



Australian Government

Australian Research Council

**Submission
to the
National Research Infrastructure Taskforce**

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TABLE OF CONTENTS

TABLE OF CONTENTS	2
1 Executive Summary	4
2 Introduction	5
3 Context.....	5
4 Issues and opportunities	8
4.1 Moving towards an integrated strategy	8
4.1.1 Minor / Project-specific Infrastructure	9
4.1.2 Non-recurrent Infrastructure costs	9
4.1.3 Subscription Costs.....	10
4.1.4 Major Infrastructure.....	10
4.1.5 Cabinet decisions	11
4.1.6 Summary	11
4.2 Co-ordination and collaboration	11
4.3 Level of funding.....	12
4.3.1 Institutional / Deep Infrastructure	12
4.3.2 Minor / Project-specific Infrastructure	12
4.3.3 Systemic infrastructure	13
4.3.4 Medium-level infrastructure (up to \$5M per item or per annum).....	13
4.3.5 Major Infrastructure (beyond \$5M)	14
5 Foundations for a nationally integrated strategy	14
5.1 Principle 1: Excellence as the basis for research investment	14
5.2 Principle 2: Co-ordination and collaboration	15
5.3 Principle 3: Efficiency and effectiveness.....	16
5.4 Principle 4: Accountability and good governance	17
5.5 An integrated infrastructure model.....	18

ABBREVIATIONS

AIMS	Australian Institute of Marine Science
AMIRA	Australian Minerals Industry Research Association
ANSTO	Australian Nuclear Science and Technology Organisation
ARC	Australian Research Council
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEST	Department of Education, Science and Training
DSTO	Defence Science and Technology Organisation
EFTSU	Equivalent Full-time Student Unit
GA	Geosciences Australia
ICT	Information and Communications Technology
IGS	Institutional Grants Scheme
LIEF	Linkage-Infrastructure: Equipment and Facilities
MNRF	Major National Research Facilities
NHMRC	National Health and Medical Research Council
NSF	National Science Foundation (US)
OECD	Organisation for Economic Cooperation and Development
PFRA	Publicly Funded Research Agency
RIBG	Research Infrastructure Block Grants
SII	Systemic Infrastructure Initiative

1 Executive Summary

Adequate access to high-quality infrastructure - minor and major - is absolutely essential to maintaining and enhancing the vitality of Australian research. Indeed, the emergence and resurgence of vibrancy in entire research fields rests often on breakthroughs in experimental tools and techniques. Eight of the past twenty Nobel prizes in Physics have been awarded for the development of new instrumental technology. Much of the explosive transformation of Biology relies on equipment and techniques that emerge rapidly and then become superseded within only a few years. Rapid advances in capacity to access and manipulate enormous, heterogeneous data sets describing people and society are transforming many of the Social and Health Sciences. Active participation in the design and development of a research field's new techniques and tools is often the characteristic that defines the world-leading research teams in that field.

Australia's current system for providing research infrastructure is far from satisfactory. Limited attention is paid to aligning investments in infrastructure with the needs of Australia's best researchers. Funding streams are complex, irregular and unpredictable. The objectives of funding programs overlap in some respects but still leave large gaps in provision. The current system lacks transparency, accountability, effectiveness and efficiency. The vibrancy of Australian research requires responsive provision of access and vigorous renewal of infrastructure. There is a pressing need for an integrated national strategy to provide infrastructure that keeps pace with rapidly advancing research developments.

The ARC strongly believes that, in Australia, arrangements for allocating public funds for research should focus on the achievement of world-class research and research training to ensure Australia develops and maintains high-quality and innovative research, highly respected in a global context. Flexible and responsive programs should support the varied needs and opportunities of research. Institutions should be encouraged to concentrate their resources and engage in strategic collaborations, so as to build critical mass in their particular strengths, thus providing the optimal conditions for maintaining excellence over the long term. Individual researchers and research teams, including research students, should have access to an environment that fosters excellent research.

In the ARC's view, the most effective way to reform the funding system for providing world-class infrastructure would be to allocate Commonwealth infrastructure funding through an integrated, largely fully funded, contestable model, accessible by higher education institutions, publicly funded research agencies, and other research active institutions. The major part of Commonwealth funding for recurrent and non-recurrent expenditure on infrastructure would be driven through competitive programs such as those of the ARC and the NHMRC.

Such an approach to infrastructure funding would significantly improve the efficiency and effectiveness of research in Australia through (i) aligning the provision of infrastructure with the needs of the most outstanding researchers, (ii) coherently and systematically planning the strategic investment of Commonwealth funding in research infrastructure to maximise national benefit; (iii) providing a single point of contact for potential co-investors (including State and Territory governments, private-sector investors, and potential international partners), and (iv) enhancing transparency and accountability arrangements.

The ARC wishes to stress that contestable allocation of infrastructure is a sound way to deal with inevitable tight limits on available infrastructure funding. A contestable approach stimulates co-ordination and co-operation as potential applicants strengthen their proposals through constructive optimisation. Contestability is a tried and proven method for identifying outstanding opportunities for investment in research.

