



Australian Research Council

Submission to the National Research Priorities Taskforce

July 2002

Introduction

Developing National Research Priorities: An Issues Paper, released in May 2002, announced the Government's intention to set national research priorities for Australia. The Board of the ARC welcomes this announcement as a continuation of the Government's commitment to maximising the returns to the community from Australia's \$4.7 billion annual investment in publicly funded research.

This submission has been prepared drawing upon the experience of the ARC in implementing a range of initiatives under *Backing Australia's Ability*, the Government's innovation action plan for Australia – including the recently announced research priorities for the ARC. Part 1 provides in broad outline what the ARC believes will be the most effective approach to developing national research priorities. Part 2 is a preliminary identification of areas of national research priority that should be a focus of investment. Part 3 is a concluding summary of key points. Specific comments on aspects of the proposed framework described in the issues paper are set out in Attachment A.

This submission also draws on the experience of the ARC in implementing investment strategies to address a range of structural and thematic research priorities. Current priority setting by the ARC is summarised in Attachment B.

Part 1 – Developing National Research Priorities

Key points

- The ARC believes that national research priorities need to be developed as part of an overall vision for Australian innovation.
- That vision will be expressed in terms of attributes of our national research and innovation system that will confer a distinct global competitive advantage for Australia.
- Competitive advantage will be achieved by a commitment to key structural priorities with ambitious but achievable targets.
- The focus of investment under these priorities will be thematic areas in which, because of the degree of research excellence and potential benefits, Australia has niche strengths and opportunities.

A vision for Australian innovation to 2020

In January 2001, the Government released its innovation action plan, *Backing Australia's Ability*, announcing an investment of \$2.9 billion over five years to support innovation and enhance Australia's international competitiveness, economic prosperity and social wellbeing.

The Government's decision to develop national research priorities is an opportunity to consolidate the direction set by *Backing Australia's Ability* and to maximise the benefits that can be delivered under that plan. To be fully successful in this, however, priorities will need to be developed according to a clearly articulated vision for Australian innovation, with the year 2020 as an appropriate horizon.

That vision will need to describe the attributes of our national research and innovation system that, by 2020, will signal that Australia has attained a distinct global competitive advantage.

Australia can and should aspire to develop a national research and innovation system that is characterised by attributes that include the following:

- Australia will be a preferred location for economic investment in new ideas by companies from around the world – it will be an important hub within innovation networks that span the globe;
- Australia will be a location of first choice for world-class researchers to pursue their work and careers;
- Australia will be a preferred site for developing major infrastructure to house and equip teams from around the world engaged in research programs that are at the frontiers of global knowledge;
- researchers in Australia will have strong links to cutting-edge international research programs and ready access to state-of-the-art research facilities and equipment in other countries; and
- Australia will be a training location of first choice among the best young researchers from around the world.

A focus on structural priorities

The distinctive assets of a modern economy are now recognised as knowledge, skills and creativity. These assets are considered to be more critical to business success and national economic performance than the availability of the traditional productive factors of land, labour and capital¹.

The achievement of a long-term vision for Australian innovation and research will require a commitment to key structural priorities. Those priorities will be associated with ambitious but achievable targets for enhancing Australia's research and innovation capability. It is the strength of this capability, and our commitment to developing or acquiring the assets that constitute it,

¹ *Interactions between universities and industry: a report to the Coordination Committee on Science and Technology* (1999).

that will be a key determinant of competitive economic advantage, social wellbeing and environmental sustainability for Australia in the 21st Century.

The structural priorities that are needed derive from the attributes of the research and innovation system that we aspire to establish. They will focus on:

- attracting and retaining talented people (with their knowledge, skills and creativity);
- providing them with the highest quality of infrastructure support in the form of equipment and facilities;
- training for our next generation of world-class researchers; and
- encouraging our researchers to operate within clusters that have strong links to international innovation networks as magnets and conduits for inward investment.

A focus on these structural priorities follows directly from the three major themes of *Backing Australia's Ability*, each of which encompasses a major area of structural capability critical to competitive advantage: strengthening our ability to generate ideas and undertake research; accelerating the commercial application of these ideas; and developing and retaining Australian skills.

Structural priorities will need to be associated with targets that can serve as goals around which concrete strategies and action plans can be developed. These targets should be aspirational to capture the imagination and enthusiasm of the Australian community.

