

INNOVATION INNOVATION

Powering **Ideas**

An Innovation Agenda
for the 21st Century

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ISBN 978-0-642-72584-4

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FOREWORD



Tough times demand creative solutions. *Powering Ideas* will help us find those solutions. It will help us transform challenges into opportunities, risks into rewards.

This is a ten-year reform agenda to make Australia more productive and more competitive. Increasing our capacity to create new knowledge and find new ways of doing business is the key to building a modern economy based on advanced skills and technologies. It is the key to success in this, the global century.

Innovation is not an abstraction. Nor is it an end itself. It is how we make a better Australia, and contribute to making a better world — a prosperous, fair and decent world, in which everyone has the chance of a fulfilling life.

A handwritten signature in black ink, reading "Kim Carr". The signature is written in a cursive style with a horizontal line underneath.

Senator Kim Carr
Minister for Innovation, Industry, Science and Research

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ABBREVIATIONS

ABS	Australian Bureau of Statistics
CRC	Cooperative Research Centre
CSIRO	Commonwealth Scientific and Industrial Research Organisation
ERA	Excellence in Research for Australia
GDP	Gross Domestic Product
ICT	Information and communication technology
OECD	Organisation for Economic Co-operation and Development
R&D	Research and development
SME	Small and medium-sized enterprise
TCF	Textiles, clothing and footwear

EXECUTIVE SUMMARY

The 2009–10 Budget includes \$8.58 billion for science and innovation, an increase of 25 per cent.

The Australian Government's goal is to create a better Australia — a fairer, richer, healthier and greener Australia that can meet the challenges and grasp the opportunities of the twenty-first century. We will do that by improving the things we make and the way we make them — the services we deliver and the way we deliver them. We will do it by transforming existing industries and building new ones to provide quality jobs. We will do it by making new discoveries and having great ideas. Our aim is to make innovation a way of life.

Innovation is the key to making Australia more productive and more competitive. It is the key to answering the challenge of climate change, the challenge of national security, the age-old challenges of disease and want. It is the key to creating a future that is better than the past.

Investing in innovation is also one of the most effective ways we can cushion Australia against the effects of the global downturn and accelerate recovery. It will simultaneously keep people in work today and generate jobs for the future.

Our capacity for invention and discovery depends on the strength of our national innovation system. This is the system we use to harness the creativity of our people. It is the system we rely on to transform great ideas into great results for the community, the economy and the environment. Genius is wasted if you can't capture it and apply it to the real world. That's what the national innovation system does.

Entrepreneurs, policy-makers, researchers, workers, and consumers are all part of the innovation system. One way to make the system stronger is by strengthening its constituent parts. The other is by strengthening the links between those parts. Australia needs to do both.

Early action

The Government took office on 3 December 2007 keenly aware of two things. First, that innovation is critical to lifting per capita incomes and community living standards. And second, that urgent action was needed to boost Australia's innovation capacity and performance.

The Commonwealth science and innovation budget increased from \$6.56 billion in 2007–08 to \$6.88 billion in 2008–09 — a rise of 5 per cent. The Government is now providing a significant boost in the 2009–10 Budget, which includes \$8.58 billion for science and

innovation. This is 25 per cent more than in 2008–09. This direct investment in Australian innovation is supported by investments in infrastructure to sustain the innovation process — including the National Broadband Network — and in the Education Revolution, which is transforming every stage of the learning journey from pre-school to post-doc.

At the same time, the Government has produced a policy framework to guide the development of Australia’s innovation system over the next ten years. *Powering Ideas* outlines that framework.

Gathering evidence and ideas

This paper builds on investigations and policy work undertaken throughout 2008.

It responds to the recommendations of *Venturous Australia — Building Strength in Innovation: Review of the National Innovation System*.