2 Introduction

A nation's innovative capacity - its national innovation system - is seen as vital to the process of future value creation and competitiveness in the 21st Century. National innovation systems comprise all the institutions, people, and processes that create, share and use new knowledge and, importantly, the collaborative linkages and interactions between them. They include government, higher education and business elements.

Within the Australian innovation system, the ARC is responsible for identifying and investing in the highest-quality research that has the potential to deliver the greatest impact in the form of economic, social and environmental returns to the community. To ensure that national benefit derives from research excellence, the ARC supports a continuum of research activities, from "blue sky" discovery research to research that is intimately linked to the strategic requirements of industry. This encourages the transfer of ideas through to their utilisation.

High-quality research requires a balance of investment in *people* and in *equipment and facilities*. In respect of investment in equipment and facilities, the ARC welcomes the opportunity to provide a submission to the National Research Infrastructure Taskforce concerning the development of a nationally integrated research infrastructure strategy to apply to public higher education institutions and all publicly funded research agencies. Whilst acknowledging that the Taskforce intends to concentrate its attention on the provision of *major* items of infrastructure, the ARC stresses that a nationally integrated strategy must ultimately address the provision of *all* research infrastructure. As described in this submission, there are important issues concerning the provision of project-specific and other "minor" infrastructure that intertwine with the provision of access to major infrastructure.

Adequate access to high-quality infrastructure - minor and major - is absolutely essential to maintaining and enhancing the vitality of Australian research. Indeed, the emergence and resurgence of vibrancy in entire research fields rests often on breakthroughs in experimental tools and techniques. Eight of the past twenty Nobel prizes in Physics have been awarded for the development of new instrumental technology. Much of the explosive transformation of Biology relies on equipment and techniques that emerge rapidly and then become superseded within only a few years. Rapid advances in capacity to access and manipulate enormous, heterogeneous data sets describing people and society are transforming many of the Social and Health Sciences. Active participation in the design and development of a research field's new techniques and tools is often the characteristic that defines the world-leading research teams in that field.

3 Context

Australia's current system for providing research infrastructure is far from satisfactory. Limited attention is paid to aligning investments in infrastructure with the needs of Australia's best researchers. Funding streams are complex, irregular and unpredictable. The objectives of funding programs overlap in some respects but still leave large gaps in provision. The current system lacks transparency, accountability, effectiveness and efficiency.

The current system provides Commonwealth funding for infrastructure through many programs, most significantly:

Institutional Grants Scheme (IGS)

The Institutional Grants Scheme supports institutions' research and research training activities. The scheme commenced in 2002, replacing the Research Quantum and the Small Research Grants Scheme. IGS funding is distributed across universities by a formula based on research

income (60 per cent) and publications (10 per cent), using the two most recent years' data, and higher degree research student places (EFTSU) (30 per cent) using the previous year's data.

Administered by: Department of Education, Science and Training

Amount: 284.6 million in 2003-04

Frequency: Annual

Use of funds: Allocated by universities within broad guidelines

Research Infrastructure Block Grants (RIBG)

The objective of the Research Infrastructure Block Grants (RIBG) scheme is to support high-quality research by:

- meeting project-related infrastructure costs associated with Australian competitive grants;
- ensuring that areas of recognised research potential have access to the support necessary for their development;
- enhancing support for areas of existing research strength; and
- remedying deficiencies in research infrastructure.

The scheme allocates grants to publicly funded universities on the basis of an index which measures institutional success in obtaining competitively awarded research funding. RIBG allocations, which can be paid to universities only, are derived from data collected for the two most recent calendar years.

Administered by: Department of Education, Science and Training

Amount: \$160.3 million in 2003-04

Frequency: Annual

Use of funds: Allocated by universities within broad guidelines

Systemic Infrastructure Initiative (SII)

The Systemic Infrastructure Initiative, established as part of *Backing Australia's Ability*, provides \$246 million over five years to upgrade the basic infrastructure of universities to support research and training.

The objective of SII is to:

- provide funding for innovative approaches which link or expand access to shared facilities or high priority investments that will bring sector-wide strategic benefits.

In the first year of SII (2002), \$22 million was provided for 22 proposals from 19 universities to strengthen 'overhead' resources to support high-quality research and research training. In the second year (2003), a strategic approach was adopted to target funding to the key areas of high performance computing, information infrastructure, bandwidth and technical data standards to facilitate interoperability. An expert committee was established for each of these areas, to identify and recommend funding for areas of information infrastructure and bandwidth of high importance to the research community. Funding for projects being identified by these committees will be paid over the period 2003-2005.

Administered by: Department of Education, Science and Training

Amount: \$246 million over five years from 2001

Frequency: targeted by committees on a call for proposals basis

Use of Funds: the operation of facilities such as libraries, computing centres, animal houses, herbaria and experimental farms; the purchase, hire, installation and

maintenance of equipment; telecommunications; and salaries and services for support staff.

Major National Research Facilities (MNRF)

A one-off round of funding for Major National Research Facilities was provided in 1996. There were no provisions at that time for a subsequent round. In 2001 a subsequent round was announced as part of *Backing Australia's Ability*, and \$155 million was provided over five years to a Major National Research Facilities program.

