

## President's Foreword

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It is pleasing to see science, engineering and technology come to the forefront in the national debate. The momentum that started with the Innovation Summit and *The Change to Change* has gained bipartisan support and is reaping benefits. For the first time in a decade, working scientists in research and innovation in Australia can look forward to some of the recognition and financial resourcing that they deserve.

The ultimate beneficiaries will be the people of Australia; the social and economic well-being of any society is critically dependent on its ability to capture and apply scientific knowledge.

It is important to emphasise that generation of Australia's knowledge is delivered by a system that fosters a plurality of research funding mechanisms and research management practices. Key players include:

- major government funding agencies including ARC and NHMRC;
- the universities;
- the CRCs;
- major Government research agencies;
- other institutes such as the Institute for Advanced Studies at the Australian National University;
- State-run institutions;
- medical research institutes; and
- independent research institutes.

These organisations provide an essential, healthy, broadening of the national perspective on what constitutes the Australian science system. This in turn benefits the national good and the application of research outcomes to achieve priority national goals. All parts of the system, including private sector R&D, should continue to receive attention and support in any revision of science policy.

The Australian Academy of Science commends the efforts being put into stimulating innovation and entrepreneurship and the attempts to make us all more skilled at juggling the commercialisation issues that we face. However, we must not forget the fundamentals upon which a solid and sustainable knowledge based economy is built.

Governments in all advanced countries accept an obligation for public investment in basic R&D. The foundations of good research and innovation are still to be found in the enabling sciences. We must address the decline in enrolments in the enabling sciences in our schools and universities if we are to sustain the internationally competitive research that we are investing in today.

Implementing many of the recommendations listed in this document would not need a significant increase in government funding. Many of the options outlined complement various existing and proposed initiatives and for the most part involve making better use of existing human and financial resources.

I would like to thank the Academy's Secretary of Science Policy, Professor Michael Barber, who headed the working group that developed this document. Thank you also to my fellow Council Members for their comments and input.

As we move towards an election, I hope there can be bipartisan acknowledgment of the issues outlined in this statement, and the measures needed to address them.



Professor B D O Anderson, AO, PresAA, FRS, FTSE



## Recommendations

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1. Policy initiatives in *Backing Australia's Ability* need to be implemented at a much faster rate than under the current arrangements that see most of the funding becoming available after the federal election in 2004.
2. The next Australian Government must encourage a shared vision for Australian higher education, in which government, universities and the private sector work for the common good of Australia. This may be effectively achieved through the establishment of a Higher Education Funding Council.
3. The next Australian Government should restore the balance between private and public contributions to higher education, for example by restoring the "missing 7 per cent" in funding to universities and put in place indexation arrangements that adequately maintain an agreed level of government funding.
4. The next Australian Government should reassess the possibility of introducing a research assessment exercise to influence the allocation of research-related funding to universities.
5. HECS-exempt scholarships should be provided for students commencing science teacher education and a percentage of the HECS debt of science and mathematics teachers forgiven for each year of teaching service.
6. Any indicative trends of unwelcome outcomes in business investment in R&D must be spotted quickly and responded to promptly. The next Australian Government must state its preparedness to fine-tune taxation incentives in the light of experience.
7. The next Australian Government should consider implementing a formal offset program when giving assistance to major industrial developments.
8. The ad hoc nature of the Major National Research Facilities program must end by inclusion of a one-line budget item in the Science and Technology Budget each year, even if there are competitive rounds on a less frequent basis than annual.
9. There is an opportunity for the next Australian Government to review in 2002 the quantum of funding allocated to CSIRO for the next triennium, to capitalise on the multidisciplinary capacity of CSIRO to engage as a coherent partner with the rest of Australia's innovation system.
10. The next Australian Government should work to maintain bipartisan support not only for the Cooperative Research Centre Program, but also for education, research and innovation more broadly.
11. The next Australian Government should retain the Prime Minister's Science, Engineering and Innovation Council (PMSEIC) and the position of Chief Scientist. It should also upgrade the Commonwealth, States and Territories Advisory Council on Innovation.
12. The next Australian Government should set broad directions for government research agencies and funding agencies. It should urge that there be put in place robust internal priority-setting mechanisms that include broad consultation with potential users of research.