It draws on *Collaborating to a Purpose: Review of the Cooperative Research Centres Program*; *Building Innovative Capability: Review of the Australian Textile, Clothing and Footwear Industries*; the *Final Report of the Review of Australia’s Automotive Industry*; the *Final Report of the Pharmaceuticals Industry Strategy Group*; the *Final Report of the Review of Australian Higher Education*; and the House of Representatives Standing Committee on Industry, Science and Innovation’s Inquiry into Research Training and Research Workforce Issues in Australian Universities, *Building Australia’s Research Capacity*.

It is also informed by the conclusions of the Australia 2020 Summit held in April last year, as outlined in the summit’s *Final Report*.

Australia’s innovation performance

Australia’s recent innovation performance has been uneven, and we have failed to keep pace with the rest of the world. In the last eight years, Australia has slipped from fifth to eighteenth in the World Economic Forum’s Global Competitiveness Index. Our multi-factor productivity grew 1.4 per cent a year on average between 1982–83 and 1995–96. Growth has averaged only 0.9 per cent a year since then, which is no better than we achieved in the 1960s. Since 2003–04, our productivity has actually declined.

The reasons for this are not hard to find. Commonwealth spending on science and innovation has fallen 22 per cent as a share of GDP since 1993–94. Business spending on research and development collapsed in the late 1990s, and while it has grown since then, we still lag many of the countries we compete with. The proportion of Australian firms introducing innovations has been stuck at one in three for years. A decade of policy neglect has hurt Australia’s innovation performance, making us less productive and competitive, and reducing our ability to meet the needs and aspirations of Australian families and communities.

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Meanwhile, the bar keeps rising. China's R&D spending has grown by 22 per cent a year since 1996, compared to 8 per cent a year in Australia. Australia spends 2 per cent of GDP on research and development. Austria, Denmark, Germany, Iceland, Switzerland, Taiwan, and the United States spend more than 2.5 per cent; Finland, Japan, South Korea, and Sweden spend more than 3 per cent; Israel spends more than 4 per cent.

While Commonwealth spending on science and innovation fell to 0.58 per cent of GDP in 2007–08, Denmark is steadily increasing government spending on R&D — from 0.89 per cent of GDP in 2008, to 0.94 per cent in 2009, with a target of 1 per cent in 2010. In the United States, President Obama has pledged to double funding for federal science agencies over the next decade.

There is much more to innovation than laboratory R&D, of course. Improvements to the way we organise, manage, operate, and market things are equally important. Nevertheless, investment in science and technology is critical to the growth of knowledge-based economies, and an important indicator of innovation capacity and performance. Measures like R&D expenditure are commonly used to compare countries, and in recent times, these comparisons have not favoured Australia.

Our innovation system has worked well enough, often enough, to show us what success looks like. Products of the system earning returns for Australia internationally include Google Maps, Biota's flu treatment (Relenza), CSIRO's polymer bank notes and wireless networking technology, CSL's anti-cancer vaccine (Gardasil), Cross Market Surveillance Service's stock market fraud detection system, and Cochlear's bionic ear.

These examples remind us that groundbreaking innovation requires sustained commitment, sometimes for decades. Translating new ideas into money-making products and services takes staying power. It requires an innovation system that offers an unbroken path from vision to realisation. The market alone can't deliver this, and governments have a responsibility to step in where markets fail. It is their job to plug gaps in the system through which ideas might be lost. Too many Australian inventions and discoveries end up being commercialised overseas, where the value they create is captured by others. This costs Australia jobs and wealth, and denies us the chance to build new industries.

Australia has shown that it can produce world-beating innovations, but we have never done it enough, and it is getting harder all the time. Old players are investing heavily to maintain their position, while new ones crowd onto the field. Countries like Russia and South Africa have more than doubled their R&D spending over the past decade. The share of global research and development performed by non-OECD countries increased from 11.7 per cent in 1996 to 18.4 per cent in 2005, and it continues to rise.

Australia's innovation system will need to work better if we want to compete in this environment. It will need to work better if we want to prevent further productivity decline. It will need to work better if we want to maintain the way of life we value so much.