The objectives of the MNRF program are to establish major research facilities that:

- Improve Australia's capability in science, engineering and technology;
- Maintain and enhance Australia's international scientific and industrial competitiveness; and
- Support the rapid commercialisation of research results.

Administered by: Department of Education, Science and Training

Amount: \$155 million over five years from 2001

Frequency: Single round, held in 2001

Use of funds: expensive, large equipment items or highly specialised laboratories that are vital for conducting leading-edge research in science, engineering and technology. Funding for the operating costs may be provided, but not beyond the five-year time frame of the program.

Linkage-Infrastructure: Equipment and Facilities (LIEF)

Linkage-Infrastructure: Equipment and Facilities is an element of the ARC National Competitive Grants program.

The objectives of LIEF are to

- encourage institutions to develop collaborative arrangements among themselves, across the higher education sector and with organisations outside the sector, in order to develop research infrastructure;
- support large-scale cooperative initiatives involving two or more institutions, thereby allowing expensive facilities to be shared;
- enhance support for areas of research strength; and
- ensure that researchers in fields of recognised research potential have access to the support necessary for development.

Administered by: Australian Research Council

Amount: \$25 million per annum

Frequency: Annual

Use of funds: major facilities and equipment, but not small items of equipment, including associated indirect costs. It excludes any direct project costs that can be covered from other sources of funding. LIEF may fund non-capital aspects of library and information infrastructure. LIEF funds some subscriptions to international facilities.

Program and/or special funding for Publicly-Funded Research Agencies (PFRA)

Organisations such as CSIRO, the Australian Nuclear Science and Technology Organisation (ANSTO), the Defence Science and Technology Organisation (DSTO), the Australian Institute

of Marine Science (AIMS) and Geoscience Australia (GA), undertake mission-oriented research funded in part by the Commonwealth. In pursuit of these missions, PFRAAs acquire and operate appropriate research infrastructure, either alone or in collaboration with other organisations.

Grants from Departments and Agencies

Commonwealth portfolios sometimes provide funding for research infrastructure that will allow a research organisation or collaborations of organisations to improve their capacity to undertake research of importance to that portfolio.

A number of industry associations (such as the Australian Minerals Industry Research Association (AMIRA)) and the industry co-funded Rural Research and Development Corporations (such as the Grains Research and Development Corporation (GRDC)) similarly provide funding for infrastructure that will support specific research programs.

Cabinet-level allocations

In exceptional circumstances the Government will decide to support individual high-cost items of infrastructure through a Cabinet-level allocation of funding specifically targeted to that item of infrastructure.

Examples of Cabinet-level funding for research infrastructure include the New Research Reactor (\$286.4 million allocated in 1997), the Australia Telescope (\$45 million allocated as a Bicentennial Project in 1983), and funding appropriated under the *Anglo-Australian Telescope Act 1977* (approximately \$3.9M per annum in 2002/3 prices).

4 Issues and opportunities

The vibrancy of Australian research requires responsive provision of access and vigorous renewal and replacement of infrastructure. There is a pressing need for an integrated national strategy to provide infrastructure that keeps pace with rapidly advancing research developments.

The ARC strongly believes that, in Australia, arrangements for allocating public funds for research should focus on the achievement of world-class research and research training to ensure Australia develops and maintains high-quality and innovative research, highly respected in a global context. Flexible and responsive programs should support the varied needs and opportunities of research. Institutions should be encouraged to concentrate their resources and engage in strategic collaborations, so as to build critical mass in their particular strengths, thus providing the optimal conditions for maintaining excellence over the long term. Individual researchers and research teams, including research students, should have access to an environment that fosters excellent research.

4.1 Moving towards an integrated strategy

The provision of funding for infrastructure is a complex matter that can be viewed from many perspectives including: (i) disciplinary focus, (ii) acquisition and access modes, including direct purchase, local construction, leasing or engagement with an international facility, (iii) arrangements for balancing the funding of capital and recurrent expenditure, (iv) the size and geographical distribution of the user base, and (v) ownership defined broadly. The complex interplay among these perspectives has possibly contributed to the variety of funding programs outlined in section 3 above. There is a pressing need to better integrate these programs to minimise duplication and to ensure that all perspectives are considered.

The ARC recognises that research institutions (including both universities and PFRAs) need to have the ability to adequately fund a broad range of ‘institutional’ or deep infrastructure, in order to support the general fabric of research and research training activities. This ability is largely provided by institutional funding mechanisms.

Beyond that level, the ARC proposes that Australia should move towards an integrated model for the funding of research infrastructure, with the following features:

- Full funding for minor / project specific infrastructure via overhead payments included within institutional payments from the ARC or NHMRC
- A coordinated mechanism for funding medium and major infrastructure (both capital and recurrent costs), jointly managed by the research funding councils (ARC / NHMRC), and based on
 - Representation on planning and selection committees from Commonwealth, State and industry bodies
 - Contestable funding based on a broad perspective of national benefit, informed by considerations of research excellence
 - Access by higher education institutions, publicly funded research agencies, and other research active institutions
 - Full funding for capital, subscription, and/or recurrent costs

Implementation of this streamlined, integrated approach would require careful planning and phasing. The ARC offers the following comments on major issues concerning the integration and re-focusing of the existing funding model.