By the year 2020, Australia can meet a number of ambitious but achievable targets that might include the following:

- twenty Nobel Prizes in Physics, Chemistry, Physiology or Medicine, and Economics;
- an ongoing, structural net gain of researchers of the highest international standing;
- a leadership role in major international consortia in five areas of research, undertaking programs at the boundaries of global knowledge;
- the establishment in Australia of five major collaborative research facilities by the international community;
- the establishment of five major national innovation clusters characterised by rapid and extensive technology transfer via spin-off company formation and licensing of intellectual property; and
- an ongoing, structural increase in the numbers of high quality students choosing to undertake research training in Australia.

Investment targeted to selected thematic areas

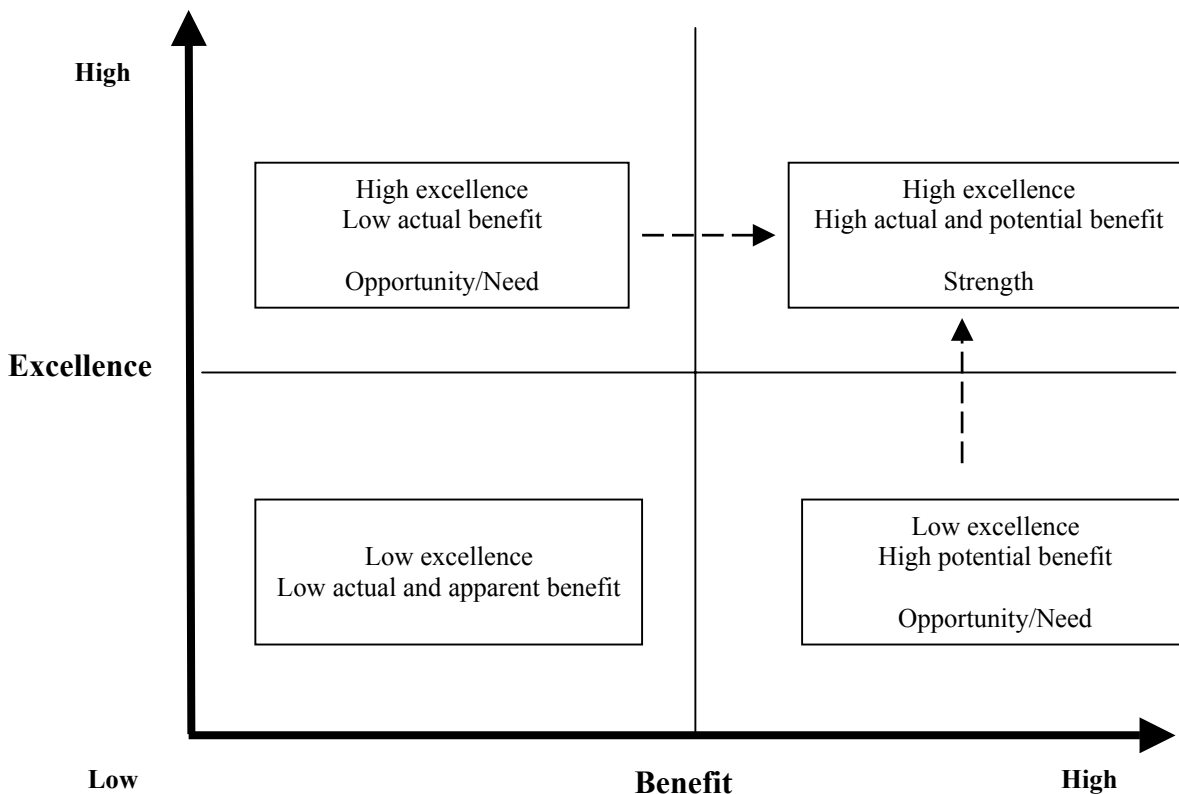
In terms of population size and wealth, Australia is a relatively small nation. It faces particular problems as a consequence of, for example, its geographic location, climate and soils. In other

areas it enjoys a comparative advantage over other countries, for example in relation to its endowment of mineral and marine resources.

