research alliances between higher education organisations and other organisations, including within industry</li> <li>■ support collaborative research on issues of benefit to regional and rural communities</li> <li>■ enhance the scale and focus of research in national research priorities</li> <li>■ foster opportunities for postdoctoral researchers to pursue internationally competitive research in collaboration with organisations outside the higher education sector</li> <li>■ provide outcome-oriented research training to prepare high-calibre postgraduate research students</li> <li>■ produce a national pool of world-class researchers to meet the needs of the broader Australian innovation system.</li> </ul>
<b>RESEARCH CENTRES: ARC CENTRES OF EXCELLENCE</b>	
Frequency	Competitive application process conducted periodically.
Purpose	To: <ul style="list-style-type: none"> <li>■ undertake highly innovative research at the forefront of developments within areas of national importance, with a scale and a focus leading to outstanding international and national recognition</li> <li>■ enhance the scale and focus of research in designated national research priorities</li> <li>■ promote research that will enhance Australia's future economic, social and cultural wellbeing</li> <li>■ link existing Australian research strengths and build new capacity for interdisciplinary, collaborative approaches to address the most challenging and significant research problems</li> <li>■ build Australia's human capacity in a range of research areas by attracting, from within Australia and abroad, researchers of high international standing as well as the most promising research students.</li> <li>■ provide high-quality postgraduate and postdoctoral training environments for the next generation of researchers in innovative and internationally competitive research</li> <li>■ offer Australian researchers access to world-class infrastructure and equipment, and to key research technologies</li> <li>■ develop relationships and build new networks with major international Centres and research programs that help achieve global competitiveness and recognition for Australian research</li> <li>■ establish Centres of such high repute in the wider community that they will serve as points of interaction among higher education institutions, governments, industry and the private sector generally.</li> </ul>

<b>RESEARCH CENTRES: CO-FUNDED CENTRES OF EXCELLENCE</b>	
Frequency	Special selection rounds conducted.
Purpose	To ensure Australia participates in key emerging technologies.
<b>ARC RESEARCH NETWORKS</b>	
Frequency	Selection round conducted in 2003 (for funding commencing in 2004).
Purpose	To build on investments in excellent research undertaken by individual investigators and small teams to: <ul style="list-style-type: none"> <li>■ enhance the scale and focus of their research</li> <li>■ encourage more inter-disciplinary approaches to research</li> <li>■ facilitate collaborative and innovative approaches to planning and undertaking research.</li> </ul>
Frequency	Various
<b>SPECIAL RESEARCH INITIATIVES</b>	
Frequency	Various
Purpose	To support activities that: <ul style="list-style-type: none"> <li>■ encourage greater collaboration among Australian researchers</li> <li>■ encourage the development of international research linkages</li> <li>■ encourage the co-operative development of high-quality research capacity in emerging areas, and/or</li> <li>■ enhance the scale and focus of research in priority areas.</li> </ul>

### 1.3 Strategic Direction

The *ARC Strategic Plan 2006-2008* was released in June 2006 (ARC 2006). It identifies the actions the ARC will undertake over the coming three years in pursuit of the seven key objectives set out in the plan, which are:

*Discovery:*

Develop and maintain a broad foundation of world-class research across a wide range of disciplines.

*Linkage:*

Encourage and extend cooperative approaches to research and improve the use of research outcomes by strengthening links within Australia's innovation system and with innovation systems internationally.

*Research training and careers:*

Contribute to high-quality research training and foster career opportunities for Australia's best and brightest researchers.

*Research infrastructure:*

Facilitate access for Australian researchers to state-of-the-art facilities and equipment and provide incentives for the cooperative development of research infrastructure.

*Research priorities:*

Encourage excellent research and research training across the broad range of national research priorities and ARC structural priorities.

*Public engagement:*

Increase awareness, understanding and support among stakeholders and the community of the outcomes and benefits of Australian research.

*Effective organisation:*

Implement a governance and organisation structure, together with management processes, to enable the ARC to achieve its objectives within a framework of transparency and accountability.

The Strategic Plan identifies the key performance indicators that the ARC will use to measure and demonstrate to the Government its progress in delivering results that benefit the Australian community.

*EFFECTIVENESS INDICATORS*

- Australia achieving high levels of research excellence and building world-class research capability in a range of research areas.
- The benefits (economic, environmental and social) that are delivered to the community through the adoption of the outcomes of ARC-funded research.

*KEY PERFORMANCE INDICATORS*

- Research funded through the National Competitive Grants Program produces high quality outputs and outcomes in public and private enterprises [Key areas: Discovery, Linkage, Research training and careers, Research infrastructure, Research priorities].
- Development, attraction and retention of high-quality researchers across disciplines, able to pursue careers within universities, industry, government and other sectors of the economy [Key areas: Discovery, Linkage, Research training and careers, Research priorities].
- A high incidence of collaboration between ARC-funded researchers and those within other sectors of the national and international innovation system, including innovative companies [Key areas: Discovery, Linkage, Research training and careers, Research infrastructure, Research priorities].
- Increase in the scale of research activities supported through the National Competitive Grants Program [Key areas: Discovery, Linkage, Research training and careers, Research infrastructure, Research priorities].
- Contribution of ARC-funded research to the development of research strengths and applications in areas of national need [Key areas: Discovery, Linkage, Research training and careers, Research infrastructure, Research priorities].

- Appropriate level of access for Australian researchers (including those in higher education institutions, government research organisations and industry) to high-quality facilities and equipment (including major research facilities located overseas) [Key area: Research infrastructure].
- Transfer of knowledge to users as shown by trends in knowledge transfer, utilisation and intellectual property measures [Key areas: Discovery, Linkage, Research training and careers, Research infrastructure, Research priorities].

## *PRINCIPLES*

Seven principles underpin the ARC's activities:

- *Excellence* – ensure high quality and innovative research that is internationally competitive.
- *Concentration* – provide a critical mass of support for research activities to foster world-class research outcomes.
- *Partnership* – encourage and increase partnerships among universities, research institutions, government, business and the wider community at the local, national and international level.
- *Flexibility* – provide flexible and responsive schemes to ensure that a range of research needs and opportunities are supported.
- *Strategic Direction* – deliver the greatest benefits to the community by encouraging research in areas of national priority.
- *Brokerage* – act as a catalyst and broker to create opportunities.
- *Accountability* – demonstrate accountability to the Government and the community by operating within a transparent and performance-driven framework, highlighting the return on the investment in research.

For further details, the Strategic Plan is available online at:

[http://www.arc.gov.au/pdf/ARC\\_Strategic\\_Plan06-08.pdf](http://www.arc.gov.au/pdf/ARC_Strategic_Plan06-08.pdf)

## ATTACHMENT 2

## NATIONAL COMPETITIVE GRANTS PROGRAM (NCGP) STATISTICS

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<b>NOTE</b>
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## Project data

Data on ARC-funded projects in this attachment are of two main types:

- Data on **project proposals submitted and/or approved for funding** in a particular year ('new' grants), and
- Data on **projects receiving funding** in a particular year ('new and ongoing' grants).

These measures generally differ in number and in value.

In any year, the **number of proposals approved for funding** ('new' grants) across all ARC schemes is smaller than the **number of proposals receiving funding** in that year. This is because, in most ARC schemes, grants are awarded for more than one year. For example, in 2005, 917 new projects were approved for funding commencing in 2006 under *Discovery Projects*, but a total of 3 007 *Discovery Projects* grants were 'live' ('new and ongoing') in 2006.

On the other hand, the **value of the funding approved for proposals submitted and successful** ('new grants') in a particular year represents a forward commitment, and generally exceeds the **value of the funding allocated for 'live' grants** ('new and ongoing') in that year. The difference between these amounts may be substantial in schemes which have intermittent rounds (such as *Centres of Excellence*), but less in schemes with smaller annual fluctuations in the number and value of projects approved (such as *Discovery Projects*).

For this reason, the value of new funding commitments to projects submitted in a particular year (generally for funding commencing the following year) does not necessarily match the ARC's administered (Program) budget. This is clear from a comparison of the data in Tables 1 and 6, despite the financial year/calendar year differential in the two tables. The difference arises because the forward commitment applies for the duration of the funded projects, which is generally longer than one year, while the administered budget covers outlays for new and ongoing projects in a single financial year. For example, the substantial new funding committed to *ARC Centres of Excellence* from 2003 boosted the total commitment of new funding in those years to a \$545.7 million and \$605.0 million respectively (Table 7), while the ARC's total Program Budget for the financial years covering those calendar years was much smaller (Table 1).

## Year data

The tables generally show project numbers and funding by calendar year. Three types of year descriptors are used:

- Year submitted – the year in which a project proposal was submitted to the ARC, generally for funding commencing the following year. Proposals have been submitted to the ARC under NCGP schemes each year from 2001 to 2005;
- Funding year – a year in which an approved project was expected to receive a funding allocation. Projects have been funded under the NCGP each year from 2002 to 2006;

- Year of first funding – the year in which an approved project was expected to receive its first allocation.

### Currency of data

Unless otherwise indicated, the data included in these tables are drawn from the documents approved by the Minister at the time the awards were made and exclude any post-award variations that may subsequently have been approved. For example:

- The funding may not have been taken up by the investigator(s) after the project was approved,
- Investigators may have been added to, or removed from, the project, and/or
- The project may have ceased prematurely.

Actual amounts paid to Administering Organisations against approved research projects will vary from the original approvals due to indexation of payments and other post-award funding variations.

## TABLES

**Table 1**  
**ARC appropriations – administered funds, 2000-01 to 2006-07**  
**(current prices)**

2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
\$m	\$m	\$m	\$m	\$m	\$m	\$m
247.8	265.8	298.3	394.4	481.4	556.5	570.3

*Source: Portfolio Budget Statements 2006-07, Education, Science and Training Portfolio*

**Table 2**  
**ARC program budgets, 2002 to 2008-09**  
**(March 2006 prices)**

ARC Scheme	Calendar year actual 2002	Calendar year actual 2003	Jan-Jun actual 2004 <sup>1</sup>	Financial year actual 2004-05	Financial year estimate 2005-06	Financial year estimate 2006-07	Financial year estimate 2007-08	Financial year estimate 2008-09
	\$m	\$m	\$m	\$m	\$m	\$m	\$m	\$m
<b>DISCOVERY</b>								
Discovery Projects	143.683	186.706	102.963	237.044	255.066	273.700	272.224	270.885
Federation Fellowships	7.254	14.253	7.317	22.346	35.938	41.170	41.754	41.754
Discovery Indigenous Researchers Development	0.225	0.236	0.123	0.323	0.400	0.400	0.400	0.400
<b>Sub-total Discovery</b>	<b>151.162</b>	<b>201.194</b>	<b>110.403</b>	<b>259.713</b>	<b>291.404</b>	<b>315.270</b>	<b>314.378</b>	<b>313.039</b>
<b>LINKAGE</b>								
Linkage Projects	63.767	71.439	38.954	98.546	111.686	115.193	118.455	118.955
Linkage Infrastructure, Equipment and Facilities	32.985	20.291	21.509	32.811	35.794	25.794	25.794	25.794
Linkage International	2.61	3.373	1.504	3.610	4.267	3.355	3.450	3.450
Research Centres <sup>2</sup>	21.29	55.799	33.368	84.958	103.732	89.415	87.029	90.230
Linkage Learned Academies Special Projects	0.462	0.463	0.231	0.483	0.472	0.472	0.472	0.472
Special Research Initiatives	0.092	2.599	0.06	0.170	4.896	2.275	2.275	2.275
Linkage Australian Postdoctoral Fellowship (CSIRO)	0	0.659	0.347	0.717	0.179	0.000	0.000	0.000
ANZCCART <sup>3</sup>	0.03	0.027	0	0.027	0.030	0.030	0.030	0.030
<b>Sub-total Linkage</b>	<b>121.236</b>	<b>154.649</b>	<b>95.973</b>	<b>221.322</b>	<b>261.056</b>	<b>236.534</b>	<b>237.505</b>	<b>241.206</b>
<b>TOTAL<sup>4</sup></b>	<b>272.398</b>	<b>355.843</b>	<b>206.376</b>	<b>481.035</b>	<b>552.460</b>	<b>551.804</b>	<b>551.883</b>	<b>554.245</b>

<sup>1</sup> The *Higher Education Legislation Amendment Act 2003* changed the ARC's program funding to a financial year basis. To make the transition from calendar to financial years, the ARC Act treats the period 1 January 2004 to 30 June 2004 as a financial year.

<sup>2</sup> Includes Centres of Excellence in Biotechnology and Information and Communications Technology, ARC Centres of Excellence, ARC Centres, the Australian Centre for Plant Functional Genomics, Special Research Centres and Key Centres of Teaching and Research.