4.1.1 Minor / Project-specific Infrastructure

It is the ARC’s view that improvements in quality and effectiveness would follow if the *direct* costs of research projects were fully funded by the funding agency. Under this model, funding for *project-specific* infrastructure would accompany project funding as an overhead component. RIBG is intended to provide for these costs in the higher education sector. However there is a two year lag in the provision of support, and the amounts provided are not directly related to the costs of the project-specific infrastructure.

As the ARC has argued in its submission to the 2002 Higher Education Review¹, and in its submission to the Research Collaboration Review², there is scope to streamline and improve the transparency of the provision of project-specific infrastructure by re-allocating RIBG as an overhead element on each project grant. The ARC proposes that responsibility for allocating funding for project-specific infrastructure could be transferred from DEST to the ARC and NHMRC. These funding councils would then be in a position to fold project-specific infrastructure funding directly and simultaneously – as funding for overheads – into the funds they pay institutions for discrete research activities and outcomes. Medical research institutes, museums and other non-university organisations that are currently excluded from receiving project-specific infrastructure would receive this overhead in association with successful competitive grants.

4.1.2 Non-recurrent Infrastructure costs

Commonwealth funding to higher education institutions for the *non-recurrent* cost of infrastructure (not project-specific) is currently provided primarily through the LIEF and SII programs. The potential for inefficient, non-strategic duplication between these programs was apparent in the first round of SII. Whilst an argument can be advanced to merge the two

¹ Australian Research Council Submission to the Higher Education Review. July 2002.

² Australian Research Council Submission to the Research Collaboration Review, August 2003

schemes by merging their objectives, a superior approach may be to enhance the distinctive differences between the programs. These differences primarily arise from the *system-wide* view of SII, compared with the strong *research-program* focus of LIEF. Infrastructure such as wide-band communication networks, high-end computing capacity, public data-banks, scholarly libraries and other collections, and so forth is ubiquitous in the higher education sector, and serves a multiplicity of uses beyond research. This form of infrastructure is the domain of the SII program. On the other hand, items of equipment that are shared by particular research communities, and whose performance might be compromised if acquired for multiple uses, are the domain of LIEF. What is clear is that the two forms of infrastructure provided by these complementary programs are *both* required in a balanced national system, and that careful cross-program management is required to ensure optimal outcomes.

Implicit in Commonwealth programs for funding non-recurrent infrastructure costs is the need to provide for the recurrent costs that must be met by the institutions that host the infrastructure. Maintaining the institutions' capacity to provide such support requires a strategic approach to establishing scale and focus in the institutions' research programs, combined with adequate provision for discretionary expenditure (e.g. through the Institutional Grants Scheme).

There is often little recognition that research programs may need to have replacement infrastructure if they are to proceed beyond the useful life of the equipment or infrastructure on which they depend. Technology advances swiftly over the useful life of many infrastructure assets. Combined with rapid evolution of research agendas, this implies that items of research infrastructure are rarely replaced with similar items. Under these circumstances, it is generally appropriate that researchers re-compete for the provision of new infrastructure, rather than to require that researchers make provision for replacement costs from budgets which do not themselves include provision for replacement costs.

4.1.3 Subscription Costs

Commonwealth funding for "*subscription*" costs of infrastructure has been provided in only a few circumstances. Examples include the payment of on-going subscription costs for international programs such as the Ocean Drilling Program, the International Gemini Project and access to the ISIS Neutron Spallation Source in the UK, all funded from the LIEF program, access to overseas synchrotron sources funded through the MNRF program, and funding for the bi-national Anglo-Australian Telescope provided under an Act of Parliament. Purchasing access to international facilities is frequently an efficient and effective way to provide Australian researchers with world-class infrastructure. The ARC believes that it is timely for Australian research to display its sophistication and confidence through wider international partnering, and that strategic advantages would follow from applying a larger share of Australia's infrastructure investment to funding subscriptions to international facilities. The LIEF program has a successful track record of funding subscription-based access to major infrastructure. The capacity of the ARC to enter into agreements with corresponding overseas partner agencies is an important feature of this success.

4.1.4 Major Infrastructure

Commonwealth major infrastructure funding that includes both non-recurrent and operating costs is provided primarily through the MNRF program. The ARC believes that there is a continuing need for the MNRF program in Australian research, primarily to provide infrastructure and facilities that have a operating cost which no institution (or consortium of institutions) has the capacity to fund. To improve the return on the Commonwealth's investments in major infrastructure of this class, the ARC believes that the program should have the following characteristics:

- The program should be established and operated with a clear intention of providing for the enduring support of funded infrastructure;

- Because a long-term commitment of valuable resources is involved, funding should be provided through this program only where there is strong demand from a large community of established, world-class researchers whose activities have been consistently successful in contestable programs;
- Wherever feasible, preference should be given to establishing the infrastructure within institutions having a proven capacity for successful operation of infrastructure;
- Facilities should be “fully funded” to the extent that access cost is not an impediment for any qualified researcher; and
- Both the program itself, and any infrastructure it funds, should be overseen by experienced steering committees that in general are distinct from the committees responsible for allocating access to the infrastructure.