These constraints and comparative advantages for Australia suggest an approach to investment in innovation that targets resources to areas of niche research strength or opportunity. At the same time, however, there is a need to balance strategic investment in particular areas with ongoing investment in a broad foundation of high quality Australian research. This is necessary to ensure that we maintain a strong research capability that can be harnessed to address emerging problems of national significance in areas including health, social welfare, the environment, defence, transport and communications. It is also critical to our ability to absorb new global ideas and technologies arising from the full spectrum of research disciplines and as the seed bed for future breakthroughs from unanticipated sources.

The importance of targeting investment in research was explicitly recognised in *Backing Australia's Ability*. In its announcement of an additional \$736.4 million over five years to double the funding for national competitive research grants administered by the ARC by 2006, the Government stated its intention that emphasis will be on areas in which Australia enjoys, or wants to build, a competitive advantage.

Decision-making about targeting investment in research to selected thematic areas needs to be guided by a consideration of excellence and benefit. A focus on excellence is critical to ensuring internationally competitive outcomes from research. A focus on benefit to the community is a pre-condition for achieving maximum return on the investment in research. A schema that can assist in evaluating competing claims for priority investment on the basis of excellence and benefit is illustrated in the diagram below.



Areas of research which are characterised by a high degree of research excellence and which deliver or have the potential to offer great benefit must be a focus for ongoing investment. Those areas that are low on both dimensions do not warrant an investment focus. Areas of demonstrably high research excellence but with low actual or apparent benefit will warrant additional investment to the extent that potential benefits can be captured – some ongoing investment is warranted on the basis that it is not a straightforward matter to predict the areas from which breakthroughs in knowledge and its application will occur. Areas characterised by a low degree of research excellence but which offer great potential benefit will require additional investment to realise those benefits – this is particularly important for capacity building in enabling technologies of key importance such as information and communications technology.

Ideally, the focus of investment will be in areas of research and application that lie within the north-east quadrant. These can be characterised as areas of strength – that is, they combine a high degree of research excellence with actual or potential delivery of outcomes of significant benefit. Investment in other areas will aim to move these to the north-east quadrant from the north-west and south-east quadrants – these can be characterised as areas of opportunity or need.

The diagram can be interpreted to suggest that competitive economic advantage and, more broadly, community benefit can be enhanced if priority setting serves to allocate resources preferentially to research that is characterised by a high degree of excellence and actual or potential benefit.

Summary

The ARC supports an enhanced commitment to setting national research priorities through an approach that addresses thematic areas. Such an approach will assist us to identify areas of research strength in which Australia can work towards establishing a leadership position internationally in particular fields. It will also assist us to identify research in areas of emerging niche opportunity as well as research that can be applied effectively to uniquely Australian problems and needs.

The ARC believes, however, that national research priorities must be developed according to a vision for Australian innovation by the year 2020. They must also serve to consolidate the strategic direction provided by *Backing Australia's Ability*, with its emphasis on strengthening the structural elements that constitute Australia's research and innovation capabilities. It is the quality of these structural assets that will be a key to our future global competitive standing.

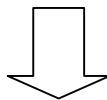
Part 2 – National Research Priorities

In Part 1 of this submission, the proposition was advanced that an effective approach to developing national research priorities will be couched within an over-arching vision for Australian innovation by the year 2020. It must also encompass an emphasis on strengthening the structural elements that constitute Australia’s research and innovation capabilities – to make full use of the knowledge, skills and creativity possessed by individuals, capture emerging global knowledge (including that embedded in new technologies), provide access to state of the art research facilities and equipment, and develop world-class research training provision . In addition, it must serve to encourage the development of innovation clusters and networks as targets and conduits for inward investment.

Part 1 identified a number of attributes that might characterise the national research and innovation system by the year 2020, as well as some indicative targets associated with key structural priorities. It also set out a schema to assist decision-making in relation to targeting investment to enhance structural capability in areas of thematic priority, on the basis of excellence and benefit.

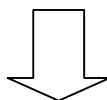
These elements, all of which are necessary to the identification of national research priorities, are summarised below. The areas of thematic priority identified are based on advice presented to the ARC Board by its Expert Advisory Committees at the time research priorities were being developed for the ARC in 2001.