<sup>3</sup> Australian and New Zealand Council for the Care of Animals in Research and Teaching

<sup>4</sup> Total Program budget as approved by the ARC Board in July 2005. These figures exclude funding to be transferred to the Department of Education, Science and Training to administer commercialisation scholarships.

**Table 3**  
**Proposals submitted and new projects funded, selected schemes,**  
**2001 to 2005**

Scheme <sup>1</sup>		Year submitted				
		2001	2002	2003	2004	2005
Discovery Projects	Applications (no.)	3 078	3 574	3 240	3 414	3 742
	Funded (no.)	784	942	875	1 055	917
	Success rate (%)	25.5	26.4	27.0	30.9	24.5
Federation Fellowships <sup>2</sup>	Applications (no.)	268	97	143	188	163
	Funded (no.)	26	24	25	24	25
	Success rate (%)	9.7	24.7	17.5	12.8	15.3
Discovery Indigenous Researchers Development	Applications (no.)	18	10	13	9	8
	Funded (no.)	8	6	3	5	5
	Success rate (%)	44.4	60.0	23.1	55.6	62.5
Linkage Projects <sup>3</sup>	Applications (no.)	910	1 178	1 047	1 048	1,106
	Funded (no.)	470	586	532	488	400
	Success rate (%)	61.6	49.7	50.8	46.5	36.2
Linkage Infrastructure, Equipment and Facilities	Applications (no.)	127	121	146	159	168
	Funded (no.)	70	78	75	78	83
	Success rate (%)	55.1	64.4	51.4	49.1	49.4
Linkage International - Fellowships	New applications (no.)	22	22	23	46	79
	Funded (no.)	12	16	11	19	20
	Success rate (%)	54.5	72.7	47.8	41.3	25.3
Linkage International - Awards	New applications (no.)	25	67	135	134	198
	Holdovers (no.) <sup>4</sup>	-	5	46	141	17
	Applications considered (no.)	25	72	181	275	214
	Funded (no.)	18	64	99	79	57
	Success rate (%)	72.0	88.9	54.7	28.7	26.6
Research Centres <sup>5</sup>	Applications (no.)	-	56	-	97	-
	Funded (no.)	-	17	-	11	-
	Success rate (%)	-	30.4	-	11.3	-
Research Networks <sup>6</sup>	Applications (no.)	-	291	84	-	-
	Funded (no.)	-	147	24	-	-
	Success rate (%)	-	50.5	28.6	-	-
Linkage Learned Academies Special Projects	Applications (no.)	8	5	5	7	-
	Funded (no.)	6	5	5	5	-
	Success rate (%)	75.0	100.0	100.0	71.4	-

<sup>1</sup> Excludes *Co-Funded Centres of Excellence*, for which a tender process was conducted, and *Special Research Initiatives*.

<sup>2</sup> Two selection rounds were held for *Federation Fellowships* commencing in 2002: Round 1, which closed in June 2001, and a supplementary round, which closed in February 2002. These rounds have been aggregated under the 2001 submit year for the purpose of this table. 41 applicants who had been unsuccessful in Round 1 submitted proposals in the supplementary round. This 'duplication' of applications affected the success rate of applications in the combined rounds.

<sup>3</sup> Includes Australian Postgraduate Awards Industry and Linkage Industry Fellowships where these were not part of other *Linkage Projects* proposals and Linkage Australian Postdoctoral Fellowship (CSIRO). As two rounds of *Linkage Projects* are held each year, the statistics shown for each year are aggregated over the two rounds.

<sup>4</sup> Up to and including Round 10 of *Linkage International*, proposals could be held over from one round for consideration in a subsequent round.

<sup>5</sup> Includes one Centre of Excellence funded under *Special Research Initiatives*.

<sup>6</sup> In 2003, seed funding was provided to 147 research networks under *Special Research Initiatives*.

**Table 4**  
**New projects approved for funding, by field of research,**  
**selected schemes<sup>1</sup>, 2001 to 2005**

Field of research <sup>2</sup>	Year submitted				
	2001	2002	2003	2004	2005
	(no.)	(no.)	(no.)	(no.)	(no.)
Agricultural, veterinary and environmental sciences	68	83	69	65	72
Architecture, urban environment and building	15	11	8	15	13
Behavioural and cognitive sciences	64	94	86	76	75
Biological sciences	208	259	217	235	198
Chemical sciences	104	139	112	126	117
Commerce, management, tourism and services	38	51	64	55	42
Earth sciences	68	89	77	90	67
Economics	31	56	33	49	43
Education	47	58	42	47	47
Engineering and technology	269	341	301	287	234
History and archaeology	43	54	54	70	50
Information, computing and communication sciences	96	139	113	133	90
Journalism, librarianship and curatorial studies	8	11	8	9	10
Language and culture	27	48	42	52	39
Law, justice and law enforcement	27	34	33	41	40
Mathematical sciences	42	71	59	60	62
Medical and health sciences	49	53	64	98	75
Philosophy and religion	15	18	19	21	26
Physical sciences	97	120	107	87	92
Policy and political science	26	33	27	30	30
Studies in human society	79	83	87	76	70
The arts	11	35	28	23	17
<b>TOTAL<sup>3</sup></b>	<b>1 432</b>	<b>1 880</b>	<b>1 650</b>	<b>1 745</b>	<b>1 509</b>

<sup>1</sup> Excludes *Co-Funded Centres*, *Linkage Learned Academies Special Projects* and some proposals funded under *Special Research Initiatives*. Fields of research were not nominated by applicants in these cases (see Note 2 below).

<sup>2</sup> Research Fields, Courses and Disciplines (RFCDD) codes, 2-digit classifications (ABS 1998). Applicants submitting proposals to the ARC are generally invited to classify their proposals to up to three 6-digit RFCDD codes and to indicate the proportion of the research content attributable to each of those codes. This distribution has been constructed by reducing the 6-digit codes to their 2-digit 'parent' codes and assigning each funded proposal to a 2-digit code according to the largest or (in the case of equal distributions) the first-listed such code. This table shows the total number of proposals in each 2-digit code group.

<sup>3</sup> Excludes projects where an RFCDD code was not provided by applicants.

**Table 5**  
**Funding commitments to new projects<sup>1</sup>, by field of research,**  
**selected schemes<sup>2</sup>, 2001 to 2005**

Field of research <sup>3</sup>	Year submitted				
	2001	2002	2003	2004	2005
	(\$m)	(\$m)	(\$m)	(\$m)	(\$m)
Agricultural, veterinary and environmental sciences	13.9	17.1	19.6	19.0	22.9
Architecture, urban environment and building	2.2	1.2	2.4	3.6	3.9
Behavioural and cognitive sciences	10.5	17.2	24.7	18.3	23.1
Biological sciences	53.1	96.1	74.6	110.2	66.9
Chemical sciences	33.3	46.9	40.3	76.1	46.4
Commerce, management, tourism and services	5.3	6.4	12.2	9.3	7.6
Earth sciences	21.1	22.5	22.0	44.9	21.4
Economics	4.7	10.4	7.6	10.6	10.8
Education	5.8	9.0	7.1	9.4	9.9
Engineering and technology	61.0	127.1	91.6	102.6	83.2
History and archaeology	8.0	12.1	14.0	17.9	12.4
Information, computing and communication sciences	17.5	32.9	28.6	29.2	30.1
Journalism, librarianship and curatorial studies	1.3	1.9	1.8	2.8	3.7
Language and culture	4.6	7.3	8.7	11.5	7.7
Law, justice and law enforcement	6.5	5.6	5.2	9.9	11.6
Mathematical sciences	10.8	25.7	15.1	17.5	20.4
Medical and health sciences	13.9	10.1	16.8	31.8	22.9
Philosophy and religion	3.6	2.7	3.9	4.9	5.6
Physical sciences	37.6	69.1	43.0	49.0	35.5
Policy and political science	3.5	5.0	7.1	5.7	8.2
Studies in human society	14.4	12.3	21.2	15.7	15.7
The arts	2.4	7.0	5.5	5.3	4.2
<b>TOTAL<sup>4</sup></b>	<b>335.1</b>	<b>545.7</b>	<b>473.1</b>	<b>605.0</b>	<b>474.1</b>

<sup>1</sup> Funding commitments for the life of the projects.

<sup>2</sup> Excludes *Co-Funded Centres*, *Linkage Learned Academies Special Projects* and some proposals funded under *Special Research Initiatives*. Fields of research were not nominated by applicants in these cases (see Note 3 below).

<sup>3</sup> Research Fields, Courses and Disciplines (RFCD) codes, 2-digit classifications (ABS 1998). Applicants submitting proposals to the ARC are generally invited to classify their proposals to up to three 6-digit RFCD codes and to indicate the proportion of the research content attributable to each of those codes. This distribution has been constructed by reducing the 6-digit codes to their 2-digit 'parent' codes and assigning each funded proposal to a 2-digit code according to the largest or (in the case of equal distributions) the first-listed such code. This table shows the total value of proposals in each 2-digit code group.

<sup>4</sup> Excludes projects where an RFCD code was not provided by applicants.

**Table 6**  
**Funding to approved proposals, as proportion of funding sought by those proposals<sup>1</sup>,  
 selected schemes, 2001 to 2005**

Scheme	Year submitted				
	2001	2002	2003	2004	2005
<b>Discovery Projects</b>					
Funding requested (\$m)	324.3	415.0	376.4	488.8	496.0
Funding approved (\$m)	193.4	234.5	237.9	297.5	273.6
Proportion funded (%)	59.6	56.5	63.2	60.9	55.1
<b>Linkage Projects</b>					
Funding requested (\$m)	146.8	246.2	225.3	255.8	308.1
Funding approved (\$m)	76.7	105.7	119.9	115.9	112.5
Proportion funded (%)	52.2	42.9	53.2	45.3	36.5
<b>Linkage Infrastructure, Equipment and Facilities</b>					
Funding requested (\$m)	30.9	31.0	38.4	36.6	46.1
Funding approved (\$m)	24.7	25.2	28.2	30.4	37.3
Proportion funded (%)	79.8	81.5	73.4	83.1	82.7

<sup>1</sup> The total amount of funding sought in proposals made to the ARC is many times this amount. The success rate of proposals averaged 26.9 per cent in *Discovery Projects*, 49.0 per cent in *Linkage Projects* and 53.9 per cent in *Linkage Infrastructure, Equipment and Facilities* over the 2001 to 2005 submission years (see Table 3 above).

**Table 7**  
**Number of new and ongoing projects, all schemes, 2002 to 2006**

Scheme <sup>1</sup>	Funding year				
	2002	2003	2004	2005	2006
	(no.)	(no.)	(no.)	(no.)	(no.)
Discovery Projects	2 297	2 440	2 532	2 865	3 007
Federation Fellowships	25	49	74	98	115
Discovery Indigenous Researchers Development	13	12	11	9	10
Linkage Projects <sup>2</sup>	1 596	1 770	1 852	1 887	1 850
Linkage Infrastructure, Equipment and Facilities	70	78	75	78	83
Linkage International	182	174	227	194	172
Research Centres	30	42	42	45	38
Research Networks	-	-	24	24	24
Linkage Learned Academies Special Projects	6	5	5	5	-
Special Research Initiatives <sup>3</sup>	-	147	-	37	37
<b>TOTAL</b>	<b>4 219</b>	<b>4 717</b>	<b>4 842</b>	<b>5 242</b>	<b>5 336</b>

<sup>1</sup> Includes projects which, at the time of Ministerial approval, were expected to receive an ARC grant payment in the year shown. Some of those projects may subsequently have been abandoned. Includes projects funded under counterpart pre-NCGP schemes and still receiving funding after the commencement of the NCGP.

<sup>2</sup> Includes Australian Postgraduate Awards Industry and Linkage Industry Fellowships where these were not part of other *Linkage Projects* proposals and Linkage Australian Postdoctoral Fellowship (CSIRO). As two rounds of *Linkage Projects* are held each year, the statistics shown for each year are aggregated over the two rounds.

<sup>3</sup> Includes seed funding for research networks. Excludes ARC Research Networks, which are shown separately in this table.

**Table 8**  
**Incidence of cross-disciplinarity in proposals submitted to the ARC,**  
**selected schemes<sup>1</sup>, 2001 to 2004**

Year submitted	Single discipline <sup>2</sup>		Cross-disciplinary <sup>3</sup>		Total	
	(no.)	(%)	(no.)	(%)	(no.)	(%)
2001	3 098	70.5	1 295	29.5	4 393	100.0
2002	3 514	66.4	1 776	33.6	5 290	100.0
2003	3 298	65.3	1 749	34.7	5 047	100.0
2004	3 296	63.3	1 908	36.7	5.204	100.0

<sup>1</sup> Excludes *Centres of Excellence, Co-Funded Centres, Linkage Learned Academies Special Projects* and some proposals funded under *Special Research Initiatives*. Fields of research were not nominated by applicants in these cases (see note to Tables 6 and 7).