The ARC believes that the MNRF program should be re-established with a long-term, investment-portfolio approach. In particular, infrastructure provided under the MNRF program (or its descendants) should be funded only on the basis of its whole-of-life cost, including both capital and operational costs over the expected life of the facility. (For reasons outlined above, it may not always be appropriate for provision to be made for replacement costs by the operators of each particular infrastructure item).

4.1.5 Cabinet decisions

The ARC recognises that there is a scale of infrastructure that is so large that the decision to provide funding (and its timing) is a political one, to be taken at Cabinet level. There are only a small number of proposed investments of this kind. Each one must be carefully evaluated from many different perspectives, of which research excellence and opportunity are but one aspect. The ARC suggests that projects having a whole-of-life cost exceeding approximately \$100 million should fall into this category.

4.1.6 Summary

The main characteristics of the current mechanisms for infrastructure funding are shown below:

Scheme	Project-specific	Research focus	Systemic focus	May fund non-recurrent costs	May fund recurrent costs
RIBG as overhead	Yes	Yes	No	Yes	Yes
LIEF	Possibly	Yes	No	Yes	Subscriptions
SII	No	No	Yes	Yes	No
MNRF	No	Yes	Yes	Yes	Yes
Cabinet-level	Possibly	Possibly	Yes	Yes	Yes

4.2 Co-ordination and collaboration

Australia makes close to 3 per cent of the world’s contributions to science (against a share of the world’s population of 0.3 per cent and of world trade of 1 per cent), and it is imperative that Australia has access to the remaining 97 per cent if we are to remain competitive. For a country such as Australia, with a small population, a highly developed and respected research community provides an essential channel of information on and access to research developments in other countries and provides a gateway for international business investment. Australia’s influence in international forums is enhanced by its research standing.

The quality of Australia’s research system in the future will depend heavily on the degree to which individual researchers, teams and research centres are integrated into networks of research excellence at local, regional, national and international levels. To remain internationally competitive, Australia must build this sort of scale and focus in its research effort

and resource this effort at the highest level the nation can afford. Fragmentation and marginalisation of research effort, induced by and accompanied by fragmentation of funding mechanisms, is not a strong foundation for driving social and economic enhancement.

In the ARC's view, the most effective way to reform the funding system for providing world-class infrastructure would be to allocate Commonwealth infrastructure funding through an integrated contestable suite of programs that (i) aligns the provision of infrastructure with the needs of the most outstanding researchers, (ii) supports coherent, systematic planning of the strategic investment of Commonwealth funding in research infrastructure to maximise national benefit; (iii) provides a single point of contact for potential co-investors (including State and Territory governments, private-sector investors, and potential international partners), and (iv) enhances transparency and accountability arrangements.

The ARC wishes to stress that contestable allocation of infrastructure is a sound way to deal with inevitable tight limits on available infrastructure funding. A contestable approach stimulates co-ordination as potential applicants strengthen their proposals through constructive optimisation and collaboration. For example, 67 LIEF grants awarded in 2003 involve 272 partner organisations including 20 Government organisations, six CSIRO divisions and three organisations from other countries. Contestability is not, as is sometimes claimed, the bane of co-operative activity. It is, however, a tried and proven method for identifying outstanding opportunities for investment in research.

4.3 Level of funding

The total infrastructure funding available is related to Government decisions regarding the proportion of the budget allocated for research. Maintaining competitive levels compared to other OECD countries is a crucial element in maintaining the economic, social and environmental health of the nation. In addition to Commonwealth funding, there are exciting opportunities for co-investment by States & Territories, the private sector, and overseas investors that require appropriate co-ordination of interests and benefits if they are to materialise.

The ARC suggests that the balance of funding between the various elements of an integrated infrastructure funding model should rest on the following considerations.

4.3.1 Institutional / Deep Infrastructure

Although not specifically a subject for examination by the taskforce, and not considered in detail in this submission, the ARC recognises that research institutions (including both universities and PFRAs) need to have the ability to adequately fund a broad range of 'institutional' or deep infrastructure, in order to support the general fabric of research and research training activities. This ability is largely provided by institutional funding mechanisms, and allows institutions necessary discretion to build and retain basic capacities, respond more flexibly to opportunities in new and emerging areas, and to be in a position to respond to local, national and international initiatives as they arise.

4.3.2 Minor / Project-specific Infrastructure

Under RIBG, project-specific infrastructure is currently funded at a rate of about 20 cents for each dollar provided by the ARC and NHMRC to meet project costs, whereas international benchmarks are at least double that rate. The UK research councils pay a contribution of 46 per cent of the direct staff costs within project grants to meet the overhead or indirect costs of research they sponsor³. The National Science Foundation (NSF) and National Institutes of Health in the US reimburse universities for the overhead costs of the research they sponsor on the basis of negotiations with each university, with the average among top research institutions

³ Australian Research Council Submission to the Higher Education Review. July 2002.

being more than 50 per cent⁴. The research funding councils in Finland and Denmark also meet the cost of overheads associated with the research they sponsor⁵.