A stronger innovation system

The Australian Government's investments in research and innovation infrastructure are designed to support jobs and growth in the short-term, while increasing our long-term capacity to produce and commercialise new ideas.

It is essential that we keep thinking beyond the needs of today — hence the ten-year horizon of this agenda. Our objective is to build a stronger national innovation system. This will involve investment in reform and renewal. It will involve setting priorities and strengthening coordination; improving skills and expanding research capacity; increasing innovation in business, government and the community sector; and boosting collaboration — domestic and international — across the system.

National Innovation Priorities

Australia's resources are finite. We can make the most of them by focusing on problems we are uniquely placed to solve, and opportunities we are uniquely placed to grasp. That means setting priorities. The Australian Government has adopted seven National Innovation Priorities to focus the production, diffusion and application of new knowledge. All of these priorities are equally important. They address the country's long-term weakness in business innovation, and in collaboration between researchers and industry. The National Innovation Priorities complement Australia's National Research Priorities, which help focus public-sector research.

Priority 1: Public research funding supports high-quality research that addresses national challenges and opens up new opportunities.

Priority 2: Australia has a strong base of skilled researchers to support the national research effort in both the public and private sectors.

Priority 3: The innovation system fosters industries of the future, securing value from the commercialisation of Australian research and development.

Priority 4: More effective dissemination of new technologies, processes, and ideas increases innovation across the economy, with a particular focus on small and medium-sized enterprises.

Priority 5: The innovation system encourages a culture of collaboration within the research sector and between researchers and industry.

Priority 6: Australian researchers and businesses are involved in more international collaborations on research and development.

Priority 7: The public and community sectors work with others in the innovation system to improve policy development and service delivery.

Measures to renew and expand Australia's publicly-funded research capabilities will yield high returns.

Skills and research capacity

Universities and public research organisations provide knowledge to fuel the innovation system and skilled people to drive it. International evidence suggests that up to three-quarters of private sector patents draw on public sector research. Measures to renew and expand Australia's publicly-funded research workforce, research infrastructure, and machinery for sharing research results will yield high returns.

With this in mind, the Australian Government will ...

Capacity

- Progressively increase the number of research groups performing at world-class levels, as measured by international performance benchmarks.
- Use mission-based funding compacts and other funding mechanisms to promote collaboration by encouraging universities to organise themselves into research hubs and spokes, and to pursue opportunities to undertake industry-driven research more vigorously.
- Progressively address the gap in funding for indirect research costs — *starting by augmenting the Research Infrastructure Block Grants Scheme with a new Sustainable Research Excellence in Universities Initiative.*
- Help smaller and regional universities develop their research capacity by teaming up with other institutions — *supported by a new Collaborative Research Networks Scheme.*
- Increase the capacity of public research organisations, especially to tackle complex problems, participate in domestic and international collaborations, and undertake multidisciplinary research.
- Continue to invest in research infrastructure to support collaboration and give Australian researchers access to the latest technology, guided by the *Strategic Roadmap for Australian Research Infrastructure* (2008) — *building on \$580 million for university research and teaching infrastructure in the first round of the Education Investment Fund, \$321 million for research infrastructure in the second round, and \$901 million for projects identified through the roadmap and funded under the Super Science Initiative; the third round of the Education Investment Fund will be conducted in 2009–10 to maintain the momentum.*

Skills

- Develop a research workforce strategy to address expected shortfalls in the supply of research-qualified people.
- Increase the stipend for Australian Postgraduate Awards — *with an increase of more than 10 per cent announced in the 2009–10 Budget, lifting the stipend to \$22,500 in 2010.*
- Significantly increase the number of students completing higher degrees by research over the next decade — *building on the Government's ambition to lift the proportion of 25–34-year-olds*

with a bachelor's degree and its new incentives to get undergraduates studying maths and science (both of which will enlarge the pool of students qualified to undertake research degrees), as well as its action to double the number of Australian Postgraduate Awards in the 2008–09 Budget.