<sup>2</sup> Proposals where the applicant indicated that more than 70 per cent of the research content in the proposal lay within a single 2-digit RFCDC code.

<sup>3</sup> Proposals where the applicant indicated that the research content was distributed over at least two 2-digit RFCDC codes, with no more than 70 per cent in any one of those codes.

**Table 9**  
**Success of cross-disciplinary proposals submitted to the ARC,**  
**selected schemes<sup>1</sup>, 2001 to 2004**

Year submitted	Single discipline <sup>2</sup>			Cross-disciplinary <sup>3</sup>			Total		
	Applied	Funded	Success rate	Applied	Funded	Success rate	Applied	Funded	Success rate
	(no.)	(no.)	(%)	(no.)	(no.)	(%)	(no.)	(no.)	(%)
2001	3 098	996	32.1	1 295	427	33.0	4.393	1 423	32.4
2002	3 514	1 176	33.5	1 776	587	33.1	5 290	1 763	33.3
2003	3 298	1 130	34.3	1 749	622	35.6	5 047	1 754	34.8
2004	3 296	1 139	34.6	1 908	654	34.3	5 204	1 793	34.5

<sup>1</sup> Excludes *Centres of Excellence, Co-Funded Centres, Linkage Learned Academies Special Projects* and some proposals funded under *Special Research Initiatives*. Fields of research were not nominated by applicants in these cases (see note to Tables 6 and 7).

<sup>2</sup> Proposals where the applicant indicated that more than 70 per cent of the research content in the proposal lay within a single 2-digit RFCDC code.

<sup>3</sup> Proposals where the applicant indicated that the research content was distributed over at least two 2-digit RFCDC codes, with no more than 70 per cent in any one of those codes.

**Table 10**  
**ARC-funded awards and fellowships, new and ongoing,**  
**2002 to 2006**

Scheme	Funding year				
	2002	2003	2004	2005	2006
	(no.)	(no.)	(no.)	(no.)	(no.)
<b>Postgraduate awards<sup>1</sup></b>					
New	397	461	426	389	304
New and ongoing	1 316	1 496	1 703	1 688	1 653
<b>Fellowships<sup>2</sup></b>					
New	197	198	215	200	198
New and ongoing	532	418	609	690	698
<b>International fellowships<sup>3</sup></b>					
New	12	16	11	19	20
New and ongoing	12	16	11	19	20
<b>Federation Fellowships</b>					
New	25	22	23	24	25
New and ongoing	25	47	70	94	115
<b>Total</b>					
New	631	697	675	632	547
New and ongoing <sup>4</sup>	1 885	1 977	2 393	2 491	2 486

<sup>1</sup> Australian Postgraduate Awards Industry.

<sup>2</sup> Includes Australian Postdoctoral Fellowships, Australian Research Fellowships, Queen Elizabeth II Fellowships, Australian Professorial Fellowships and Australian Postdoctoral Fellowships Industry.

<sup>3</sup> *Linkage International Fellowships* are funded for one year only.

<sup>4</sup> Includes fellowships still in place under pre-NCGP schemes.

**Table 11**  
**Early Career Researcher awards and fellowships, *Discovery Projects*,**  
**2002 to 2006**

Award		First year of funding				
		2002	2003	2004	2005	2006
Early career researcher (ECR) <sup>1</sup>	Applications (no.)	653	861	663	747	860
	Funded (no.)	161	162	138	171	155
	Success rate (%)	24.7	18.8	20.8	22.9	18.0
Fellowships	Applications (no.)	830	1 005	871	1 010	1 159
	Funded (no.)	163	166	161	167	168
	Success rate (%)	19.6	16.5	18.5	16.5	14.5

<sup>1</sup> ECR-only applications. Excludes ECRs in applications involving non-ECR participants.

**Table 12**  
**Industry-linked awards and fellowships, *Linkage Projects*,**  
**2002 to 2006**

Award		First year of funding <sup>1</sup>				
		2002	2003	2004	2005	2006
Australian Postgraduate Awards Industry	Applications (no.)	822	1 012	775	878	886
	Funded (no.)	350	461	426	390	304
	Success rate (%)	42.6	45.6	55.0	44.4	34.3
Australian Postdoctoral Fellowships Industry	Applications (no.)	59	73	82	75	62
	Funded (no.)	27	32	46	33	30
	Success rate (%)	45.8	43.8	56.1	44.0	48.4
Linkage Industry Fellowships	Applications (no.)	-	-	6	7	4
	Funded (no.)	-	-	3	3	-
	Success rate (%)	-	-	50.0	42.9	0

<sup>1</sup> Commencing in 2003, two rounds of *Linkage Projects* were held each year. For the purpose of this table, the outcomes of the two rounds are aggregated to yield a total for each calendar year.

**Table 13**  
**ARC-funded fellowship holders, by scheme and number of fellowships held<sup>1</sup>,**  
**1998 to 2006**

ARC Scheme	No. of fellowships held by each fellowship holder over period			
	One	Two	Three	Total
Discovery Projects	814	21	-	835
Federation Fellowship	100	19	4	123
Linkage Australian Postdoctoral Fellowship CSIRO	10	-	-	10
Linkage Projects	172	1	-	173
Research Fellowships Scheme	289	56	-	345
Strategic Partnerships with Industry for Research and Training	71	-	-	71
<b>Total</b>	<b>1456</b>	<b>97</b>	<b>4</b>	<b>1557</b>

<sup>1</sup> Includes Australian Postdoctoral Fellowships, Australian Postdoctoral Fellowships Industry, Linkage Industry Fellowships, Linkage-Australian Postdoctoral Fellowship CSIRO, Australian Research Fellowships, Queen Elizabeth II Fellowships, Australian Professorial Fellowships and Federation Fellowships.

**Table 14**  
**ARC salary and stipend rates<sup>1</sup> for *Discovery* and *Linkage*,**  
**2002 to 2006**

Award	Funding year				
	2002	2003	2004	2005	2006
	(\$)	(\$)	(\$)	(\$)	(\$)
Australian Postdoctoral Fellowship (APD)	49 621	52 240	53 567	54 692	59 000
Australian Postdoctoral Fellowship Industry (APDI)	49 621	52 240	53 567	54 692	59 000
Linkage - Australian Postdoctoral Fellowship CSIRO (APDC)	49 621	52 240	53 567	54 692	59 000
Research Cadetship - Aboriginal and Torres Strait Islander (RC-ATSI) <sup>2</sup>	49 621	52 240	53 567	54 692	59 000
Australian Research Fellowship (ARF)					
Step 1	62 755	65 210	66 867	68 271	74 000
Step 2	74 483	77 497	79 465	81 134	88 000
Queen Elizabeth II Fellowship (QEII)					
Step 1	62 755	65 210	66 867	68 271	74 000
Step 2	74 483	77 497	79 465	81 134	88 000
Australian Professorial Fellowship (APF)					
Step 1	82 152	89 516	91 790	93 718	102 000
Step 2	100 078	105 125	107 795	110 059	118 000
Federation Fellowship (FF)	-	235 201	241 224	246 290	250 970
Australian Postgraduate Award Industry (APAI)					
<i>Amount paid to institutions</i>					
Full year	23 033 <sup>5</sup>	23 556 <sup>5</sup>	24 148 <sup>5</sup>	24 650 <sup>5,7</sup>	25 118 <sup>5,11</sup>
Half year	11 386 <sup>6</sup>	11 647 <sup>6</sup>	11 943 <sup>6</sup>	12 325 <sup>5,8</sup>	12 559 <sup>6,12</sup>
<i>Annual stipend rates for students</i>					
Full year <sup>3</sup>	22 771	23 294	23 886	24 650 <sup>9</sup>	25 118 <sup>13</sup>
Half year <sup>4</sup>	12 366	12 650	13 160	13 463 <sup>10</sup>	13 719 <sup>14</sup>

<sup>1</sup> Rates shown exclude the loading for on-costs of 26 per cent which is paid by the ARC. Allowances (relocation and thesis) are additional where paid. Full details of salary and stipend rates and allowances are contained in [http://www.arc.gov.au/apply\\_grants/salaries.htm](http://www.arc.gov.au/apply_grants/salaries.htm)

<sup>2</sup> From 2007, these awards will be known as Indigenous Research Fellowships.

<sup>3</sup> Tax free.

<sup>4</sup> Part time stipends are taxable.

<sup>5</sup> Includes \$262 allowance rate per year.

<sup>6</sup> Six months extension does not include allowances.

<sup>7</sup> For projects commencing in 2005. For projects continuing in 2005, the amount paid to institutions was \$24 650.

<sup>8</sup> For projects commencing in 2005. For projects continuing in 2005, the amount paid to institutions was \$12 194.

<sup>9</sup> For projects commencing in 2005. For projects continuing in 2005, the annual stipend rate for students was \$24 388.

<sup>10</sup> For projects commencing in 2005. For projects continuing in 2005, the annual stipend rate for students was \$13 463.

<sup>11</sup> For projects commencing in 2005 and 2006. For projects commenced in 2004 and earlier, the amount paid to institutions was \$25 118.

<sup>12</sup> For projects commencing in 2005 and 2006. For projects commenced in 2004 and earlier, the amount paid to institutions was \$12 426.

<sup>13</sup> For projects commencing in 2005 and 2006. For projects commenced in 2004 and earlier, the annual stipend rate for students was \$24 851.

<sup>14</sup> For projects commencing in 2005. For projects commenced in 2004 and earlier, the annual stipend rate for students was \$13 719.

**Table 15**  
**Origin of awardees<sup>1</sup> under the *Federation Fellowships* scheme,**  
**2002 to 2006**

Origin	First year of funding				
	2002	2003	2004	2005	2006
	(no.)	(no.)	(no.)	(no.)	(no.)
Expatriate Australians	6	6	7	3	5
Resident Australians	18	16	10	15	18
Foreign nationals	1	-	5	3	2
<b>Total</b>	<b>25</b>	<b>22</b>	<b>22</b>	<b>21</b>	<b>25</b>

<sup>1</sup> Excludes Fellowship offers declined subsequent to the Minister's announcement.

**Table 16**  
**Investigators on proposals submitted to the ARC, selected schemes<sup>1</sup>,**  
**2001 to 2005**

Number of investigators named <sup>2</sup>	Year submitted				
	2001	2002	2003	2004	2005
	(no.)	(no.)	(no.)	(no.)	(no.)
On proposals submitted	8 889	11 006	16 219	12 779	12 538
On proposals funded	3 475	4 447	7 774	4 962	4 125

<sup>1</sup> Excludes *Co-Funded Centres*, *Linkage Learned Academies Special Projects* and some proposals funded under *Special Research Initiatives*.

<sup>2</sup> An individual may be named as an investigator on more than one proposal. This listing includes such multiple incidences.

*Note:* Proposals submitted for *ARC Research Networks* in 2003 included a large number of investigators. This contributed to the large increase in investigator numbers in that year.

**Table 17**  
**Investigators on ARC-funded projects, by number of grants held,**  
**1998 to 2006**

Number of grants held over period <sup>1</sup>	Number of investigators <sup>2</sup>	Per cent of all investigators on grants funded over period
1	10 320	59.4
2	2 876	16.6
3	1 439	8.3
4	796	4.6
5	542	3.1
6	381	2.2
7	259	1.5
8	180	1.0
9	164	0.9
10	96	0.6
More than 10	328	1.9
<b>Total</b>	<b>17 381</b>	<b>100.0</b>

<sup>1</sup> Includes all ARC schemes (including pre-NCGP schemes) other than *Centres of Excellence, Key Centres, Special Research Centres, Co-Funded Centres, Linkage Learned Academies Special Projects* and some proposals funded under *Special Research Initiatives*.

<sup>2</sup> Includes all named investigators on each funded project.

**Table 18**  
**Collaboration with researchers in other countries<sup>1</sup> in ARC-funded research,**  
**selected schemes<sup>2</sup>, 2002 to 2006**

Year first funded <sup>3</sup>	ARC-funded proposals indicating intended collaboration with researchers in other universities	
	(no.)	(% of all funded proposals)
2002	589	41.1
2003	792	42.1
2004	917	55.6
2005	925	53.1
2006	807	53.6

<sup>1</sup> Applicants submitting proposals to the ARC are generally invited to indicate whether they expect to collaborate with researchers in other countries and, if so, to name that country and any collaborating individuals or organisations in that country. This table has been compiled from those indicated intentions.

<sup>2</sup> Excludes *Co-Funded Centres, Linkage Learned Academies Special Projects* and some proposals funded under *Special Research Initiatives*.