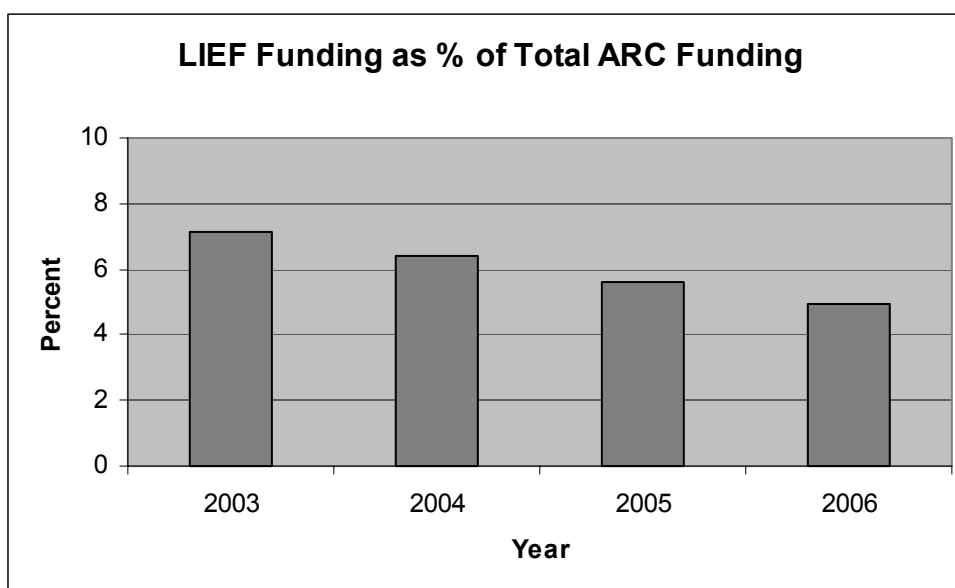
The ARC believes that project-specific infrastructure overheads should be paid at a rate of at least 40% of the associated grant. The corresponding annual funding for overhead payments paid on successful grants would need to rise to \$320M from approximately \$160M (the amount currently allocated through RIBG). Overheads would be paid directly and immediately to institutions by the ARC and NHMRC who have responsibility for maintaining adequate infrastructure overheads.

4.3.3 Systemic infrastructure

Because of the systemic character of the SII program, its level of funding might best be established by reference to the cost of re-investments required to maintain (and enhance) the capacity of networks, information infrastructure and computer facilities that serve a multiplicity of uses within higher education institutions. Data are not available to determine how SII funding should be attributed between research and these other purposes.

4.3.4 Medium-level infrastructure (up to \$5M per item or per annum)

Funding for the ARC LIEF scheme has not kept pace with funding increases provided to other ARC programs under the Government's *Backing Australia's Ability* program (see figure below). The shortfall is placing increasing pressure on LIEF funding and may soon compromise Australia's capacity to capitalise on the increased investment in high-quality research in Discovery-Projects, Linkage-Projects and in the Centres of Excellence. The LIEF program is currently under considerable pressure and is unable to meet demand (high quality projects are unsuccessful due to available funds being exhausted).



The ARC proposes that LIEF funding be raised to \$75M per annum, and that, with this additional funding, access to LIEF be broadened to include the PRFAs. The increased funding would also be targeted to broaden the scope of the LIEF program in two important directions: (i) raising the maximum value of items of infrastructure funded under LIEF from approximately \$2M (per item, or per annum) to \$5M, thereby closing a gap that has been identified by many commentators; and (ii) increasing the proportion of LIEF funding that is allocated to long-term, international subscriptions from its current level of approximately 10% to approximately 15% of

⁴ Ibid

⁵ Ibid

the total LIEF allocation. These developments would allow the MNRF program to focus on the provision of non-recurrent major infrastructure and of subscriptions to major international facilities.

4.3.5 Major Infrastructure (beyond \$5M)

The ARC suggests that the MNRF program should focus on the provision of full funding (recurrent and non-recurrent) for infrastructure with a whole-of-life cost between \$5 million and \$100 million. A detailed analysis of the MNRF program has been undertaken in 2000-01 by the then Department of Industry, Science and Resources and the ARC suggests that this analysis be re-examined and used as a platform for the future design of the program.

5 Foundations for a nationally integrated strategy

While advocating the advantages of an integrated, contestable model, the ARC recognises that the proposed reforms need to be phased in over time to minimise disruption to research.

The ARC believes that four principles should guide the development of a nationally integrated strategy for the provision of research infrastructure, within this transformative process:

5.1 Principle 1: Excellence as the basis for research investment

The Commonwealth should aim to identify and invest in the highest-quality Australian research. It is precisely this research that has the potential to deliver the greatest impact in the form of economic, social and environmental returns to the community.

Several studies have shown that research excellence drives high-quality innovation. In Australia, private sector patents depend almost exclusively on publicly-funded research. About 96 per cent of Australian scientific papers cited in private sector, Australian-invented US patents are from publicly-funded research institutions⁶. These scientific research papers are drawn overwhelmingly from high-impact research, such as that sponsored by the ARC and NHMRC.

There is clear evidence that an emphasis on excellence leads to a high economic return from the public investment, both in absolute terms and relative to the average returns associated with all publicly-funded research. A recent study has suggested that the social rate of return on ARC-funded research is about twice that on all publicly funded research, and has identified a measurable social rate of return of 39 per cent from ARC-funded research.