- Create viable career paths for Australian researchers — *building on the Government's measures to support research trainees (more Australian Postgraduate Awards with higher stipends), early-career researchers (Super Science Fellowships), mid-career researchers (Future Fellowships), and senior researchers (Australian Laureate Fellowships).*

Accountability

- Introduce mission-based funding compacts that allow universities to determine their own research and collaboration agendas in line with national priorities.
- Implement Excellence in Research for Australia to measure the quality of university research and guide the allocation of resources.
- Require universities to provide more meaningful data on research costs through activity-based reporting, and to meet specific performance targets to be developed in consultation with the sector.

Business innovation

While profit opportunities and competition motivate most business innovation, governments can support innovative businesses by reducing impediments and providing incentives to address specific market failures. Australia has relatively few large firms, so it is especially important that we lift the innovation performance of smaller ones. It is also essential that firms can access finance to commercialise their ideas. This was a problem before the global financial crisis; it is a bigger problem now.

With this in mind, the Australian Government will ...

- Aim to increase the proportion of businesses engaging in innovation by 25 per cent over the next decade — *building on initiatives including Enterprise Connect, Clean Business Australia, and the new \$4.5 billion Clean Energy Initiative.*
- Aim to increase the number of businesses investing in R&D over time — *fuelled by the introduction of a new R&D Tax Credit, which will double the tax incentive for small-business R&D (restoring it to pre-1996 levels), and lift the base tax incentive for R&D by larger firms.*
- Support innovative responses to climate change — *including through Clean Business Australia, the Green Car Innovation Fund, the Clean Energy Initiative, the Global Carbon Capture and Storage Institute, and the Climate Change Action Fund.*
- Improve innovation skills and workplace capabilities, including management and leadership skills — *building on Enterprise Connect and the Education Revolution.*

Australia has relatively few large firms, so it is especially important that we lift the innovation performance of smaller ones.

- Support the efforts of Australian firms to get their ideas to market — *through initiatives including Climate Ready, the Green Car Innovation Fund, and the new Commonwealth Commercialisation Institute.*
- Work with the private sector to increase the supply of venture capital — *building on the Government's measures to maintain stability and liquidity in the Australian financial system during the global financial crisis, and on the new Innovation Investment Follow-on Fund.*
- Maintain a continuous dialogue with industry about how we can maximise business innovation — *including through Enterprise Connect, Industry Innovation Councils, and working groups like that established for pharmaceuticals.*

Public sector innovation

The Australian Government must lead the national innovation system by example, embracing new and better ways to develop policy, deliver services, and manage information — both on its own account and through its partners in the community sector. It can also use its procurement powers to stimulate innovation in the private sector.

With this in mind, the Australian Government will ...

- Take advice from the Australian Public Service Management Advisory Committee and the Australian National Audit Office on how the public sector can implement the recommendations of the Review of the National Innovation System.
- Use public procurement to drive research, innovation and technology development by Australian firms — *building on the new Commonwealth Procurement Guidelines released in December 2008.*
- Take steps to develop a more coordinated approach to Commonwealth information management, innovation, and engagement involving the Australian Government Information Management Office and other federal agencies.
- Consider options for reforming the Australian patent system to increase innovation, investment and trade; and supporting intellectual property education for researchers and business.
- Improve the management and regulation of biotechnology and nanotechnology to maximise community confidence and community benefits from the use of new technology — *starting with a new National Enabling Technologies Strategy.*

Collaboration

Collaboration stretches our research dollars further, spreads risk, favours serendipity, propagates skills, and builds critical mass. It is increasingly the engine of innovation. Australia has everything to gain from improving connections within the national innovation system and expanding its participation in international research and innovation networks. It is especially important that we increase the level of collaboration between public researchers and private industry — we rank last in the OECD on this measure.

Collaboration is increasingly the engine of innovation.

With this in mind, the Australian Government will ...