**Table 19**  
**ARC-funded research proposals indicating intended collaboration with researchers in other countries, by field of research, selected schemes<sup>1</sup>, 2002 to 2006**

Field of research <sup>2</sup>	Year first funded				
	2002	2003	2004	2005	2006
	(no.)	(no.)	(no.)	(no.)	(no.)
Agricultural, veterinary and environmental sciences	19	25	37	18	30
Architecture, urban environment and building	2	-	2	4	7
Behavioural and cognitive sciences	18	37	42	31	42
Biological sciences	90	106	133	131	104
Chemical sciences	47	77	75	83	74
Commerce, management, tourism and services	14	16	17	20	12
Earth sciences	41	60	55	67	56
Economics	7	16	20	28	22
Education	11	13	9	8	8
Engineering and technology	99	130	163	162	134
History and archaeology	14	21	27	33	24
Information, computing and communication sciences	43	62	72	74	41
Journalism, librarianship and curatorial studies	4	1	4	5	3
Language and culture	7	14	12	22	13
Law, justice and law enforcement	7	6	16	17	12
Mathematical sciences	40	51	47	52	51
Medical and health sciences	13	18	25	34	26
Philosophy and religion	9	5	9	12	17
Physical sciences	71	96	86	79	80
Policy and political science	8	12	13	11	10
Studies in human society	22	16	42	25	33
The arts	3	10	11	9	8
<b>TOTAL</b>	<b>589</b>	<b>792</b>	<b>917</b>	<b>925</b>	<b>807</b>

<sup>1</sup> Excludes *Centres of Excellence, Co-Funded Centres, Linkage Learned Academies Special Projects* and some proposals funded under *Special Research Initiatives*. Fields of research were not nominated by applicants in these cases (see following note).

<sup>2</sup> Research Fields, Courses and Disciplines (RFCD) codes, 2-digit classifications (ABS 1998). Applicants submitting proposals to the ARC are generally invited to classify their proposals to up to three 6-digit RFCD codes and to indicate the proportion of the research content attributable to each of those codes. This distribution has been constructed for funded proposals indicating an intention to collaborate with researchers overseas by reducing the 6-digit codes to their 2-digit 'parent' codes and assigning each funded proposal to a 2-digit code according to the largest or (in the case of equal distributions) the first-listed such code. This table shows the total number of proposals in each 2-digit code group. A proposal may have indicated more than one country of intended collaboration.

**Table 20**  
**Incidences of intended collaboration<sup>1</sup> in ARC-funded research, by country, selected schemes<sup>2</sup>, 2002 to 2006**

Country of intended collaboration	Year first funded				
	2002	2003	2004	2005	2006
	(no.)	(no.)	(no.)	(no.)	(no.)
United States	296	421	485	511	422
United Kingdom	165	248	333	348	261
Germany	109	143	190	164	134
France	87	112	123	117	103
Canada	66	93	138	139	110
Japan	65	95	138	113	86
China, People's Republic of	39	47	84	76	59
New Zealand	35	32	89	76	55
Italy	25	43	64	65	48
Netherlands, The	31	43	74	44	45
Sweden	31	48	53	45	36
Switzerland	25	30	43	34	21
Singapore	15	19	40	32	31
Korea, Republic of	19	22	41	21	23
Indonesia	7	15	29	29	23
Denmark	12	17	32	32	19
South Africa	12	24	21	16	22
Spain	13	19	20	24	21
Hong Kong	13	17	26	24	18
Other	173	215	328	305	251
<b>Total</b>	<b>1 238</b>	<b>1 703</b>	<b>2 323</b>	<b>2 215</b>	<b>1 788</b>

<sup>1</sup> Applicants submitting proposals to the ARC are generally invited to indicate whether they expect to collaborate with researchers in other countries and, if so, to name that country and any collaborating individuals or organisations in that country. This table has been compiled from those indicated intentions. A single proposal may involve intended collaboration with more than one country. In such cases, multiple incidences of collaboration will be recorded in this table.

<sup>2</sup> Excludes *Co-Funded Centres, Linkage Learned Academies Special Projects* and some proposals funded under *Special Research Initiatives*.

**Table 21**  
**Collaboration with researchers in other Australian universities in ARC-funded research, selected schemes<sup>1</sup>, 2002 to 2006**

Year first funded	ARC-funded proposals indicating intended collaboration with researchers in other universities	
	(no.)	(% of all funded proposals)
2002	307	21.4
2003	528	28.1
2004	369	22.4
2005	447	25.6
2006	342	22.7

<sup>1</sup> Applicants submitting proposals to the ARC are generally invited to indicate whether they expect to collaborate with researchers in other universities and, if so, to name that university. This table has been compiled from those indicated intentions. A single proposal may include intended collaboration with more than one other university.

<sup>2</sup> Excludes *Co-Funded Centres*, *Linkage Learned Academies Special Projects* and some proposals funded under *Special Research Initiatives*.

**Table 22**  
**Participation by partner organisations in *Linkage Projects*, 2002 to 2006**

Year submitted <sup>1</sup>	Partner organisations collaborating on research proposals	Partner organisations collaborating on funded proposals	Per cent of partner organisations whose proposals are funded
	(no.)	(no.)	(%)
2001	1 398	738	52.8
2002	1 899	948	49.9
2003	1 800	939	52.2
2004	1 869	895	47.9
2005	2 060	764	37.1

<sup>1</sup> Commencing in 2003, two rounds of *Linkage Projects* were held each year. For the purpose of this table, the outcomes of the two rounds are aggregated to yield a total for each calendar year.

**Table 23**  
**Partner organisations in *Linkage Projects*, by organisation type,**  
**2004 and 2005**

Organisation type <sup>1</sup>	Submit year 2004 <sup>3</sup>		Submit year 2005 <sup>3</sup>	
	On proposals	Funded	On proposals	Funded
	(no.)	(no.)	(no.)	(no.)
Company / Industry body - Australian <sup>2</sup>	528	234	615	232
Company / Industry body - International <sup>2</sup>	147	77	166	77
Government – Commonwealth	108	63	104	43
Government – State and local	648	331	729	257
Government – International	30	16	50	19
Non-Profit – Australian	386	164	374	129
Non-Profit - International	22	10	22	7
<b>Total</b>	<b>1 869</b>	<b>895</b>	<b>2 060</b>	<b>764</b>

<sup>1</sup> *Linkage Projects* application forms have included a field for organisation type since Round 1 2005 (submitted in 2004). Partner organisations are invited to classify their organisation into one of the mutually exclusive types shown. More than one partner organisation may be involved in any single *Linkage Projects* proposal.

<sup>2</sup> Described in 2004 as Private Company – Australian and Private Company – International respectively.

<sup>3</sup> Commencing in 2003, two rounds of *Linkage Projects* were held each year. For the purpose of this table, the outcomes of the two rounds are aggregated to yield a total for each calendar year.

**Table 24**  
**Contributions of partner organisations to funded proposals in *Linkage Projects*,**  
**2002 to 2006**

Contribution <sup>2</sup>	Year submitted <sup>1</sup>				
	2001	2002	2003	2004	2005
	(\$m)	(\$m)	(\$m)	(\$m)	(\$m)
<b>Partner organisations on proposals</b>					
Cash contribution (\$m)	54.0	82.3	77.3	89.5	112.5
In kind contribution (\$m)	137.1	199.4	193.3	213.3	267.9
Total contribution (\$m)	191.1	281.7	270.6	302.8	380.4
<b>Partner organisations on funded proposals</b>					
Cash contribution (\$m)	33.1	47.6	49.6	51.4	60.4
In kind contribution (\$m)	86.8	111.0	114.4	121.7	114.9
Total contribution (\$m)	120.0	158.6	164.0	173.0	175.2
<b>ARC commitment (\$m)</b>	76.7	106.1	119.9	115.9	114.2
Cash contribution to funded proposals by partner organisations as proportion of ARC commitment (%)	43.2	44.9	41.4	44.3	52.9

<sup>1</sup> Commencing in 2003, two rounds of *Linkage Projects* were held each year. For the purpose of this table, the outcomes of the two rounds are aggregated to yield a total for each calendar year.

<sup>2</sup> Partner contributions are derived from proposals. Actual contributions may vary from those indicated in the proposal.

**Table 25**  
**Contributions of partner organisations to funded proposals in *Linkage Projects*, by organisation type, Rounds 1 and 2, 2006**

Organisation type	Cash contribution <sup>1</sup>	In kind contribution <sup>1</sup>	Total contribution <sup>1</sup>
	(\$m)	(\$m)	(\$m)
<b>Company / Industry body</b>			
Australian	21.5	45.1	66.6
International	15.5	17.8	33.3
<b>Government body</b>			
Commonwealth	3.2	4.0	7.3
State and Local	13.0	28.1	41.1
International	0.7	3.6	4.3
<b>Non-profit organisation</b>			
Australian	4.6	14.8	19.4
International	1.9	1.4	3.3
<b>Total</b>	<b>60.4</b>	<b>114.9</b>	<b>175.3</b>

<sup>1</sup> Partner contributions are derived from proposals. Actual contributions may vary from those indicated in the proposal.

**Table 26**  
**National Research Priorities in new projects approved for funding commencing in 2006, selected schemes**

National Research Priority (NRP) <sup>1</sup>	Scheme / Funding over project life			
	Discovery Projects	Federation Fellowships	Linkage Infrastructure, Equipment and Facilities	Linkage Projects
	(\$m)	(\$m)	(\$m)	(\$m)
1. An environmentally sustainable Australia	46.2	6.6	4.5	23.4
2. Promoting and maintaining good health	44.6	5.4	5.0	11.4
3. Frontier technologies for building and transforming Australian industries	115.7	21.4	27.3	16.1
4. Safeguarding Australia	26.2	8.1	0.5	5.6
<b>Total research priority areas</b>	<b>232.8</b>	<b>41.5</b>	<b>37.3</b>	<b>56.6</b>
Total of selected schemes	273.6	41.5	37.3	112.5
<b>NRP as per cent of selected schemes</b>	<b>85.1</b>	<b>100.0</b>	<b>100.0</b>	<b>91.7</b>

<sup>1</sup> Applicants to ARC schemes are generally invited to indicate whether their proposal falls within one of the National Research Priority areas. This table has been constructed based on applicants' assessments of the relevance of their proposed research content to those priority areas.

Table 27

## Early academic outputs from ARC-funded research:

Outputs reported six months after the final ARC grant payment from projects first funded between 1998 and 2002

Type of output <sup>1</sup>	Year first funded <sup>2</sup>				
	1998	1999	2000	2001	2002
	Number of outputs reported				
Book					
Authored research	33	120	113	130	96
Authored other	184	37	35	20	12
Edited	118	100	122	86	89
Translation	1	-	4	7	7
Revision/new edition	9	11	16	5	10
Chapter	945	960	856	747	701
Journal article					
Article in scholarly refereed journal	5 509	5 137	5 053	4 678	3 478
Other contribution to refereed journal	193	90	93	91	116
Non-refereed article	222	190	198	146	161
Letter or note	80	71	57	45	50
Major review	184	133	193	188	122
Conference					
Full written paper – refereed proceedings	1 711	1 947	1 832	1 570	1 245
Full written paper – non-refereed proceedings	639	710	684	640	417
Extract of paper	1 569	1 414	1 037	907	661
Edited volume of conference proceedings	370	975	3 920	2 197	1 848
Unpublished presentation	439	-	-	-	-
Audio-visual recording	163	27	42	17	52
Computer software	95	67	87	81	60
Designs	3	8	11	24	11
Technical drawing	18	7	2	-	-
Patents	21	14	7	1	-
Other creative works					
Major written or recorded work	179	44	32	1	-
Minor written or recorded work	72	56	19	5	-
Individual exhibition of original art	3	2	18	-	-
Representation of original art	1	16	1	-	-
Major creative works	-	17	22	18	48
Creative work included in group exhibition, performance, recording or anthology	-	4	19	44	63
Exhibition curatorship	3	3	7	7	5
Other academic outputs	199	333	634	1 057	920
<b>TOTAL</b>	<b>12 963</b>	<b>12 493</b>	<b>15 114</b>	<b>12 712</b>	<b>10 172</b>
Final reports	1 116	1 179	1 280	1 366	675
Average number of outputs per grant	11.6	10.6	11.8	9.3	15.1

<sup>1</sup> As reported in final reports submitted by grant recipients. Such reports must be submitted six months after the final grant payment (or any authorised carryover of grant funding). Many academic outputs are likely to take longer than six months to finalise.

<sup>2</sup> As most grants in major schemes are funded for three years, many of those first funded after 2002 are still in progress and have not yet been required to complete final reports.

**Table 28**  
**Early commercialisation outputs from ARC-funded research:**

Invention disclosures, licences, patents and start-up companies reported six months after the final ARC grant payment, from projects first funded between 1998 and 2002

Output <sup>1</sup>	First year of funding <sup>2</sup>				
	1998	1999	2000	2001	2002
	(no.)	(no.)	(no.)	(no.)	(no.)
Invention disclosures	3	14	15	25	28
Licences executed	5	6	6	9	9
Patents	27	14	11	1	-
Patents filed	23	66	65	77	39
Patents pending	3	13	19	36	12
Start-up companies	1	7	6	10	5
<b>Final reports</b>	<b>1 116</b>	<b>1 179</b>	<b>1 280</b>	<b>1 366</b>	<b>675</b>

<sup>1</sup> As reported in final reports submitted by grant recipients. Such reports must be submitted six months after the final grant payment (or any authorised carryover of grant funding). Commercialisation outputs are likely to take much longer than six months to finalise. Prior to May 2003, data on invention disclosures, licences and start-up companies were not collected on final report forms. Data on patents filed and pending were extracted from hard-copy final report forms prior to May 2003.