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## Building a knowledge economy

### Recommendation 1

*Policy initiatives in Backing Australia's Ability need to be implemented at a much faster rate than under the current arrangements that see most of the funding becoming available after the federal election in 2004.*

The next Australian Government must make a serious commitment to national investment in research and development if Australia is to become a generator and exporter of creative intellectual property, thereby contributing to its economic, social and cultural development. The roadmap for innovation is available in the Chief Scientist's paper *The Chance to Change*<sup>1</sup>. This document, which led to policy initiatives in *Backing Australia's Ability*,<sup>2</sup> is broadly owned by the business, science and education communities and can provide the basis for a non-partisan commitment to change. It recognises that our economic system is based increasingly on innovation. The initiatives announced in *Backing Australia's Ability* are consistent with ideas put forward in *Knowledge Nation*<sup>3</sup>. The Academy applauds the beginnings of a bipartisan approach to innovation. Such a bipartisan view is essential for the development of an innovative Australia, particularly for science where many of the issues, problems and programs have time scales that cover several parliamentary terms.

*Backing Australia's Ability* is a welcome first step towards an innovative nation, but too little is provided over too long a time frame. *Knowledge Nation* is less clear about priorities, costing and timing. But for the first time in a decade, science and technology have come to the forefront of the national agenda, in response to broad community recognition that the nation's future vitality is critically dependent on innovation. State Governments have been sensitive to the depth of understanding among voters about a knowledge economy. It is important that the next Australian Government arrives in Canberra ready to get on with it, fully prepared to invest further in science and technology - sooner rather than later, if the expected benefits of innovation are going to be realised.

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<sup>1</sup> Batterham R (November 2001) *The Chance to Change*

<sup>2</sup> Commonwealth Government (2001) *Backing Australia's Ability: An Innovation Action Plan for the Future*

<sup>3</sup> Chifley Research Centre (July 2001) *An Agenda for the Knowledge Nation*

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## Higher education system

### Recommendation 2

*The next Australian Government must encourage a shared vision for Australian higher education, in which government, universities and the private sector work for the common good of Australia. This may be effectively achieved through the establishment of a Higher Education Funding Council.*

Australia needs a thriving and vigorous higher education system to achieve its aspirations as an innovative nation. Universities play a special role in the knowledge economy through

- the production of qualified graduates;
- fundamental research to underpin the innovation system;
- linkages to the wider innovation system;
- the professional development of the workforce.

If a nation's university system is ailing, it will not succeed in the knowledge economy of the 21st century.

Australia's university system is ailing: class sizes are too large, salary levels are too low, current funding levels per student are too low, and morale is low. There is too much emphasis on redistribution of existing funding and on increasing activity as a means to increasing income. There is not enough emphasis on the need to increase student per capita funding to allow universities to meet the increasing requirements being placed upon them.

Government Ministers and senior bureaucrats are inclined to criticise the university sector. They perceive a need for change yet tend to be reluctant to acknowledge the values of a university, or acknowledge the change that has occurred in Australian universities in the past decade. For example, universities contribute 23 per cent in cash and in kind towards the Cooperative Research Centres Program (CRCs) compared to a contribution of 17 per cent from industry. Yet universities are still regarded as being unable to meet the needs of industry.

Australia needs a healthy, efficient and diverse higher education system that serves a multiplicity of missions. The Academy is concerned that there is little shared vision in Australia for the roles of its higher education sector.

The Academy has argued<sup>4</sup> that a coordinating body, such as a Higher Education Funding Council, should be established. It could assist in the development of a vision and encourage innovation and diversity in our universities. The Academy considers that it is in the national interest that individual universities are funded at arm's length from government. The synergy of the relationship that could be achieved between a Higher Education Funding Council and the existing research councils would allow a pluralism of funding mechanisms. Part of that pluralism should also include recognition of the roles of government research agencies such as CSIRO, ANSTO and AIMS, and the ANU's Institute of Advanced Studies and medical research institutes, that contribute widely to research training at postgraduate and postdoctoral levels.