- Aim to double the level of collaboration between Australian businesses, universities, and publicly-funded research agencies over the next decade — *building on initiatives including mission-based funding compacts for universities, Enterprise Connect (including its Researchers in Business Program), Industry Innovation Councils, the new Joint Research Engagement Scheme, and the new Royal Institution of Australia.*
- Increase international collaboration in research by Australian universities — *building on actions to open important Australian Research Council awards and fellowships to international applicants, and increase multilateral engagement (for example, in the Square Kilometre Array radio-telescope project).*
- Renew the Cooperative Research Centres Program along the lines proposed in *Collaborating to a Purpose* — *building on the new program guidelines released in 2008, which reinstate public good as a funding criterion, encourage research in the humanities, arts and social sciences, and increase the program's focus on the needs of end-users.*
- Improve Enterprise Connect's services to individual firms, anticipating that Enterprise Connect will continue to develop and may include regional clusters and networks uniting businesses, researchers and educational institutions.
- Promote proven models for linking public and not-for-profit researchers with industry and the wider Australian community — *including the CSIRO's National Research Flagships and the CSIRO ICT Centre.*

Governance

To ensure that Australia continues to have the right innovation priorities and that we are pursuing them in the right way, we must continuously evaluate our policies and measure our performance. This will tell us what's working, what isn't, and what we can improve. Given the growing complexity of the innovation process, we also need to ensure that the national innovation system is governed effectively.

With this in mind, the Australia Government will ...

- Strengthen the Prime Minister's Science, Engineering and Innovation Council, especially its capacity to look over the horizon and identify emerging trends.
- Use the Commonwealth, State and Territory Advisory Council on Innovation to improve intergovernmental coordination, starting with the design and delivery of business programs.
- Give the interagency Coordination Committee for Science and Technology more responsibility and rename it the Coordination Committee on Innovation.
- Increase the use of metrics, analysis, and evaluation to inform policy development and decision-making.

The future

By 2020, the Australian Government wants a national innovation system in which:

- the *Commonwealth* clearly articulates national priorities and aspirations to make the best use of resources, drive change, and provide benchmarks against which to measure success;
- *universities and research organisations* attract the best minds to conduct world-class research, fuelling the innovation system with new knowledge and ideas;
- *businesses of all sizes and in all sectors* embrace innovation as the pathway to greater competitiveness, supported by government policies that minimise barriers and maximise opportunities for the commercialisation of new ideas and new technologies;
- *governments and community organisations* consciously seek to improve policy development and service delivery through innovation; and
- *researchers, businesses and governments* work collaboratively to secure value from commercial innovation and to address national and global challenges.

We embrace these aims not for what they are, but for what they represent — a radically expanded power to create jobs, build prosperity, save lives, eliminate disadvantage, protect our fragile planet, and increase happiness. Innovation can help us achieve all these things. It is our best hope for a better future.

Chapter 1

WHY INNOVATION?

The government has stimulated the economy precisely by accelerating investment in its long-term productivity agenda.

We cannot maximise productivity without increasing our capacity for invention and discovery: “Innovation and diffusion of new and better production methods, and the introduction of new goods and services, are the core drivers of productivity growth — getting more, and more highly valued, outputs from any level of inputs.”¹

These were the Australian Government’s priorities before the world plunged into recession, and they remain its priorities now. The Government has stimulated the economy to support growth and jobs through the crisis precisely by accelerating investment in its long-term productivity agenda. Renewing Australia’s schools and universities, modernising research facilities, building community and economic infrastructure, supporting business innovation — each of these measures serves two aims: to keep the country working while the storm rages, and to tool it for a better future once the storm has passed.