<sup>2</sup> As most grants in major schemes are funded for three years, many of those first funded after 2002 are still in progress and have not yet been required to complete final reports.

## PARTNER ORGANISATIONS IN LINKAGE PROJECTS<sup>1</sup>, 2005 AND 2006

### Private company / industry body - Australian

AAMHatch Pty Ltd	Australian Agricultural Company	BM Alliance Coal Operations Pty Ltd	Dermcare-Vet Pty Ltd
AB Mauri Ltd	Australian Biodiesel Group	Boehringer Ingelheim	Diagnostic Technology
Accenture Australia	Australian Coal Research Limited	Booz Allen Hamilton	DIGA
ACIL Australia Pty Ltd	Australian Defence Apparel P/L	Botanical Resources Australia - Agricultural Services Pty. Ltd.	Digital Technology International (DTI)
ACIRL Pty Ltd	Australian Education Union, South Australian Branch	Brain Resources Company	Digital Trends WA
Acorn Capital Ltd	Australian Healthcare Messaging Laboratory	Brambles	Dionex Pty Ltd
ActewAGL	Australian Institute of Judicial Administration	Bret-Tech	Doral Specialty Chemicals
Acuiti Advisory (a division of Acuiti Legal)	Australian Interactive Media Industry Association	Brickworks Ltd.	Dow AgroSciences LLC
ADI Limited	Australian Mobile Telecommunications Association	Britton Timbers Tasmania	Dulux/Orica Pty Ltd
AEShareNet Limited	Australian Olive Oil Brokerage	Bus Association Victoria	DuPont Australia
Affinity Health Limited	Australian Pork Ltd	Cable Sands Pty Ltd	DVExperts International
Age Mining Services Pty Ltd	Australian Project Management Services	Cancer Therapeutics Limited	DYMON INDUSTRIES PTY LTD
Agent Oriented Software	Australian Publishers Association	Carlton and United Breweries	Dyno Nobel (Asia Pacific) Ltd
AGR Matthey	Australian Queen Bee Breeding Group	Cash Research Screw Compressors Pty. Ltd.	Eagle Datamation International Pty. Ltd.
AGRICULTURAL PRODUCE COMMISSION	Australian Security Industry Association Limited	Cashmere Connections P/L	Echo Remediation
Agriculture Victoria Services Pty Ltd	Australian Stock Exchange Limited	C-Bio Ltd.	Econova
AIMEDICS Pty Ltd	Australian Superconductors	Cement Australia - Pozzalonc Enterprises	EcoTech Group
Ajax Engineered Fasteners	Australian Unity	Centre for Infectious Diseases and Microbiology	ECOWISE Environmental
Alchemia Pty Ltd	AVCAL	CH4 Gas Ltd	Eden Energy Ltd
Alcoa World Alumina	Avtronics (Australia) Pty. Ltd.	ChemGenex	Egon Zehnder International
Alexander Technology Research and Development Pty Ltd	AZURN International Pty Ltd	CHEMSTAB Consulting Pty Ltd	Electrolux Major Appliances, Australia
Alinta Network Services	BAE Systems Australia	Cisco Systems Australia	Ellex Medical Pty Ltd
Alinta Network Services	BAE Systems Engineering Operations Division	Citrix Systems Australasia R&D Pty Ltd	Empower Australia
Alive Technologies Pty Ltd	Bakers Delight Holdings	Claire Energy Pty. Ltd.	Endeavour
Almax Aluminium	Barrick Gold of Australia Limited (ACN 008 143 137)	Clay Brick & Paver Institute	Engana Ltd
Alphatech International Ltd	Bartlett Grain Pty Ltd	Cochlear Ltd	EOS Space Systems Pty Ltd
AMIRA International Ltd	Bassetts Consulting Engineers	Colliers International	EpiTactix Pty Ltd
AMP Capital Investors	Baulderstone Hornibrook	Colour Vision Systems Pty Ltd	Epitan Limited
Ampcontrol	Bawinanga Aboriginal Corporation	Composite Material Engineering Pty Ltd	Era Sustainable
Anaconda Nickel Limited	Beacon Software Innovations Pty Ltd.	Compumedics Limited	Ernst & Young
Analytical Reference Laboratories (ARL)	Belmont Computer Centre Pty Ltd	Constraint Technologies International	Everyday Interactive Networks (EIN)
Anglesea Power Station	BEMAX incorporating Cable Sands	Copyright Agency Limited	Falconbridge LTD
ANGLO Coal Australia	Benthic Geotech Pty Ltd	Corangamite Catchment Management Authority	Fertility Control Pty Ltd
Anglo Coal Australia Pty Ltd	BHP Billiton	Corinna Sawmills	Fidler Partners Pty Ltd
ANZ Australia and New Zealand Banking Group	Billy Blue School of Graphic Arts Pty Ltd	Corrs Chambers Westgarth	FinaMetrica Limited
Aquatas Pty Ltd	BIO-ANALYSIS: Marine, Estuarine & Freshwater Ecology	Cosy Cabins	Fireplay Pty Ltd
Aquatic Solutions International	BioAust Bioenergy Pty Ltd	Council of Grain Grower Organisations (COGGO)	FKP Australian Retirement Homes
Arafura Pearls Holdings Ltd	Biofeedback Instruments	CPA Australia	Flexitech Pty Ltd
Ashton Raggatt McDougal	Biogen Idec Australia Pty Ltd	Creative Media Warehouse	Flinders Diamonds Ltd
Atlas Pacific Ltd	Bio-Rad Laboratories	Cryptopharma Pty Ltd	FLOORBOTICS International
Aurora Energy Pty Ltd	Biosupplies Australia	CSL Limited	Forests and Forest Industries Council of Tasmania
Ausanda Communications Pty. Ltd.	BIOTA Environmental Sciences	CSR Hebel	Forge
AusMalt Pty Ltd	Biotron	Cytopia Research Pty.Ltd	Frankipile Australia Pty. Ltd.
Ausplas Industries	Bishop Innovation Ltd	Dairy Farmers	FTS Australasia
Austofix	Black Kosloff, Knott Architects P/L	Dairy Ingredients Group of Australia Ltd.	Fuji Xerox
Australia Zoo	BlueScope Steel	Demac Wildlife Nutrition	GBS Venture Partners

Gelita Australia Pty Ltd	Joe White Maltings Pty. Ltd.	Museums and Galleries Foundation of NSW	pSivida Limited
General Property Trust	Jones Lang Lasalle	NanoChem Holdings Pty Ltd.	PTW Architects
Genetic Technologies Limited (GTG)	Kann Finch Group	National Australia Bank Limited	Qantas
Geocomp Systems Pty Ltd	KAZ Group Ltd	National Jet Systems	RACV
Geodynamics Limited	Kinetic Pty. Ltd.	Native Seeds Pty Ltd.	Ramsay Health Care
Geomatic Technologies P/L	Koda International Pty Ltd	Nekon Pty Ltd	Rayonier Tasmania
Glassy Metal Technologies Ltd.	Lab.3000	Netstar Australia	Readymix Holdings
GlaxoSmithKline	LAMS International Pty Ltd	Neural Diagnostics Pty Ltd	Regis Group Pty Ltd
Glenvern Technologies Pty Ltd	Lastek Pty Ltd	Newmont Australia	Repcol Limited
Global Solutions Network Pty Ltd	Laxwood Pty Ltd	NHEW R&D Pty Ltd	ResMed Ltd
Gold Fields Australasia	Leica Geosystems	Nino Pty Ltd (Trading as Barramundi Waters)	Retirement Village Association Ltd VIC & TAS
Goldstar Resources NL	Leighton Kumagai Joint Venture	Nomura Australia Limited	Revolution Design Pty Ltd
Gollings Photography Pty. Ltd	Lend Lease Lease Communities	Norske Skog Paper Mills (Australia) Limited	Ridley Aqua-Feeds Ltd
Good Fortune Bay Ltd	Lifelink Care Pty Ltd	Northern Territory Seafood Council	Rijk Zwaan Australia Pty Ltd
Graham Walters & Associates P/L	LINC ENERGY	Northshore Development Group (Port of Brisbane)	Rindies Pty Ltd
Great Southern Plantations Limited	Linfox	Novapharm Research (Australia) Pty Ltd	Rio Tinto
Group Credit, St George Bank	Lion Nathan Ltd.	Novo Nordisk Pharmaceuticals	RoadSAVE Holding Pty. Ltd.
Gulf Conveyor Holdings Pty Ltd	Living Choice Australia Ltd	Novogen Limited	Roche Pharmaceuticals
Gunns Limited	LNB Consulting	NRMA Motoring & Services	Ronin Films
Gunns Veneers	Locata Corporation	NSDC Pty Ltd	RPO Pty Ltd
Hancock Victorian Plantations Pty Ltd	Lyons Architects	NSI Dental Pty Ltd	Saltgrow Pty Ltd
Hansen Corporation	M.G. Kailis Group	nSynergy Pty. Ltd.	Sanitarium Health food company
Health Services Engineering Pty Ltd	m.Net Corporation Ltd	NT Tourist Commission	Santos Ltd
Henry Kendall Group	Macquarie Bank Ltd	NuMega Ingredients	SAP Australia PtyLtd
Heritage Seeds	Maddocks	Object: Australian Centre for Craft and Design	Saturn Biotech
Hexima Ltd.	Mailmasters Pty. Ltd.	OneSteel Manufacturing P/L	Savv-e Pty
High Power Ultrasonics Pty Ltd	Main Roads Western Australia (MRWA)	Organon	Scantech International Pty Ltd
Hismelt Corporation	Mainmark-Uretek	Orica Australia Pty Ltd	Schefenacker Vision Systems
Huon Aquaculture Company Pty. Ltd.	Marine Harvest Ltd	Ove Arup Pty Ltd	Schering
Hydro Tasmania	Mauri Yeast Australia Pty Ltd	Pacific Biologics	Schneider (Australia) Consulting
Hydrogen Technology Limited	Mayne Health Pathology Pty Ltd	Pacific Satellite Pty Ltd	Scientific Technology
IAG Insurance Australia Group	McCains Foods (Australia) Pty Ltd	Pacificca Group Technologies	Seed Solutions
IBM Australia Ltd	McDonald's Australia Limited	Pakiwi Connections Pty Ltd	Sensis Pty Ltd
Iliad Chemicals	McGauran Gianinni Soon	Pan Macmillan Australia	Shared Web Services
Iluka Resources Ltd	MedCare Systems Pty Ltd	Panbio Pty Ltd	Sialon Ceramics Pty. Ltd.
INCAT Tasmania Pty Ltd	Members Equity	Panviva Pty Ltd	Silicon Graphics Inc
Insurance Australia Group (IAG)	Memcor	Parasitech	SingTel Optus Pty Ltd
Integrated Energy Services	Merinomark P/L	Peptech Animal Health Pty Ltd.	Skilled Group
Integrated Media Pty Ltd	MG Nutritionals	Peregrine Semiconductor Australia Pty Ltd	Smorgon Steel Tube Mills
Integrated Tree Cropping Ltd	Micronisers Pty Ltd	Pfizer Australia	Snowy Hydro Limited
Integrated Vigilance Systems Pty Ltd	Microsoft Australia Pty Ltd	Pharmaxis Ltd	Softwood Tasmania Operator Ltd
Intelligent Electric Motor Solutions Pty Ltd	Mimetica Pty Ltd	Pikington (Australia) Limited	Sola International Holdings Ltd
IntelliGuard I.T. Pty Ltd	Minomic Pty Ltd	Plantation Fresh	Solar Heat and Power Pty Ltd
IntelliRAD Solutions Pty Ltd	Moran Furniture	Polarised Technology Pty Ltd	Solar Safety Management
Invensys Rail Systems Australia	Moran Health Care Group	Port Kembla Port Corporation	Soliton Network Consulting
iOmniscient Pty. Ltd.	Morgan & Wacker Pty Ltd	Poseiden Scientific Instruments	South Australian Grain Industry Trust
Janison Solutions Pty Ltd	Multiplex Construction Pty Ltd	Post Stephens Council	South East Qld Water Corporation
Janssen-Cilag	MURCOTTS driving excellence	Powercor Australia	Special Broadcasting Service
Jl Peston	Murdoch Childrens Research Institute	Proteomics International	Specialised Container Transport Limited