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**Recommendation 3**

*The next Australian Government should restore the balance between private and public contributions to higher education, for example by restoring the "missing 7 per cent" in funding to universities and put in place indexation arrangements that adequately maintain an agreed level of government funding.*

The Academy is concerned that the balance between private and public contributions to higher education has swung too far towards private contributions.

The Australian Vice-Chancellors' Committee has noted that the amount of HECS receipts has been estimated at just over \$941 million in 2001, compared to the actual receipts of \$118 million in 1989. While the total Commonwealth funding for higher education in 2001 has risen 9.4 per cent since 1988 at constant price level, this is reduced to a decline of 7 per cent when the amount of HECS receipts is discounted.

The Department of Finance has projected that Commonwealth expenditure on higher education, as a percentage of GDP, will decline from 0.59 per cent in 2000-2001 to 0.52 per cent in 2003-4.

University funding must increase and must increase in per capita terms. It is also time that future funding is indexed in a way that better reflects the cost drivers that impact

upon the sector. This is not an argument necessarily for an increase in public funding, although that is part of the equation. It is sophistry for government to argue that issues such as salary levels and teaching costs in science are issues for universities to handle, when the "price" that the universities can charge their main client for undergraduate teaching is fixed by that client—the Australian Government.

*Backing Australia's Ability* had several welcome initiatives: more places in science and technology, increased infrastructure funds for universities and a postgraduate coursework loans scheme. All pertained to increased university funding but all came with increased compliance costs in application and accountability. The distribution of the science places and their funding at a marginal cost of \$10,000 per Equivalent Full Time Student Unit (EFTSU) hardly appears to be a major investment in a critical area for Australia's development as an innovative society.

The Academy would urge the next Government to simplify the multiplicity of small programs in which universities unnecessarily compete for relatively limited resources and instead look to increase the core undergraduate per capita funding, particularly in science, engineering and technology.

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**Recommendation 4**

*The next Australian Government should reassess the possibility of introducing a research assessment exercise to influence the allocation of research-related funding to universities.*

The Academy has two additional and more specific concerns with current trends in higher education in Australia because of their impact upon the health and vitality of Australia's scientific effort. These relate to two broad areas, declining enrolments of our brightest students in the enabling sciences and broader policy questions about the current system of higher education funding formulae.

Many universities have teaching faculties in the enabling sciences that are simply subcritical and cannot be sustained under the current funding levels per student.

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<sup>4</sup> [www.aph.gov.au/senate/committee/eet\\_ctte/public\\_uni/335\\_Academy\\_of\\_Science.doc](http://www.aph.gov.au/senate/committee/eet_ctte/public_uni/335_Academy_of_Science.doc)

The policy aimed at fostering competition between universities has been poorly managed and has reached a stage that is destructive. For example, market forces cannot be relied upon to shape the structure of our universities, because training capability cannot be turned on and off. In a National Press Club Address on 25 July the President of the Academy, Professor B D O Anderson,<sup>5</sup> raised the issue of DETYA and the monopsony, with respect to funding per student. Elsewhere the Academy has argued that there should be some form of “research assessment exercise” so as to incorporate a more rigorous quality element in the allocation of research related funding. While the administrative costs associated with a full-scale United Kingdom style Research Assessment Exercise scheme are considerable, simpler schemes are possible, as are currently under consideration in New Zealand.

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## Science and mathematics education and awareness

### Recommendation 5

*HECS-exempt scholarships should be provided for students commencing science teacher education and a percentage of the HECS debt of science and mathematics teachers forgiven for each year of teaching service.*

A strong education sector at all levels is vital to creating and sustaining a knowledge-based economy. The primary purpose of school science education is to develop scientifically literate citizens with the skills to make informed decisions on issues of science, technology, the environment and their own health and well-being. An important secondary purpose is to attract students into science-related careers.