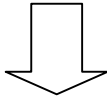
Vision for the Australian research and innovation system



Key attributes of the national research and innovation system in the year 2020

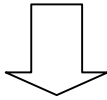
- these attributes will confer competitive global advantage





Targets to focus investment aimed at strengthening structural capability in key areas

- People – their knowledge, skills and creativity
- Infrastructure – equipment and facilities
- Training – for ongoing renewal of capability
- Clusters – to build scale, focus and connectivity and to capture commercial benefits
- Networks – to provide links to global knowledge and facilitate inward investment



Potential thematic areas of research priority

- preliminary selection on the basis of excellence and benefit
- genome and phenome research
- nano- and bio-materials
- complex and intelligent systems
- photon science and technology
- the development and wellbeing of young Australians
- deep earth exploration for minerals and energy
- long distance infrastructure – connecting Australia
- ICT new media

Summary

Under a guiding vision for Australian research and innovation, a focus of investment in these structural and thematic areas would deliver wide-ranging economic and social benefits to Australia. It would contribute to future economic prosperity in many areas of industry, through the formation of new companies and the creation of new jobs. It would also allow us to profit from Australia's unique natural endowments, address uniquely Australian problems such as the 'tyranny of distance' and contribute to the future health and wellbeing of the population.

Part 3 – Conclusions

1. International experience suggests that the primary objective of priority setting is to achieve global competitive advantage by providing a focus for investment to develop or acquire the key structural assets that constitute national capability in research and innovation.
2. An effective framework for developing national research priorities – one that will maximise the delivery of economic, social and environmental benefits to the community – will be couched within a long-term vision for the national research and innovation system that describes the characteristics of that system which will confer global competitive advantage. Targets for achieving that vision should be expressed in aspirational terms to capture the imagination and enthusiasm of the Australian community.
3. Constraints on resources, as well as unique national endowments and needs, will mean that an effective framework for developing national research priorities targets investment to areas of niche research strength or opportunity on the basis of excellence and actual or potential benefit.
4. At the same time, however, there is a need to balance strategic investment in particular areas with ongoing investment in a broad foundation of high quality Australian research. This will ensure that we maintain a strong research capability that can be harnessed to address emerging problems of national significance. It will also underpin our ability to absorb new global ideas and technologies and serve as the seed bed for future breakthroughs from unanticipated sources.
5. National research priorities will combine identification of key structural capabilities and selection of thematic areas on the basis of excellence and benefit.

The key structural capabilities are:

- people – knowledge, skills and creativity;
- infrastructure – equipment and facilities;
- training – ongoing renewal of capability;
- clusters – scale, focus, connectivity and commercial benefit; and
- networks – links to global knowledge and inward investment.

Thematic areas characterised by a high degree of excellence and actual or potential benefit include the following:

- genome/phenome research
- nano- and bio-materials
- photon science and technology
- complex and intelligent systems
- the development and wellbeing of young Australians
- deep earth exploration for minerals and energy
- long distance infrastructure – connecting Australia
- ICT new media

6. An effective framework for developing national research priorities will:

- encourage collaborative investment to build the scale and focus of research activity and innovation;
- be sensitive to the varying missions and programs of agencies and bodies with responsibility for implementation;
- provide a high degree of certainty and stability to allow long-range planning and implementation; and
- encompass all areas of research as having the potential to make a significant contribution to innovation.

Comments on specific aspects of the proposed framework for developing national research priorities

Key principles

The process for developing national research priorities will need to be subject to four key principles:

- there will be a transparent process to allow consideration of competing claims for priority;
- judgements of priority will be based on a clear demonstration of excellence and actual or potential benefit;
- there will be a consensus of expert judgement and stakeholder interest – amongst the research community as providers and on the part of business, industry and government as important users of research; and
- judgements of priority will be evidence-based.

The framework for developing national research priorities, as proposed, can accommodate these.

The implementation strategy

A sound implementation strategy will be critical to achieving positive outcomes from national research priorities. The most effective approach to implementing priorities will be one which places responsibility for developing detailed implementation plans for government consideration with the relevant research agencies and funding bodies.

Those agencies and bodies with responsibility for implementing national research priorities should, however, be given every encouragement to address collaborative investment in their implementation plans. This will require a recognition that implementation is likely to occur in stages – initiatives internal to an organisation should be relatively straightforward but those involving collaboration may require extensive consultation.