Illawarra Forum Inc  
 Impact: Youth Organisations Reducing Crime  
 Information and Cultural Exchange (ICE)  
 Injury Prevention and Control (Australia) Ltd  
 Institute for Eye Research  
 Islamic Council of Victoria  
 Jimmys Beach Association  
 Joan Harrison Support Services for Women Inc  
 Jobs Australia  
 K.I.D.S. Education Pty. Ltd.  
 Kangaroo Flat Secondary College  
 Kenmore State High School  
 Koala Preservation Society NSW  
 Law and Justice Foundation NSW  
 Learning Links  
 Leonora-Gwalia Historical Museum  
 Lifeline Australia Inc.  
 Lincoln Centre  
 Linux Australia Inc.  
 Loddon Mallee Housing Services  
 Mackay-Whitsunday Natural Resource Management Group  
 MacKillop Family Services  
 Macquarie Library Pty Ltd  
 Mater Christi College  
 Melbourne Citymission  
 Mental Health Review Board of Victoria  
 Mercy Hospital for Women  
 Micah Projects  
 Migrant Resource Centre of South Australia  
 Migrante Melbourne  
 Minda Incorporated  
 Mingenew-Irwin Group  
 Mission Australia  
 Moreton Bay Waterways and Catchments Partnership  
 Motor Neurone Disease Association of Victoria Inc.  
 MS Society Victoria  
 Murray Valley Citrus Board  
 Museum Victoria  
 Museums Australia  
 National centre for Vocational Education Research LTD  
 National Institute for Forensic Science  
 National Library of Australia  
 National Trust of Australia (Western Australia)  
 Nature Foundation of Australia Inc.  
 NEAMI Ltd.  
 Neporendi Aboriginal Forum Inc.  
 Neurosciences Victoria  
 New South Wales Council for Intellectual Disability  
 Nicholson Angling Club

Noel Baker Centre for School Mathematics  
 Northern Land Council  
 Northern Territory Department of Employment, Education and  
 NRMA ACT Road Safety Trust  
 NSW Rape Crisis Centre  
 Open Source Industry Australia Limited  
 Optometrists Association Australia (NSW Division)  
 Origin Energy Asset Management Services  
 Oxfam Community Aid Abroad  
 PALMS Australia  
 Panthers Entertainment Group  
 Parkinson's Victoria Inc  
 Police Association of South Australia  
 Primary Health Institute Ltd  
 Public Interest Advocacy Centre Ltd (PIAC)  
 QLD Prog.of Assi. to Survivors of Torture and Trauma  
 Queensland Aged and Disability Advocacy Inc  
 Queensland AIDS Council  
 Queensland Department of Corrective Services  
 Queensland Murray Darling Committee Inc.  
 Queensland Museum  
 Queensland Nursing Council  
 Queensland Performing Arts Centre  
 Redeemer Lutheran College  
 Relationships Australia (Victoria)  
 Relationships Australia SA  
 Retirement Village Association Ltd NSW & ACT  
 Returned and Services League  
 Riverina Citrus  
 Royal Far West Children's Health Scheme  
 Royal Flying Doctors Service [RFDS, central operations inc.]  
 Royal Zoological Society of South Australia Inc.  
 RSL (QLD) War Veteran's Homes Ltd  
 Russell Mineral Equipment Pty. Ltd.  
 Sandhurst Catholic Education Office  
 SCISCO Career Pathways  
 Scotch College  
 SCRAYP Youth Arts With an Edge  
 SEQ Western Catchments Group Inc.  
 Service Industries Skills Council  
 Sexual Health and Family Planning of Australia  
 Silver Chain  
 SIRCA  
 South Australian Chamber of Mines and Energy  
 South Coast Regional Initiative Planning Team  
 South West Aboriginal Land and Sea Council  
 South West Catchments Council  
 Spastic Centre  
 Speech Pathology Association of Australia  
 St Vincent de Paul Society Victoria Inc.  
 St Vincent Hospital  
 St. Peter's Catholic Primary School  
 Sugar Research Institute  
 Sunraysia Mallee Economic Development Board  
 Sunshine Coast Environment Council  
 Supported Housing Limited  
 Sydney Opera House  
 Sydney West Area Health Service  
 Tasmanian Conservation Trust  
 Tasmanian Farmers and Graziers Association  
 The Arts Centre  
 The Australian Ballet  
 The Australian Choreographic Centre  
 The Australian Council on Healthcare Standards  
 The Aust Pregnancy Register for Women With Epilepsy  
 The Benevolent Society  
 The Brisbane Institute  
 The Cancer Council NSW  
 The Cancer Council Victoria  
 The Council of Social Service of NSW (NCOSS)  
 The Finch Society of Western Australia  
 The Foundation for Development Cooperation (FDC)  
 The Hornery Institute  
 The National Forum  
 The Oceania Project  
 The Police Association  
 The Queensland Orchestra  
 The Smith Family  
 Turning Point Drug & Alcohol Centre  
 Unions WA  
 United Muslim Women Association  
 UnitingCare Burnside  
 VicHealth - Victorian Health Promotion Foundation  
 Victoria Law Foundation  
 Victorian AIDS Council / Gay Men's Health Centre  
 Vic Assoc for the Care and Re-settlement of Offenders  
 Victorian Foundation for Survivors of Torture  
 Vision Australia Foundation  
 Volunteering Australia  
 Waste Management Association of Australia  
 Water Services Association of Australia  
 Weeroona College Bendigo  
 Wesley College  
 Wesley Mission  
 Wesley Research Institute  
 Westmead Hospital  
 WIRES  
 Woolcock Institute of Medical Research

World Vision Australia  
 Yothu Yindi Foundation

### Non-Profit - International

AMIRA International  
 China Research Centre on Ageing  
 Electronic Music Foundation (EMF)  
 EPIDEMIC  
 IFAW Asia-Pacific  
 J. Craig Venter Institute  
 Microfinance Council of the Philippines, Inc. (MCPI)  
 Olympic Carillon International  
 Placer Dome Asia Pacific - Kanowna Belle Gold Mine  
 Save the Children UK  
 South Pacific Business Development Foundation  
 Transparency International Australia  
 TSPI (Tulay Sa Pag-Unlad Inc.) Development Corporation  
 ZKM

### Private Company - International

ABB  
 ABB Automation Technologies  
 ACNielsen  
 Agere Systems Australia  
 Albany Forest Res.Centre, OJI Paper Company Limited  
 Alcan Engineering Pty Ltd  
 Alcatel Pty Ltd  
 ALCOA World Alumina Australia  
 Anglogold Australia Limited  
 ANZ Bank Fiji  
 Arup, Risk and Security  
 AstraZeneca R&D  
 Australian Forest Corporation Pty. Ltd.  
 Baker & McKenzie  
 BAS Medical Inc  
 BHP Billiton  
 BHP Billiton Cannington  
 BHP Billiton Innovation Pty. Ltd.  
 BHP Billiton Minerals Pty Ltd - Cannington  
 BHP Billiton Mitsubishi Alliance, Central Qld Office  
 BHP Billiton Petroleum Pty Ltd  
 BlueScope Steel Limited, Port Kembla  
 BP Australasia  
 Cadence Design Systems  
 ChemGenex Pharmaceuticals Ltd.  
 Colliers International

Comalco Limited	<b>Government - State &amp; Local</b>	CJS Training Unit	Department of Main Roads
Concorde Microsystems, Inc.	ACT Chief Minister's Department	Cobar Shire Council	Department of Natural Resources and Mines
Connell Mott MacDonald Pty Ltd	ACT Department of Education and Training (ACTDET)	Commission for Children and Young People	Department of Primary Industries
Cook Australia Pty Ltd	ACT Health	Corangamite Catchment Management Authority (CCMA)	Dept of Primary Industries and Resources SA
CSL Bioplasma	Aged Pers. Mental Health Prog, Nth West, Mental Health	Cultural facilities Corporation	Department of Primary Industries Forestry
Diageo Australia	Armidale Regional Coordination Program	Dajarra State School	Department of Primary Industries NSW
ERGO Forschungsgesellschaft mbH	Art Gallery of NSW	Darwin Aquaculture Centre, Fisheries Group	Department of Primary Industries, Victoria
Ernst & Young	Arthur Rylah Institute of Environmental Research	Darwin City Council	Dept of Primary Industries, Water and Environment
Far Eastern Securities Co., Ltd.	Artlab Australia	Debney Park Secondary College	Department of Public Works, Queensland Government
FEI Company	Arts Queensland & Dept of Premier and Cabinet	Department of Natural Resources and Mines	Department of Sustainability and Environment
Fonterra Co-operative Group Limited	Auburn	Department for Environment and Heritage	Department of the Chief Minister
Ford Motor Company	Australian Centre for the Moving Image	Department for Planning and Infrastructure	Dept of the Premier and Cabinet, Govt WA
Ford Motor Company of Australia Ltd	Australian Museum	Department Main Roads, PD&E Division	Department of Treasury and Finance, Govt WA
GlaxoSmithKline	Bankstown City Council	Department of Education and Training, Victoria	Department of Victorian Communities
Holden Innovation	Bankstown Multicultural Youth Service	Department of Ag. WA	Dept of Water, Land and Biodiversity Conservation
HP Linux and Open Source Lab	Barwon Health	Department of Ageing, Disability and Home Care	Department of Water, Land and Biodiversity Conservation
Hyper Tech Research Inc	Berrimah Veterinary Laboratory	Department of Agriculture of Western Australia	Derwent Valley Council
Inovio AS	Black Dog Institute	Department of Business, Economic and Regional Dev.	Diabetes Centre
Keppel Offshore and Marine Ltd	Botanic Gardens & Parks Authority	Department of Chief Minister	Director of Public Prosecutions
Microsoft	Boulia State School	Department of Child Safety	Doomadgee State School
Moldflow Pty Ltd	Bowden Brompton Community School	Department of Communities	East Perth Redevelopment Authority
Nanon Technologies GmbH	Bremer Institute of TAFE	Department of Community Services	Economic Development Unit, Swan Hill Rural City Council
NanoMaterials Technology Pte Ltd	Bremer State High School	Department of Conservation and Land Management	Education Centre Against Violence
NIWA	Brisbane City Council	Department of Corrective Services New South Wales	Education Queensland
Novartis Animal Vaccines Ltd	Building Commission	Department of Disability, Housing and Community Services	Education Queensland District Office
Novo Nordisk Pharmaceuticals Pty Ltd	Building Commission Victoria	Department of Education	Environment ACT
Ove Arup Pty Ltd	Bundamba State Secondary College	Department of Education and Children's Services	Environment Protection Authority
Pfizer Australia	Burkeown State School	Department of Education and Training	Environment Protection Authority (South Australia)
Pfizer Pty Ltd, Animal Health	CALM	Department of Education and Training, Victoria	Environment Protection Authority (Victoria)
Pioneer Hi-Bred International Inc.	Castlemaine Secondary College	Department of Environment	Environmental Protection Agency
QNI	Casula Powerhouse Arts Centre	Department of Environment (WA)	Environmental Protection Agency QLD
Queensland Nickel Industries Pty	Central Darling Shire Council	Department of Environment and Conservation	EPA Victoria
RHEOCHEM Limited	Centre for Mental Health (NSW)	Department of Environment and Conservation NSW	EPHC State of Environment Task Force
Rio Tinto Technology Ltd.	Centre for Paediatrics, Women's and Children's Hospital	Department of Environment and Heritage South Australia	Ergon Energy
Robertson Cooper Ltd	Chemistry Centre of Western Australia	Department of Forensic Medicine	Eurobodalla Shire Council
SANTOS LTD	Children's Court of Victoria	Department of Further Education, Emp, Science and Trng	Fairfield City Council
Sanwa Kagaku Kenkyusho Co. Ltd.	City of Cockburn	Department of Health	Fairfield/Liverpool Mental Health Service
Schering pharmaceuticals	City of Greater Geelong	Department of Health and Ageing	Far West Brain Injury Service
SGI	CITY OF MELBOURNE	Department of Health and Community Services	Fisheries Group
Shanghai Yulun New Technology Co., Ltd.	City of Melville	Department of Health Western Australia	Fisheries Victoria, Department of Primary Industries
Sodexo	CITY OF MORELAND	Department of Housing and Works WA	Forensic Science South Australia
Spotless Services Limited	City of Port Phillip	Department of Human Services	Forest Practices Board
Tassal Pty Ltd	City of Rockingham	Department of Human Services - South Australia	Forest Products Commission of Western Australia
The Centeno Clinic	City of Ryde	Department of Infrastructure	Forestry Tasmania
Veolia Water Australia	City of Salisbury	Department of Infrastructure, Planning and Environment	Forests and Forest Industry Council of Tasmania
Virotec International Pty. Ltd	City of Sydney	Department of Innovation, Industry and Regional Dev.	Forests New South Wales
Webraska Australia Pty Ltd	City of Whittlesea	Department of Justice, Office of the State Coroner	Fremantle Ports
Worsley Alumina Pty Ltd	CITY OF YARRA	Department of Juvenile Justice	Geological Survey of Victoria
	City West Water Limited	Department of Lands	