Australia is suffering because it is not attracting sufficient high-ability students into the enabling sciences of physics, chemistry and mathematics at the secondary school level, and hence, as a consequence, at the university level. Unless we effectively address this shortcoming, it is doubtful that Australia will have the capacity to support the skilled workforce necessary to prosper in an innovative and competitive global environment.

Teachers are the key to change. The best science and mathematics graduates need to be attracted to school teaching and adequately remunerated and resourced. Currently, science teachers pay higher HECS than humanities teachers but do not receive higher salaries. This deters students from entering science teacher education courses.

The average age of secondary science teachers is the late forties. A recent study showed that 50 per cent of science teachers would prefer a change of career<sup>6</sup>. There are also disturbing signs that the supply of qualified science and mathematics teachers will not meet future demand.

Currently there is wasteful duplication in the development of resources amongst the various educational jurisdictions. There is also no consistent system to allow accurate collection of national data regarding the supply and demand of science teachers and the participation of students in upper secondary science courses.

Although school education is primarily a State responsibility, there are a number of actions that could be initiated or promoted by the next Australian Government. For instance, programs could be introduced to attract high-ability students into the enabling sciences at secondary school and, consequently, university.

HECS should be calculated at the same rate for all subjects in teacher education courses.

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## Private Investment in research and development

### Recommendation 6

*Any indicative trends of unwelcome outcomes in business investment in R&D must be spotted quickly and responded to promptly. The next Australian Government must state its preparedness to fine-tune taxation incentives in the light of experience.*

In July this year the Australian Bureau of Statistics released the latest figures for business investment in research and development (‘BIRD’). Business investment in R&D in 1999-2000 showed a 3 per cent decline on 1998-99, confirming the slump

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<sup>5</sup> [www.science.org.au/academy/media/npc.htm](http://www.science.org.au/academy/media/npc.htm)

<sup>6</sup> Department of Education Training and Youth Affairs (2001) *The Status and Quality of Teaching and Learning of Science in Australian Schools*



since 1995-96. As a percentage of GDP, Australia's business expenditure on R&D fell to 0.64 per cent in 1999-2000, following decreases in the previous three years. The falls follow significant increases in the five years before the high of 0.86 per cent in 1995-96.

Even if the 'BIRD' figures have reached a plateau, they have not yet turned around and the next Australian Government must do all it can to reverse the erosion in private sector R&D.

This is a serious situation that should have all sides of politics, and indeed all Australians, very worried. If the policy settings that are now being implemented in the changes to the R&D taxation concession legislation do not provoke a response, then the next Australian Government must move very quickly to change them.

For instance, the requirement for proposals to demonstrate both innovation and high technical risk is a standard FRASCATI definition from the OECD. However, if these two conditions are harshly applied, much work that would be regarded as R&D, particularly for information and communications technology software, might be excluded. The two conditions of innovation and high technical risk might apply to a greater or lesser extent over the length of a project. For example, the balance might change, in some cases a small technical risk and considerable innovation or vice versa.

The impact of these changes needs to be interpreted in light of the body of experience and case law surrounding decisions of the IR&D Board and appeals against them. However, considering that most R&D by established firms is incremental, the concern seems reasonable and deserves attention.

The key test of whether the effects of the changes will be significantly negative is the actual outcome of the aggregate concession claimed. It is essential for the credibility of the changes to the IR&D scheme, and indeed of the Innovation Action Plan in general, that any indicative trends of unwelcome outcomes are quickly spotted and responded to before they discredit the new arrangements. The next Government may wish to consider fore-shadowing in the near future its willingness to fine tune in the light of experience.

The Academy supports the provision of a refundable tax offset in the new legislation

designed to assist small companies, so that they do not have to wait until they have sufficient income to take advantage of a tax deduction. This will work towards redressing a long-standing problem for small companies not able to access R&D concessions.