Contestability and competition are the keys to identifying research excellence. ARC funding is allocated competitively on the basis of research excellence determined by internationally benchmarked peer review. The direct link between this competitiveness and research excellence is demonstrated by the fact that ARC-funded research generates output of a higher impact than that of publicly funded research in general.

For example, scientific research papers in the biological sciences produced by ARC research centres and research projects are, respectively, four and three times more likely to be in the top one per cent (and five and two times more likely to be in the top five per cent) of cited papers worldwide than papers produced in universities by researchers not supported by ARC funding⁷. Across all disciplines supported by the ARC, the impact of publications generated by ARC-funded research is significantly higher (with, on average, between 4.9 and 7.6 citations per publication, depending on the particular program) than the world average (about 4 citations per publication) which, in turn, is higher than for non-ARC-funded university research (on average,

⁶ Narin, F., et al., 2000. *Inventing Our Future: The Link between Australian Patenting and Basic Science*. Australian Research Council and CSIRO, Canberra.

⁷ Paul Bourke, Linda Butler and Beverley Biglia, *A Bibliometric Analysis of Biological Sciences Research in Australia*, June 1999

3.4 citations per publication)⁸. Moreover, analysis of the output of publications in 2000 from ARC-funded Large Grants indicates that a Commonwealth dollar invested through the ARC results in at least five times more publications than a Commonwealth dollar allocated to university research through non-contestable processes.⁹

The ARC and NHMRC emphasis on research excellence, assessed competitively against international standards, has critically important implications for the provision of Australia's research infrastructure. There is little point in funding research excellence if it is not supported by world-class infrastructure. Thus, alignment between areas of research excellence identified by the competitive processes of the ARC and the NHMRC, and the provision of infrastructure to support these areas, must thus be a core objective of Australia's national infrastructure policy. Equally, decisions to maintain or invest in new research infrastructure must take into consideration the quality and standing of the researchers and the research projects that will use that infrastructure.

For project-specific infrastructure, a simple way to achieve this alignment has been proposed in the ARC's submission to the Research Collaboration Review¹⁰. The ARC argues that responsibility for allocating funding for project-specific infrastructure should be transferred from the Department of Education, Science and Training to the ARC and the NHMRC. The funding councils would then be in a position to fund, by way of an overheads component in the grant payment to the institution, the project-specific infrastructure costs directly and at the time the project grant is paid. This will help ensure that the resources required by the researchers who have been selected by intensely competitive processes are available at an appropriate level and in a timely way to allow the research to progress.

It is similarly important to strive to align support for research excellence and investments in major research infrastructure and in deep infrastructure. Alignment could be facilitated by ensuring that the agencies responsible for the national competitive research grants programs play a key, formal role in the initial evaluation of proposals for developing new major research infrastructure, and in any reviews of the efficacy of existing facilities. The quality of research activity and the level of demand for any proposed facility would be assessed, and used to inform the decision-making processes for selecting major infrastructure projects for funding.

Opportunities to align research excellence and the provision of infrastructure also arise in the settings created by the focused activities of ARC research Centres and Networks. Centres often have the scale and skills required to support associated research infrastructure, and frequently have established rich networks of researchers in Australia and overseas. The ARC believes that there would be significant benefits in locating research infrastructure in close association with Centres of research excellence, and in providing funding support to ensure that the Centres' facilities are accessible by qualified users.

5.2 Principle 2: Co-ordination and collaboration

The high cost of research infrastructure means that Australia needs to cooperate and collaborate wherever possible to ensure appropriate provision of and/or access to leading-edge research infrastructure. Often access to international research facilities may be the only feasible means for providing access to certain kinds of research infrastructure.

Developments in information and communications technology (ICT) are transforming many fields of research. Computer modelling and new tools for dealing with very large, heterogeneous data sets, in particular, are re-shaping the agendas of a number of research disciplines. Promotion and development of cross-cutting research, for example by funding high

⁸ Linda Butler, *ARC-supported research: the impact of its journal publications 1996-2000* (in press)

⁹ Australian research Council, *Submission to the Higher Education Review*, July 2002.

¹⁰ Australian research Council, *Submission to the Research Collaboration Review August 2003*

bandwidth communications infrastructure, is a key to enhancing Australian research vitality in these emerging areas.

Co-ordination and cooperation needs to be promoted and enhanced among research institutions and other agencies at state, national and international levels. Partnerships (public-private, state-commonwealth, higher education-research agency, etc) among all participants in the national innovation system are vital. Increased collaboration and cooperation across broad sectors will offer a number of advantages related to the provision of research infrastructure, including:

- Concentration of research developing into centres of excellence (e.g. National Stem Cell Centre with leading-edge MNRF infrastructure);
- Provision of a wider range of research facilities;
- Spreading the costs and benefits of infrastructure, including among State and Territory governments, particularly by promoting the establishment of a co-ordinated regional presence;
- Providing greater funding opportunities from the various sectors for the required infrastructure;
- Eliminating inefficient, piece-meal provision of under-utilised infrastructure to individual researchers or single organisations leading to duplication and idleness of facilities.
- Accelerating and broadening development of research opportunities; and,
- Enhancing and accelerating the transfer of knowledge.