Research agencies and funding bodies can be expected to develop implementation plans that will maximise the outcomes from investment in the national research priorities to be identified. It will be important, however, that implementation occurs in a way that is consistent with the overall missions of individual agencies and bodies, and in a manner that is sensitive to obligations on the part of agencies and bodies to meet the requirements of previous decisions and ongoing expectations of the Government in other areas – for example, in the case of the ARC, in relation to support for research of benefit to rural and regional Australia, research training in

information and communications technology and early career researchers, as well as in relation to ongoing improvements to application success rates, and average grant sizes.

Monitoring and review

A major effort and an appropriate timeframe will be needed to properly monitor and evaluate performance in and outcomes from the identified areas of priority. This will need to be on the basis of expert judgments of quality, as well as a range of quantitative measures of inputs, gross outputs, productivity and, in particular, quality.

There will need to be a recognition that responding to opportunities arising from increased investment in areas of national research priority will take some time – to allow the size of research teams to be increased, leading researchers from overseas to be recruited, a significantly greater range of research programs to be established, collaborative networks of researchers and their industry partners to be extended, and necessary research infrastructure to be developed or acquired. To allow these activities to occur in such a way that there are major enhancement to capability that can deliver real and lasting positive outcomes, no major revisions to the national research priorities identified should occur within a period of at least five years.

The social sciences and humanities

There is no compelling reason for adopting a two-phased approach to identifying national research priorities, that is, with science, engineering and technology being addressed in the first phase and the social sciences and humanities being addressed in the second.

There are few areas of national priority which would not benefit from significant research input from the social sciences and humanities – for example, advances in areas such as sustainable development, national health and wellbeing and biotechnology will depend on research contributions from fields such as demography, management, the law and ethics.

As an example of the humanities' engagement with innovation, the ARC is aware of exciting work in areas of new media being conducted in Australia and in research centres in other countries which, in a multidisciplinary setting, combines the talents of researchers from fields such as engineering, information and communications technology and the creative arts. This work has the potential for revolutionary applications in education and entertainment, an industry in which Australia has developed links into global commercial networks.

Exclusion of industry programs and university block grants

The proposed framework for developing national research priorities excludes Commonwealth funding for universities' operating expenses and programs that target industry research and development. Nevertheless, in developing implementation plans to address identified national research priorities, research agencies and funding bodies should be encouraged to explore strategies that will provide incentives for both universities and industry to contribute to investment through collaborative partnerships.

ARC priority setting

The ARC has extensive experience in implementing research priorities through targeted investment strategies.

The National Competitive Grants Program (NCGP) administered by the ARC embodies a commitment to investment in excellence, through open competition on the basis of internationally benchmarked peer assessment. It also represents a commitment to maximising the return on investment in research in the form of economic, social and environmental benefits to the community. These twin commitments are reflected in the two major elements of the NCGP – Discovery and Linkage.

Areas of research priority that are the focus of investment by the ARC under the NCGP are as follows:

- In its 2003 new funding round, the ARC will target at least 33 percent of funds to discovery research and collaborative research partnerships in four priority areas in which Australia enjoys or wants to build a competitive advantage: nano- and bio-materials; genome/phenome research; complex/intelligent systems; and photon science and technology. A major element of the ARC's funding strategy for these priorities will be the establishment of centres of excellence in order to build the scale and focus of research activity.
- Over the period 2003 to 2006, the ARC will contribute approximately half of the Commonwealth funding allocated to establishing two centres of excellence announced in *Backing Australia's Ability* – in biotechnology and in information and communications technology.
- In 2002, the ARC, in partnership with the Grains Research and Development Corporation, the South Australian State Government, the Victorian Department of Natural Resources and Environment and participating universities, will establish the Australian Centre for Plant Functional Genomics.
- Each year, at least 50 new Australian Postgraduate Awards (Industry) are targeted to research training in the field of information and communications technology.
- In each new funding round, the ARC targets 20 percent of funds under the Linkage–Projects element of the NCGP to research that will directly benefit regional and rural Australian communities.
- The ARC also earmarks a proportion of funds under the Discovery–Projects element of the NCGP to early career researchers.

Contributing to the development of a coordinated approach to setting priorities in research and research training is one of seven key strategic objectives identified in the ARC strategic action plan for 2002-2004, entitled *Investing in our Future*.