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### **Other Incentives to stimulate private Investment In R&D**

#### **Recommendation 7**

*The next Australian Government should consider implementing a formal offset program when giving assistance to major industrial developments.*

In building the innovative capacity of the nation, more attention might be given by the next Australian Government to a formal offset program. An Australian-based R&D component, that includes the building of capability, would be required whenever the government provides assistance to major industrial developments. One example where this has operated satisfactorily in the past is the Pharmaceutical Industry's Investment Program (PIIP) which encourages investment by pharmaceutical companies. Even when government assistance is given to industries with mature technology, R&D may be necessary to adapt the technology to Australian conditions. It should be a requirement of the assistance package that this R&D is carried out in Australia whenever possible.

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#### **Recommendation 8**

*The ad hoc nature of the Major National Research Facilities program must end by inclusion of a one-line budget item in the Science and Technology Budget each year, even if there are competitive rounds on a less frequent basis than annual.*

The Academy notes that development agencies in many countries have been successful in attracting major investment through the ability to negotiate and make decisions quickly on a national basis. Australia's effort in this respect is seen as uncoordinated and overlapping.<sup>7</sup> Simplifying unduly complex administrative arrangements wherever feasible would be a step in the right direction.

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<sup>7</sup> Blackburn, I (2001) *Winning Investment: Strategy, People and Partners*

Perhaps more important than streamlining bureaucratic structures is the need to continue taxation reform to ensure the international competitiveness of Australia's company and personal taxation rates.

Other incentives to stimulate private investment in R&D could include provision for scientists in publicly funded research agencies, such as CSIRO, to share in revenues flowing from their intellectual property.

### **Major National Research Facilities**

There is an ongoing need to maintain internationally competitive infrastructure for R&D. There is a real weakness in policy in this area, because investment in infrastructure is not tied directly to national competitive grants.

Long-term planning in the context of national priorities is also urgently required for Major National Research Facilities, with coordination between State and Federal Governments. The ad hoc nature of the competitive rounds, held prior to elections in 1995 and again in 2001, does not assist long-term and robust development of major proposals.

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#### **Recommendation 9**

*There is an opportunity for the next Australian Government to review in 2002 the quantum of funding allocated to CSIRO for the next triennium, to capitalise on the multidisciplinary capacity of CSIRO to engage as a coherent partner with the rest of Australia's innovation system.*

### **Australian Research Council**

The Academy supports the structural reform to the ARC and increased funding for research grants. In the early years of the increased funding, it will be possible to provide very few of the new five-year by \$500,000 p.a. research grants. The Academy considers these Program Grants, which support research teams rather than individual researchers, as a better reflection of the way in which contemporary, competitive research is being undertaken. If the policies in *Backing Australia's Ability* could be implemented more quickly by the next Australian Government than is currently envisaged, then ramping up the introduction of ARC Program Grants would be an important starting point.

The Academy sees merit in adding a national overseas postdoctoral fellowship scheme, with conditions similar to the C J Martin Fellowships of the National Health and Medical Research Council, to significantly increase the opportunities for early career researchers to gain research experience overseas. The four-year fellowships, with two years overseas and two years in Australia, should be tenable in both public and private sector laboratories. These fellowships should be made available in research areas of national priority where there are identified weaknesses in the nation's research activity.

### **CSIRO**

The Academy supports the exciting new initiatives within CSIRO that aim to provide a new level of innovation through greater focus on partnerships with universities and other research providers. The new initiatives reflect a commitment to outcomes underpinned by sound investment in internationally competitive basic and applied research. There is a need for these initiatives to be seen as a component of the total national effort and as a collaborative and innovative part of Science Australia. If there is a strong case, CSIRO should be supported both by government and industry in its challenging aims of 50 per cent growth over the next five years.

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### **Cooperative Research Centres**

#### **Recommendation 10**

*The next Australian Government should work to maintain bipartisan support not only for the Cooperative Research Centre Program, but also for education, research and innovation more broadly.*

CRCs have been able to establish a wide range of valuable international links with universities, research institutes and companies. They have provided many opportunities for their postgraduate students to participate in international conferences and visit laboratories. CRCs also have been able to provide for their researchers the type of interface between public and private sector organisations, defence and civilian sectors, and national/overseas organisations along the lines of the European Union Mobility and Training Program (albeit on a smaller scale).