Gippsland Coastal Board	Mornington Island State School	NT Office of the Commissioner for Public Employment	Queensland Rail Crime Prevention
Gold Coast City Council	Mosman Council	NT Research & Innovation Board	Queensland Studies Authority
Gold Coast Institute of TAFE	Motor Accidents Authority of NSW	NT Treasury	Queensland Transport
Gold Coast Safety Camera Network	Mt Lofty Ranges Animal and Plant Control Board	Nursing and Midwifery Office	Queensland Treasury Department
Goulburn Broken Catchment Management Authority	Multicultural Affairs Queensland	Office for the Ageing	RailCorp
Great Lake Council	Museum of Contemporary Arts	Office of Econ, and Statistical Research, QLD Treasury	Redland Shire Council
Greater Shepparton City Council	Museum Victoria	Office of Recreation and Sport	Richmond Shire Council
Griffith City Council	National Capital Authority	Office of the Adult Guardian	Richmond Valley Council
Healthy Waterways	National Gallery of Victoria	Office of the Public Advocate	River Murray Catchment Water Management Board
Healy State School	Natural Resources and Mines	Overseas Qualifications Unit, WA Dept of Ed & Training	Riverland Animal and Plant Control Board
Hornsby Shire Council	Nature Conservation Branch, Dept Prim, Ind, Water & Env	Parks Australia North (Kakadu National Park)	Roads & Traffic Authority (NSW)
Hunter Brain Injury Service	Nepean Hospital, Wentworth Area Health Service	Parks Victoria, Dept of Sustainability and Environment	Royal Botanic Gardens Melbourne
Hunter Mental Health	New England Brain Injury Rehabilitation Service	Penrith City Council	Royal Brisb. and Women's Hospital Research Foundation
Hunter Population Health	New South Wales Department for Women	Penrith Regional Gallery	Royal Childrens' Hospital Education Institute
Hunter Water	New South Wales Department of Education and Training	PIRSA - Fisheries	Royal Women's Hospital
Illawarra Brain Injury Service	New South Wales Fire Brigade	Policy & Science Division, NSW Dept of Env & Cons.	SA Department for Environment and Heritage
Illawarra Regional Coordination Program	North Central Catchment Management Authority	Power House Museum	SA Department of Health
Independent Safety Transport and Reliability Regulator	North Coast Head Injury Service	Primary Industries and Resources South Australia	SA Water
Indigenous Education and Training Alliance	North East Catchment Management Authority	Primary Industries Research Victoria	School of Languages
Indigenous Issues Unit, Department of Justice	North Sydney Council	Primary Industry and Resources South Australia	Senior Secondary Assessment Board of South Australia
Institute of Dental Research	Northern Metropolitan Community Health Service	Princess Alexandra Hospital	Shanghai Municipal Labour and Social Security Bureau
Intellectual Disability Services Council	Northern Territory Dept of Health and Comm. Services	Private Forests Tasmania	Shire of Campaspe
Ipswich City Council	NT Department of Employment, Education and Training	Public Transport Authority of Western Australia	Shire of Leonora
JS Battye Library of West Australian History	NT Dept of Primary Ind., Fisheries and Mines	QDPI&F	Shire of Strathbogie
Justice Health	Northern Territory Geological Survey	QFleet	Shire of Wagin
Knox City Council	Northern Territory Research & Innovation Board	Qld Crime and Misconduct Commission	Social Inclusion Unit, Dept of Premier and Cabinet
Koorringal High School	Northern Territory Treasury	Qld Department of Corrective Services	SA Department of Education and Children's Services
LandCorp (Western Australian Land Authority)	NSW Agriculture	Qld Dept of Local Govt, Planning, Sport and Recreation	SA Govt, Dept of Education and Children's Services
Legal Aid Queensland	NSW Cabinet Office	Qld Dept. of Communities	South Australian Museum
Liverpool Health Service	NSW Department of Commerce	QR	South East Health
Logan City Council	NSW Department of Community Services	Queensland Academy of Sport	South East Water Ltd
Mackay City Council	NSW Department of Education and Training	Queensland Commission for Children and Young People	South West Brain Injury Rehabilitation Service
Magistrates Court	NSW Department of Environment and Conservation	Queensland Department of Housing	Southbank Institute of TAFE
Magistrates Court, Northern Territory	NSW Department of Health	Queensland Department of Main Roads	Southern Area (Goulburn) Brain Injury Service
Magistrates Court, South Australia	NSW Department of Housing	Queensland Department of Main Roads	Southern Health
MAIC (QLD)	NSW Dept of Infrast., Planning and Natural Resources	Queensland Dept of Natural Resources and Mines	State Library of NSW
Malle Catchment Management Authority	NSW Department of Primary Industries	Queensland Dept of Primary Industries and Fisheries	State Library of Victoria
Maribyrnong City Council	NSW Dept Health	Queensland Environmental Protection Agency	State Library of Western Australia
Maroochy Shire Council	NSW Dept of Education and Training	Queensland government	State Records NSW
Melbourne Water	NSW Department of Natural Resources	Queensland Government Office for Women	State Records of South Australia
Mental Health Review Tribunal NSW	NSW Fisheries	Queensland Government, Dept of Emergency Services	State Records Office of Western Australia
Mental Health Tribunal ACT	NSW Health	Queensland Health	Subiaco Redevelopment Authority
Merrimac State High School	NSW Independent Commission Against Corruption	Queensland Herbarium, Env. Protection Agency	Sunset State School
MFESB	NSW Maritime	Queensland Investment Corporation	Sydney Catchment Authority
Mid Western Brain Injury Rehabilitation Service	NSW Ombudsman	Queensland Museum	Sydney Ports Corporation
Midland Redevelopment Authority	NSW Police	Queensland Office of the Public Advocate	Sydney Water
Milperra State High School	NSW Premiers Department	Queensland Ombudsman	Tasmania Police
Moira Shire	NT Department of Employment, Education and Training	Queensland Police Service	
Moreton Bay Waterways and Catchments Partnership	NT Dept of Nat, Resources, Environment and the Arts	Queensland Rail	

Tasmanian Department of Education  
 The Brisbane Festival  
 The Canberra Hospital  
 The Children's Hospital at Westmead  
 The Department of Environment and Heritage  
 The Migration Museum  
 The Royal Women's Hospital  
 The South Australian Museum  
 Toowoomba Health Service District  
 Tourism Tasmania  
 Town of Kwinana  
 Town of Vincent  
 Transcultural Mental Health Centre  
 TransGrid  
 Transport Accident Commission Victoria  
 Urandangi State School  
 Vic Roads  
 VicHealth  
 VICNET  
 Victoria Police  
 Victorian Auditor-General's Office  
 Victorian Department of Education and Training  
 Victorian Department of Human Services  
 Victorian Department of Primary Industries  
 Victorian Department of Sustainability & Environment  
 Victorian Department of Treasury and Cabinet  
 Victorian EPA  
 Victorian Health Promotion Foundation  
 Victorian Multicultural Commission  
 Victorian Office of the Public Advocate  
 Victorian Schools Innovation Commission  
 VicUrban  
 WA Corruption and Crime Commission  
 WA Department of Education and Training  
 WA Office of the Public Sector Standards Commissioner  
 WA Parliamentary Comm. for Admin. Investigations  
 Warringah Council  
 Water Corporation  
 Waterwatch Victoria  
 West Australian Auditor-General's Office  
 West Australian Department of Education and Training  
 Western Australia Department of Environment  
 Western Australian Dept of Cons, and Land Management  
 Western Australian Museum  
 Western Hospital,  
 Western Sydney Area Health Service  
 Western Sydney Regional Organisation of Councils  
 Westmead Hospital  
 William Buckland Radiotherapy Centre

Women's and Children's Hospital  
 WorkCover Corporation SA  
 Wyong Shire Council  
 Youth Education Centre  
 Zoological Parks Board of NSW

#### Government - Commonwealth

Airservices Australia  
 Army History Unit  
 Attorney General's Department  
 AusAID  
 Austrade  
 Australia Council for the Arts  
 Australia Post  
 Australian Agency for International Development (AusAID)  
 Australian Building Codes Board  
 Australian Bureau of Meteorology  
 Australian Bureau of Statistics  
 Australian Customs Service  
 Australian Federal Police  
 Australian Film Commission  
 Australian Government Analytical Laboratory  
 Australian Government Department of Health & Ageing  
 Australian Government Productivity Commission  
 Australian Greenhouse Office  
 Australian Institute of Sport  
 Australian Maritime Safety Authority  
 Australian Plague Locust Commission  
 Australian Public Service Commission  
 Australian Taxation Office  
 Australian Transport Safety Bureau  
 Australian War Memorial  
 Australian Water Quality Centre  
 Bureau of Meteorology  
 Bureau of Rural Sciences  
 Central Land Council  
 Centrelink  
 City of Mandurah  
 Commonwealth Ombudsman  
 Commonwealth Rehabilitation Service Australia  
 Crime Prevention Queensland  
 Defence Health Service  
 Department of Agriculture, Fisheries & Forestry  
 Department of Communications, IT and the Arts  
 Department of Defence  
 Department of Education and Children's Services  
 Department of Education and the Arts  
 Department of Education Science and Training

Department of Employment and Workplace Relations  
 Department of Environment and Heritage  
 Department of Family and Community Services  
 Department of Finance and Administration  
 Dept of Immigration and Multicultural and Indig. Affairs  
 Department of Industry, Tourism and Resources  
 Department of Prime Minister and Cabinet  
 Department of the Environment and Heritage  
 Department of the Treasury  
 Department of Transport and Regional Services (DOTARS)  
 Department of Veterans Affairs  
 Dept of Defence, Corp. Services and Infrs. NT/ Kim.  
 DHI Water & Environment Pty Ltd  
 DPI Forestry  
 Environmental Protection Agency  
 ForestrySA  
 Gold Coast Hospital  
 Great Barrier Reef Marine Park Authority  
 High Court of Australia  
 Human Rights and Equal Opportunity Commission  
 Hunter-Central Rivers Catchment Management Authority  
 IP Australia  
 IPS Radio and Space Services  
 Ipswich Waste Services (Ipswich City Council)  
 Janganpa Aboriginal Corporation  
 Landcare Research  
 Local Government Association of Queensland Inc.  
 Murray-Darling Basin Commission  
 National Archives of Australia  
 National Gallery of Australia  
 National Institute of Forensic Science  
 National Library of Australia  
 National Museum of Australia  
 National Nursing and Nurse Education Taskforce  
 Naval Heritage Collection  
 NEPC Service Corporation  
 New South Wales Commission for Children and Young People  
 New South Wales Teachers Federation  
 Norfolk Island Central School  
 Norfolk Island Government  
 Norfolk Island Museum  
 Northern Australia Quarantine Strategy-Australian Quarantine & Inspection Service  
 Office of Indigenous Policy and Coordination  
 Parks Australia  
 Public Transport Authority of Western Australia  
 Queensland Sea Scallop Ltd  
 RAAF Museum  
 Royal Prince Alfred Hospital  
 Shire of Busselton

Southern Health  
 Surfers Paradise Management Association Limited  
 The Australia Council of the Arts  
 The Northern Land Council  
 The Salvation Army Crisis Services

#### Government - International

Bank Rakyat Indonesia  
 Department of Training and Employment  
 Embassy of the Republic of Korea  
 Environmental Agency (UK)  
 Land Transport Safety Authority  
 Ministry of Education  
 National Council for Curriculum and Assessment  
 National Museum of Contemporary Art, Korea  
 NOAA/NESDIS/ORA/ORAD  
 Statistics Netherlands (CBS)  
 Swedish National Road Authority  
 UNDP Indonesia  
 UNESCO

**1 Partner organisations and organisation classifications shown are those listed on the proposal approved by the Minister. Changes may subsequently have been made to the number or nature of the partner organisations involved.**

## ATTACHMENT 4

### ARC CENTRES OF EXCELLENCE AND RESEARCH NETWORKS<sup>1</sup>

ARC Centres of Excellence 2005	Centre Director	Centre Administering Organisation	Partner Organisations
ARC Centre of Excellence in Antimatter-Matter Studies	Buckman, S	The Australian National University	Biomolecular Research Institute; CSIRO - Manufacturing and Infrastructure Technology; Drake University; Griffith University; Murdoch University; The Flinders University of South Australia; The Lawrence Berkeley National Laboratory; The Open University; The University of California Davis; The University of California San Diego; The University of Munster; The University of Nebraska - Lincoln; The University of Western Australia; Tohoku University Japan.
ARC Centre of Excellence in Creative Industries and Innovation	Cunningham, S	Queensland University of Technology	Australasian CRC for Interaction Design; Australian Film Commission; Australian Film Television and Radio School; Australian Museum; Department of Communications, Information Technology and the Arts; Edith Cowan University; National Museum of Australia; Northern Territory University; Queensland Museum; State Library of Queensland; Swinburne University of Technology; The Australia Council for the Arts; The Australian National University; The Salvation Army; University of Wollongong.
ARC Centre of Excellence in Coherent X-ray Science	Nugent, K	The University of Melbourne	Advanced Photon Source; Australian Synchrotron Research Program; CSIRO - Health Sciences and Nutrition; CSIRO - Manufacturing and Infrastructure Technology; La Trobe University; Lawrence Livermore National Laboratory; Monash University; National University of Singapore; SPring8, Riken; Swinburne University of Technology; University of California, Los Angeles; Victorian Department of Innovation, Industry and Regional Development; Walter and Eliza Hall Institute of Medical Research.
ARC Centre of Excellence in Structural and Functional Microbial Genomics	Adler, B	Monash University	Australian Genome Research Facility Ltd; Australian Proteome Analysis Facility; CSIRO - Livestock Industries; Department of Innovation, Industry and Regional Development; Department of Primary Industries, Victoria; Pfizer Australia; The University of Queensland; The University of Sydney; Victorian Bioinformatics Consortium; Victorian Partnership for Advanced Computing.
ARC Centre of Excellence in Vision Science	Lamb, T	The Australian National University	Swiss Federal Institute of Technology (EPFL); Centre for Information Science, Kokushikan University; CSIRO - ICT Centre; Emory University; Helsinki University of Technology; ObjectiVision; Regenera; Royal Holloway University of London; Seeing Machines; Smith-Kettlewell Eye Research Institute; The University of Queensland; The University of Sydney; The University of Western Australia; Universitaet Bielefeld; University of L'Aquila.