The productivity agenda

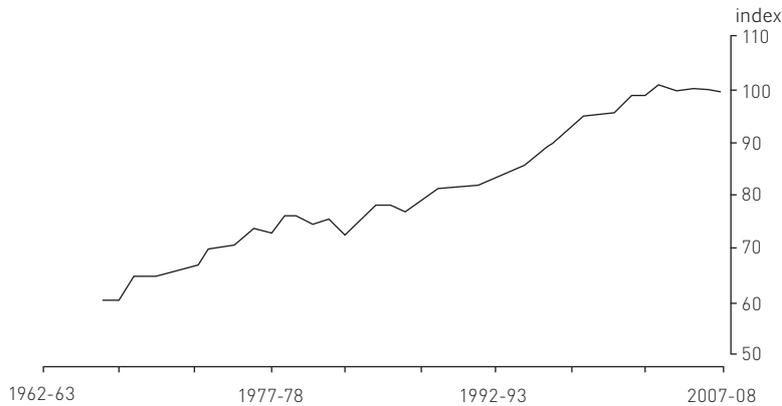
The Australian economy grew strongly between 1992 and 2007, thanks mainly to reforms made in the 1980s and a boom in demand for our resources. No mining boom lasts forever, however, and as the Commonwealth’s commitment to economic reform and investment in education, innovation and infrastructure stalled after 1996, Australia’s productivity growth slowed dramatically. Multi-factor productivity grew 1.4 per cent a year on average between 1982–83 and 1995–96. Growth has averaged only 0.9 per cent a year since then, which is no better than we achieved in the 1960s.² “Sometime around 2002 Australian productivity went from growing substantially faster to growing substantially slower than the Organisation for Economic Cooperation and Development (OECD) average.”³ Since 2003–04, it has actually declined (Figure 1.1).

1 *Annual Report 2007–08* (Melbourne: Productivity Commission, 2008), p. 1.

2 ABS, *Australian System of National Accounts, 2007–08* (cat. no. 5204.0), Table 13.

3 *Venturous Australia: Building Strength in Innovation* (Melbourne: Cutler & Company, 2008), p. ix.

Figure 1.1: Australia's multi-factor productivity, 1962–63 to 2007–08 (2006–07 = 100.0)



Source: ABS, *Australian System of National Accounts, 2007-08* (cat no 5204 0).

While the global economy was growing and the terms of trade were in our favour, Australia's deteriorating productivity performance went largely unnoticed, despite the harm it was doing our ability to compete. In the last eight years, Australia has slipped from fifth to eighteenth in the World Economic Forum's Global Competitiveness Index. We are even further back on capacity for innovation, ranking twenty-ninth.⁴

With the world now in recession, the toll of political complacency and policy neglect on Australia's productivity can no longer be ignored. Urgent action is needed to turn things around. What form should this take? How do we rekindle the productivity growth needed to keep Australia competitive, maintain living standards, and create jobs? Investment in education and infrastructure is essential. So is micro-economic reform. And so is innovation.⁵ We have seen the innovation pipeline shut down in previous recessions, and the results have been disastrous. Knowledge and capital have been destroyed, recovery has been delayed, and growth has been slowed — often for many years.⁶ This must not be allowed to happen again.

4 Michael E. Porter and Klaus Schwab, *The Global Competitiveness Report 2008-2009* (Geneva: World Economic Forum, 2008), pp. 92-93; and Michael E. Porter, Jeffrey D. Sachs and John W. McArthur, *The Global Competitiveness Report 2001-2002* (Geneva: World Economic Forum, 2002), p. 20.

5 Kevin Rudd, "Towards a Productivity Revolution: A New Agenda of Micro-economic Reform for Australia", Address to the *Australian-Melbourne Institute New Agenda for Prosperity Conference*, University of Melbourne, 27 March 2008.

6 *A European Economic Recovery Plan* (Brussels: Commission of the European Communities, 2008), p. 15.

If we act now, we can gain a head start in the race to come up with climate change solutions for the global market.

Solving problems and improving lives

While we need innovation to revive productivity growth, we also need it to tackle the many pressing economic, social and environmental challenges facing Australia and the world. We need innovation to create better products and services, higher levels of comfort and security, richer experiences, and new forms of social engagement.