The CRCs appear to have more flexibility in the allocation of their resources than universities. They have been able to support more overseas visits by their students and early career researchers. There is scope, however, for the CRCs to selectively train more overseas graduate students.

The CRC Program has set an international benchmark for collaborative research and development between industry, academia and government research organisations. Research funded through the program is flowing through to commercialisation and wealth generation.

To improve the CRC program further, the next Australian Government should ensure that centres are set up in emerging industries and that better ways are found to involve small and medium enterprises. It should provide more funding for commercialisation, reduce the requirements for leverage and encourage international collaboration.

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### **The roles of State and Commonwealth governments**

#### **Recommendation 11**

*The next Australian Government should retain the Prime Minister's Science, Engineering and Innovation Council (PMSEIC) and the position of Chief Scientist. It should also upgrade the Commonwealth, States and Territories Advisory Council on Innovation.*

States now have greatly increased capacity for direct investment in R&D initiatives. There is the potential for fragmentation, duplication and counter-productive, rather than healthy, competition. Federal leadership and leveraging, as well as streamlined administrative processes, are needed to avoid fragmentation.

In R&D, State priorities will differ and formulation of whole-of-government approaches takes time. New Commonwealth government initiatives should be flagged well in advance to ensure maximum capacity of States to play to their strengths.

There is an urgent need to review guidelines for programs in which the Commonwealth now "expects" States' contributions, for example, Major National Research Facilities and Cooperative Research Programs. Agencies will either be a research plus cash provider or a cash only provider.

CSIRO, with its national remit, has a critical role to play in the linking of State Government needs and activities into regional and national collaborations and programs. There are opportunities for CSIRO to link more closely with State government-funded research providers. It has, like the Commonwealth, a critical role in facilitating inter-State initiatives around such major projects as salinity, greenhouse, biodiversity, energy and sustainability.

An advisory group that embraces S&T stakeholders in the States becomes important. The current Commonwealth, States and Territories Advisory Council on Innovation (CSTACI) could be upgraded to facilitate two-way traffic in S&T activities and policy between the States and the Commonwealth.

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### **National research priorities**

#### **Recommendation 12**

*The next Australian Government should set broad directions for government research agencies and funding agencies. It should urge that there be put in place robust internal priority-setting mechanisms that include broad consultation with potential users of research.*

There is a very real opportunity for the national science priority-setting activities underway in CSIRO and other government agencies to be aligned with NHMRC, CRC and ARC programs to achieve a national consensus on science priorities, big goals, and areas of emerging science that merit Australian national attention. Aligning and harnessing the science leadership capacities and vision inherent in the national research agencies, universities and CRCs with the national priorities identified by national political leaders is essential for a sustainable and competitive Australia.

In putting forward thematic areas of national priority, the Academy cautions that basic research should not be overlooked. Indeed, thematic areas of greatest priority are those where there are rapid advances in basic research, because this is where the greatest benefits from investment in R&D are likely to be realised. The Academy sees a need for better links between basic and applied research than is currently the case in Australia, especially as the CRCs are becoming increasingly more applied in orientation and need to be better networked with ARC programs. Joint development of high priority



thematic areas by the CRC and ARC programs may help address this issue.

As the Australian economy diversifies and moves away from its traditional reliance on primary production to embrace advanced technology, Australia is not optimally placed in terms of its scientific disciplinary base. Australia seriously under-performs, in world terms, in the disciplines of materials science, engineering and information and communications technology (ICT).

National research priorities should be aimed at optimising the socioeconomic well-being of the nation, within the context of good international citizenship. This good citizenship acknowledges the responsibility of the nation for stewardship of one of the world's most fragile continents, with its unique fauna and biota. The Academy has based its selection of high priority thematic and disciplinary areas on these two principles, with due attention to areas of national research strengths and weaknesses.

### **Wealth generation**

The four thematic areas in which there are rapid advances in basic research and where investment in research and development is expected to result in substantial returns are:

- biotechnology in agriculture, medicine and industry;
- complex earth systems science;
- nanoscale material science; and
- information and communications technology, including bioinformatics.