ARC Centre of Excellence in Coral Reef Studies	Hughes, T	James Cook University	Australian Institute of Marine Science (AIMS); CSIRO - Marine Resaerch; Doulgas Shire Council; Great Barrier Reef Marine Park Authority; Great Barrier Reef Research Foundation; Mackay City Council; Mackay-Whitsunday Natural Resource Management Group; Stockholm University; The Australian National University; The University of Queensland; University of Delaware; University of Maine; University of Perpignan; Voyages Hotels and Resorts.
ARC Centre of Excellence for Free Radical Chemistry and Biotechnology	Schiesser, C	The University of Melbourne	Bluescope Steel; Carlton United Brewery; CSIRO - Molecular Science; Dulux/ Orica Pty Ltd; Monash University; Queensland University of Technology; The Australian National University; The Howard Florey Institute; The University of Sydney; Victorian Institute for Chemical Sciences.
ARC Centre of Excellence for Electromaterials Science	Wallace, G	University of Wollongong	Bionic Ear Institute; Monash University; NSW Department of State and Regional Development.
ARC Centre of Excellence in Plant Energy Biology (CPEB)	Small, I	The University of Western Australia	The Australian National University; The University of Sydney.
ARC Centre of Excellence in Design in Light Metals	Muddle, B	Monash University	Deakin University; Department of Innovation, Industry and Regional Development; The University of Melbourne; The University of New South Wales; The University of Queensland; The University of Sydney.
ARC Centre of Excellence in Ore Deposits	Large, R	University of Tasmania	AMIRA International; Anglo American; Anglo Gold Ashanti; Barrick; BHP Billiton; Colorado School of Mines; CSIRO - Exploration & Mining; Johns Hopkins University; Minerals Council of Australia; Newcrest Mining Limited; Newmont Mining Corporation; Rio Tinto; State Government of Tasmania; Teck Cominco Limited; The Australian National University; The University of Melbourne; The University of Queensland; University of British Columbia; WMC Resources Ltd; Zinifex Limited.
<b>ARC Centres of Excellence 2003</b>	<b>Centre Director</b>	<b>Centre Administering Organisation</b>	<b>Partner Organisations</b>
ARC Centre of Excellence in Biotechnology and Development	Aitken, R	The University of Newcastle	Department of State and Regional Development, NSW Government; Department of State and Regional Development, QLD Government; Monash University; The University of Melbourne; The University of Queensland.
ARC Centre of Excellence for Quantum-Atom Optics	Bachor, H	The Australian National University	Imperial College; Swinburne University of Technology; The University of Queensland; Universitaet Erlangen; Universitat Hannover; Universite Pierre et Marie Curie; University of Auckland; UNIVERSITY OF OTAGO ; Vrije Universiteit.
ARC Centre of Excellence in Quantum Computer Technology	Clark, R	The University of New South Wales	Department of Defence; Department of State and Regional Development - NSW Government; Griffith University; Hewlett Packard Laboratories; Los Alamos National Laboratory; Macquarie University; Ohio State University; The University of Melbourne; The University of Queensland; The University of Sydney; UNSW @ Australian Defence Force Academy ; US Army Research Office / NSA / ARDA.

ARC Centre of Excellence for Autonomous Systems	Durrant-Whyte, H	The University of Sydney	The University of New South Wales; University of Technology, Sydney.
ARC Centre of Excellence for Ultrahigh-bandwidth Devices for Optical Systems (CUDOS)	Eggleton, B	The University of Sydney	Macquarie University; NSW Department of Information Technology Management; Swinburne University of Technology; The Australian National University; University of Technology, Sydney.
ARC Centre of Excellence for Integrative Legume Research	Gresshoff, P	The University of Queensland	The Australian National University; The University of Melbourne; The University of Newcastle.
ARC Centre of Excellence for Mathematical and Statistical Modelling of Complex Systems (MASCOS)	Guttmann, A	The University of Melbourne	La Trobe University; The Australian Mathematical Sciences Institute; The Australian National University; The University of New South Wales; The University of Queensland.
ARC Centre of Excellence for Advanced Silicon Photovoltaics and Photonics	Wenham, S	The University of New South Wales	FOM Institute, Netherlands; Max Planck Institute for Microstructures, Germany; Pacific Solar, Australia.
<b>ARC Centres</b>	<b>Centre Director</b>	<b>Centre Administering Organisation</b>	<b>Partner Organisations</b>
ARC Centre for Complex Dynamic Systems and Control	Middleton, R	The University of Newcastle	BHP Billiton; Department of State and Regional Development, NSW Government; Industrial Automation Services; Matrikon.
ARC Centre for Perceptive and Intelligent Machines in Complex Environments	Jarvis, R	Monash University	Curtin University of Technology; Kungliga Tekniska Hogskolan (KTH); Nanyang Technological University; Osaka University; The Australian National University; The University of Melbourne; University of Alberta; University of Karlsruhe; University of Massachusetts; University of South Florida; University of Texas Arlington.
ARC Centre for Structural and Functional Microbial Genomics <sup>2</sup>	Adler, B	Monash University	Australian Genome Research Facility Ltd; Australian Proteome Analysis Facility; CSIRO - Livestock Industries; CSL Limited; Cytosia P/L; The University of Queensland; The University of Sydney; Victorian Bioinformatics Consortium; Victorian Institute of Animal Science; Victorian Partnership for Advanced Computing.
ARC Centre for Solar Energy Systems	Blakers, A	The Australian National University	Murdoch University; Origin Energy, Generation Division.
ARC Centre for Genome-Phenome Bioinformatics	Ragan, M	The University of Queensland	IBM Australia; James Cook University; Queensland University of Technology; The Australian National University; The University of Colorado; The University of Newcastle; The University of Sydney.
ARC Centre for Kangaroo Genome	Graves	The Australian National University	Australian Genome Research Facility; Macquarie University; The University of Melbourne; Walter and Eliza Hall Institute of Medical Research.
ARC Centre for Functional Nanomaterials <sup>3</sup>	Lu, G	The University of Queensland	CSIRO - Manufacturing and Infrastructure Technology; CSIRO - Molecular Science; CSIRO - Petroleum Resources; CSIRO - Telecommunications & Industrial Physics; IBM Almaden Research Center; The Australian National University; The University of New South Wales; The University of Queensland; University of Western Sydney; Washington University St Louis.

ARC Centre for Nanostructured Electromaterials	Wallace, G	University of Wollongong	CSIRO - Manufacturing Science and Technology; CSIRO - Molecular Science; CSIRO - Textile & Fibre Technology; Delft University of Technology; Department of State and Regional Development, NSW Government; Massey University; Monash University; Nankai University; The Bionic Ear Institute; The University of Melbourne; University of Akron.
ARC Centre for Complex Systems (ACCS)	Lindsay, P	The University of Queensland	Boeing Australia Limited; Centre National de la Recherche Scientifique, France; Charles Sturt University; Department of Natural Resources & Mines; Griffith University; Hewlett Packard; Indian Institute of Technology, India.; Monash University; The University of New South Wales.
<b>Special Research Centres</b>	<b>Centre Director</b>	<b>Centre Administering Organisation</b>	<b>Partner Organisations</b>
Centre for Green Chemistry	Hearn, M	Monash University	CSIRO, Forestry & Forestry Products; CSIRO, Manu. Science & Technology; CSIRO, Minerals; CSIRO, Molecular Sciences; H R L Technology Pty Ltd.
Centre for Particle and Material Interfaces	Ralston, J	University of South Australia	
Centre for Cognitive Science and Cognitive Neuropsychology	Coltheart, M	Macquarie University	The University of Melbourne
Centre for Particulate Fluids Processing Centre	Stevens (ex Boger)	The University of Melbourne	
Centre for Environmental Stress and Adaptation Research (CESAR)	Batterham (ex Hoffmann)	La Trobe University-transferred to Uni Melb (1 July 2005)	Agriculture Victoria; Melbourne Water; Monash University; Novartis.
Centre for Molecular Genetics of Development	Saint, R	The University of Adelaide	Bresagen Pty. Ltd.; Children's Medical Research Institute.
Centre for Ultra-Broadband Information Networks (CUBIN)	Tucker, R	The University of Melbourne	Aust. Photonics CRC; CRC-BTN; Hewlett Packard Labs; Nortel Networks; Redfern Broadband Networks; SERC (RMIT); Virtual Photonics.
Centre for Functional and Applied Genomics	Mattick, J	The University of Queensland	
Centre for Applied Philosophy and Public Ethics	Miller, S	Charles Sturt University	The University of Melbourne

<b>ARC Research Networks</b>	<b>Network Convenor</b>	<b>Administering Organisation</b>
The Economic Design Network: Practical Policy Tools for Industry, Infrastructure, Services and the Environment	Bardsley, P	The University of Melbourne
Financial Integrity Research Network	Chiarella, C	University of Technology, Sydney
Enabling Human Communication: Tough problems in human communication with bold but informed solutions drawing on sound, speech, and language research capabilities.	Dale, R	University of Western Sydney
Complex Open Systems Network (COSNet)	Dewar, R	The Australian National University
Asia-Pacific Futures Network	Edwards, L	The Australian National University

Fluorescence Applications in Biotechnology and Life Sciences	Goldys, E	Macquarie University
Discovering the past and present to shape the future: networking environmental sciences for understanding and managing Australian biodiversity	Hill, R	The University of Adelaide
Australian Nanotechnology Network	Jagadish, C	The Australian National University
ARC Research Network in Ageing Well	Kendig, H	The University of Sydney
Molecular and Materials Structure Network	Keper, C	The University of Sydney
Research Network for a Secure Australia (RNSA)	Mendis, P	The University of Melbourne
ARC Research Network in Enterprise Information Infrastructure (EII)	Orlowska, M	The University of Queensland
ARC Research Network on Intelligent Sensors, Sensor Networks and Information Processing	Palaniswami, M	The University of Melbourne
The ARC Earth System Science Network	Pitman, A	Macquarie University
Australian Communications Research Network	Rasmussen, L	University of South Australia
ARC Research Network in Genes and Environment in Development (NGED)	Richards, R	The University of Adelaide
The Governance Research Network (GovNet)	Sampford, C	Griffith University
ARC Research Network for Early European Research	Sharpe, P	The University of Western Australia
Australian Research Council Network for Parasitology	Smith, N	University of Technology, Sydney
ARACY/ARC Research Network: Future Generation	Stanley, F	The University of Western Australia
ARC Research Network in Spatially Integrated Social Science	Stimson, R	The University of Queensland
The Cultural Research Network	Turner, G	The University of Queensland
Australia-New Zealand Research Network for Vegetation Function	Westoby, M	Macquarie University
Australian Research Network for Advanced Materials	Williams, J	The Australian National University

<sup>1</sup> Partner organisations shown are those listed on the proposal approved by the Minister. Changes may subsequently have been made to the number or nature of the partner organisations involved.

<sup>2</sup> This Centre was funded as an ARC Centre of Excellence in the 2005 round.

<sup>3</sup> This Centre was funded as an ARC Centre of Excellence in the 2005 round and is known as the ARC Centre of Excellence for Electromaterials Science.