Ubiquitous and/or 'deep' infrastructure such as libraries, bandwidth, databases, building and common services generally aim to satisfy many requirements, extending beyond the needs of researchers. Their provision should integrate across these purposes. This integration will generally involve compromise, cooperation and collaboration in respect of the research use.

Networking and clustering around infrastructure promise such benefits that they should be actively encouraged. Commonwealth, State and Territory governments can play a major role in encouraging clustering, networking and collaboration among the different sectors by addressing policy issues and administrative requirements which currently impede partnerships between publicly funded research agencies and the private sector. For example governments could:

- Develop a whole-of-government policy and funding strategy for research infrastructure, including a National Steering Committee of Science/Innovation Ministers or Chief Scientists;
- Provide consistent and continuous government policy across jurisdictions;
- Provide favourable legal and regulatory environments, particularly in relation to intellectual property;
- Provide tax incentives to encourage private sector investment and collaboration;
- Encourage venture capital and philanthropy in the research sector; and,
- Extend program time frames and stabilise funding mechanisms.

For certain types of infrastructure, the provision of facilities at the international, regional or national level will offer superior quality of services at lower overall cost. The OECD Global Science Forum represents an important opportunity for Australia to keep informed about, and to influence, the provision of very expensive infrastructure of the kind that is either unique or provided only in a few locations in the world.

5.3 Principle 3: Efficiency and effectiveness

Australia's research excellence and associated leading-edge infrastructure must be provided in the most efficient and effective manner. In particular, there should be no "gaps" in the mechanisms that provide infrastructure – be they cost ranges, modes of access or types of

facilities. To maximise efficiency and effectiveness in the delivery of research infrastructure a number of areas need to be considered, including:

- Emerging trends and priorities in Australian research, and their emerging infrastructure requirements (including hard choices that might restrict the emergence of research activities that are too costly to support);
- Impact of major investments in research infrastructure on Australian research agendas, and the associated obligations to maintain and provide access to this infrastructure;
- Potential for co-location of infrastructure with centres of research excellence and/or within other collaborative vehicles;
- Allocation of responsibility for infrastructure funding and evaluation programs to the agency/agencies best equipped to undertake these tasks;
- Contestability and competition is a proven way to identify the best opportunities for research, and is not the bane of co-operation and co-ordination provided that the rules of the competition are framed with care;
- Considerable efficiencies and savings in real and opportunity costs arise if full funding is provided for infrastructure that has been selected for funding; and
- Supporting and encouraging co-funding activities that optimise the benefit of the investment to all parties.

Access to international research infrastructures is extremely important for Australian researchers, because we are a small but advanced economy. In many cases, the return to investment in overseas facilities is a significant net gain. Australia's access to international facilities needs to be developed, with particular focus on Australia's current isolation from the North Atlantic research community.

There is often intense international competition between countries to host global research facilities. This is based on the benefits and spin offs that accrue to the host country. Australia should aspire to host a small number of large global research facilities, especially when these are based on evident natural advantages and a strong local research base. For some classes of equipment and facilities, Australia's purchasing power can be increased by careful coordination.

5.4 Principle 4: Accountability and good governance

Management of research infrastructure demands transparency and a high standard of accountability for the expenditure of public funds. Access to infrastructure provided with public funding should be open, transparent and available on a competitive and/or partnership basis to the best researchers.

Australia's current model for providing research infrastructure is complex and opaque. By relying on partial funding and heterogeneous leverage of funding, it encourages cost shifting and fosters problems of accountability. The strategy needs to be re-structured to incorporate a revised budget framework including:

- Clear and consistent definitions and treatment of infrastructure cost components, including direct and indirect costs, non-recurrent and recurrent costs, and the application of whole-of-life, full-costing methodologies;
- Integration of Commonwealth and State/Territory budget strategies for research and development activities;
- Where practicable, separate the provision of an infrastructure service from the allocation of access to the resource. Owner/operators of infrastructure may not be the best gatekeepers to use of the facility;
- Operators of publicly-funded infrastructure should maintain appropriate, adequate records of use, costs and outcomes, preferably in electronic form;

- Major infrastructure operators should publish financial reports (revenues and expenses, expenditure, operating and cash flow statement projections, funding sources) on a regular basis, and be subject to independent performance reviews from time to time; and
- Infrastructure provision based on the construction of equipment should be “project managed” to ensure timely delivery within the allocated budget.

5.5 An integrated infrastructure model

The ARC proposes an integrated model for the funding of research infrastructure with the following features:

- Full funding for minor / project specific infrastructure via overhead payments included within institutional payments from the ARC or NHMRC who take responsibility for ensuring adequate support is provided
- A coordinated mechanism for funding medium and major infrastructure (both capital and recurrent costs), jointly managed by the research funding councils (ARC / NHMRC), and based on
 - Representation on planning and selection committees from Commonwealth State and industry bodies
 - Contestable funding based on a broad perspective on national benefit, informed by considerations of research excellence
 - Access by higher education institutions, publicly funded research agencies, and other research active institutions
 - Full funding for capital, subscription, and/or recurrent costs

The ARC recognises that changes such as these require phasing in order to avoid any disruption to research.