Strategic investment in these areas should recognise the national research strength in biotechnology and the relative weaknesses in nanoscience and ICT. For biotechnology, where the ratio of public to private investment in R&D is relatively high, funding should be directed at commercialisation frameworks and at facilitating links with other disciplines such as information sciences, in order to build national capacity in bio-informatics.

The research agencies need to give special attention to developing capabilities in nanoscience and ICT. At the very least, the nation needs to develop adequate capacity to be alert to new opportunities in these areas of weakness. For nanoscience, most rapid progress may be gained by redirecting existing talented researchers in physics, mathematics, chemistry and biology into this emerging field, and facilitate their transition into nanoscience by bringing experts from overseas to work in research groups which have an adequate critical mass.

For ICT, the greatest imperative is training. This is why agreement to fund a world-class ICT centre has been so welcome. Such a centre will need to create much human capital and, in particular, train many trainers, and it will necessarily have to be staffed to a significant degree by people imported to this country. It is simply not practical to imagine that one could assemble such a centre from existing talent in Australia and create a world-class enterprise in the process.

### **Environmental sustainability**

The nation must recognise that a high-energy, high-waste, high environmental impact economy is not sustainable in the longer term, and research into an orderly transition to sustainability is imperative. Research into prevention of environmental degradation, as well as into remediation, is a national priority. Research should be aimed not only at the ground-surface and sub-surface interface that has been so important in generating wealth in the past from Australia's natural resources, it should also be aimed at the marine resources in our nation's extended economic zone.

Bioprospecting in this zone might be given particular attention.

### **Population ageing**

The mental and physical health of an ageing population will be a critical determinant of the nation's future socioeconomic well-being. Australian researchers have a competitive international edge in developing medical technologies, such as human stem cell research, and devices that may have a significant impact on future treatments of degenerative and other diseases. Research in medical and social sciences in the general thematic area of ageing is potentially of great international as well as national importance.

Strategic investment in areas of national priority should recognise the national research strength in biotechnology and the relative weaknesses in nanoscience and ICT, and that different strategies are required to optimise investment in these areas.

Any research priorities set in place should be sustained for a number of years, as there may well be disappointments if outcomes are assessed within too short a time frame.

### **International nature of science**

More opportunities are needed for postgraduates and postdoctorates to gain training and career development overseas. These opportunities include participation in international conferences and workshops,

visits for short periods at major overseas public or private research facilities, exchanges, and PhD and postdoctoral fellowships tenable at overseas institutions. Opportunities for such experience have declined substantially. The principal explanations being that

- sources of adequate overseas funding have become more difficult to obtain;
- there are very few schemes in Australia which support this type of experience at a realistic funding level;
- the awards provided under these schemes are too few in number, generating unreasonably intense levels of competition;
- funding pressures within Australian universities force young researchers to

compete with established researchers for support;

- the cost of living in many overseas countries, combined with a weak Australian currency, are active deterrents to overseas travel in general.

The former Science and Technology Bilateral Collaborations Program should be reinstated and expanded.

The opportunity for young researchers to obtain postdoctoral training overseas and then to bring their networks back to Australia is the key to establishing international linkages and is an essential part of any strategy for innovation.

## Abbreviations

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AIMS	Australian Institute of Marine Science
ANSTO	Australian Nuclear Science and Technology Organisation
ARC	Australian Research Council
BIRD	Business Investment in Research and Development
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSTACI	Commonwealth, States and Territories Advisory Council on Innovation
DETYA	Department of Education, Training and Youth Affairs
DSTO	Defence Science and Technology Organisation
EFTSU	Equivalent Full Time Student Unit
HECS	Higher Education Contribution Scheme
ICT	Information and Communications Technology
IR&D	Industry Research and Development
NHMRC	National Health and Medical Research Council
OECD	Organisation for Economic Cooperation and Development
PMSEIC	Prime Minister's Science, Engineering and Innovation Council
R&D	Research and Development