Innovation to build new industries

Innovation has the power to transform existing industries — enabling them to operate more efficiently, to deliver improved products and services, and to win new markets. It can also give rise to entirely new industries, from carbon capture and storage to online retailing. A strong innovation system also gives us the capacity to match and adapt to the innovations of others. This is especially important given the pace of technological and organisational change in today's world. In the last decade, for example, some consumer products, such as film cameras, have all but disappeared, and the producers of these products have had to make massive adjustments to survive. Some manufacturers have gone from making end-products to making inputs for global supply chains; others have evolved into marketing and logistics operations. Service industries have grown rapidly. Australia must be flexible and creative if it is to prosper in a global environment where change is the only constant. Without innovation, we cannot hope to provide the varied job opportunities needed to match the aptitudes and aspirations of Australia's workers.

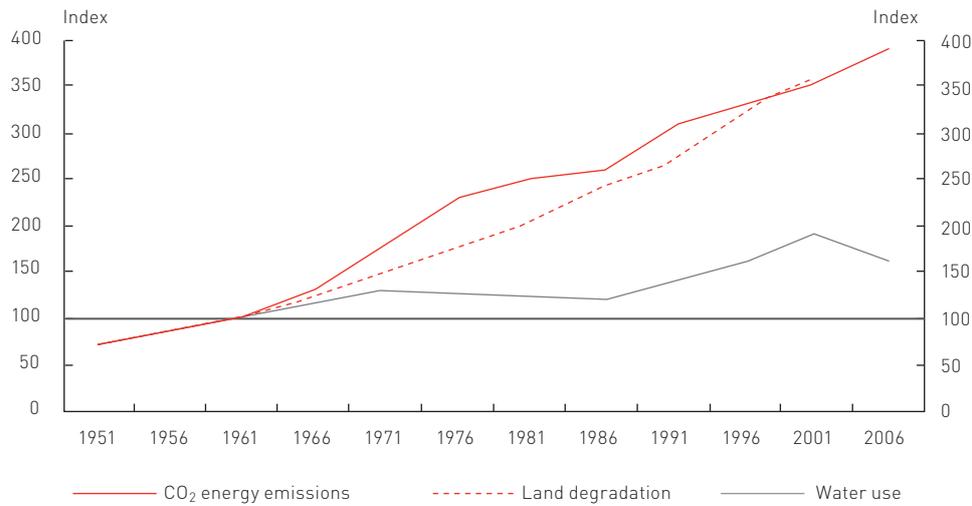
Innovation to protect the environment

Climate change threatens Australia's agriculture, tourism industry, water supplies, coastal settlements, natural environment, and way of life. "Without action, scientists predict up to 20 per cent more drought months over most of Australia by 2030, more intense and damaging cyclones and rising sea levels."⁷ The Intergovernmental Panel on Climate Change predicts temperature increases of between 1.1 and 6.4 degrees by 2100 relative to the period from 1980 to 1999.⁸ Addressing the causes and effects of climate change will require major changes to how industries and households operate. So will dealing with longstanding environmental problems such as land degradation, the loss of biodiversity, water scarcity, and the sustainability of our sprawling cities (Figure 1.2). Australia can meet these challenges without compromising living standards or imposing an unfair burden on any one part of the community by developing new and better ways of doing things — by investing in information, science, research and innovation. If we act now, we can gain a head start in the race to come up with climate change solutions for the global market. Australia is also ideally placed to develop specific environmental solutions for export to the many countries that have ecologies similar to ours, but lack our technological capabilities.

7 *Carbon Pollution Reduction Scheme: Green Paper* (Canberra: Department of Climate Change, 2008), p. iii.

8 *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Geneva: IPCC, 2007), p. 45.

Figure 1.2: Indicators of Australian environmental pressures, 1951–2006



Source: *Intergenerational Report 2007* (Canberra: Department of the Treasury, 2007).

Innovation for social justice

Social and economic disadvantage persists in Australia despite our relatively high standard of living. If we are serious about eliminating disadvantage, we must start by ensuring that every Australian has the chance to work, to access government and other services, and to stay connected with their family, friends and community. Good healthcare and a good education are not prerogatives of the rich, but rights all Australians should enjoy. Innovation — and especially advances in information and communication technology — can help to deliver these things.

For example, the role of innovation in improving health outcomes is well publicised and generally well understood. Australia is especially good at this kind of innovation. Recent successes include the world's first vaccine to prevent cancer (CSL's Gardasil), a drug that can significantly reduce influenza symptoms (Biota's Relenza), an enzyme replacement therapy to treat a life-threatening lysosomal storage disorder (BioMarin's Naglazyme), and — most famous of all — Cochlear's bionic ear.

There is more to improving health, however, than inventing new drugs and medical devices. We also need to improve our understanding of the physical, environmental and social determinants of disease. We need to focus on prevention, not just on cure. We need to get smarter about the way we deliver healthcare, especially as our ageing population puts increasing pressure on services.

Social innovation takes many forms. Very often the answer to a problem lies not in introducing new technologies, but in developing smarter policies and more effective ways of meeting people's needs. An effective innovation system can do more than churn out new gadgets; it can show us better ways to live.

An effective innovation system can do more than churn out new gadgets; it can show us better ways to live.

Review of the National Innovation System

Mindful of the need to reverse the relative decline in Australia's innovation capacity and performance since the 1990s, the Australian Government announced a Review of the National Innovation System on 22 January 2008. The review panel, chaired by Dr Terry Cutler, was asked to identify gaps and weaknesses in Australia's innovation system and recommend ways to correct them. The panel considered evidence of both market failure — where commercial incentives are insufficient to induce socially and economically desirable behaviour; and system failure — where the scope for innovation is limited by policy and institutional shortcomings.

The review panel's report, *Venturous Australia: Building Strength in Innovation*, was released on 9 September 2008. It identified several problems with Australia's innovation system and recommended that the Australian Government:

- Develop innovation priorities to ensure that scarce public resources are directed to areas of competitive advantage and strategic importance, and that progress is properly monitored and evaluated.
- Improve the governance of the innovation system to provide clear leadership and coordination across government, business, research centres, and educational institutions.
- Allocate research funding in ways that drive excellence, collaboration and diversity, within a framework that improves the links between funding, national priorities, and the diverse research missions of Australia's universities.
- Establish a business environment conducive to innovation, including through support programs to maintain the recent growth in R&D, and measures to encourage knowledge partnerships and networks.
- Develop the skills and capabilities of workers and managers to promote cultural change and creativity in Australia's workplaces.
- Promote innovation within government and the community sector, with the emphasis on whole-of-government approaches to innovation and the use of public procurement to build world-competitive capabilities in Australian organisations.
- Introduce measures to increase domestic and international collaboration between businesses and researchers, to maximise knowledge flows and value-creation.

The Australian Government's innovation agenda for the twenty-first century responds to recommendations from the Review of the National Innovation System and builds on the ten-point plan for innovation that formed part of the Government's 2007 election platform.⁹

It also draws on *Collaborating to a Purpose: Review of the Cooperative Research Centres Program* (conducted by Professor Mary O'Kane); *Building Innovative Capability: Review of the Australian Textile, Clothing and Footwear Industries* (conducted by Professor Roy Green); the *Final Report of the Review of Australia's Automotive*

⁹ *New Directions for Innovation, Competitiveness and Productivity* (Canberra: Australian Labor Party, 2007).

Industry (conducted by the Hon Steve Bracks); the *Final Report of the Pharmaceuticals Industry Strategy Group*; the *Final Report of the Review of Australian Higher Education* (led by Professor Denise Bradley); and the House of Representatives Standing Committee on Industry, Science and Innovation's Inquiry into Research Training and Research Workforce Issues in Australian Universities, *Building Australia's Research Capacity*.

It is informed by the conclusions of the Australia 2020 Summit held in April last year, as outlined in the summit's *Final Report*.

Chapter 2

AUSTRALIA'S INNOVATION SYSTEM

Innovation happens because organisations mobilise resources to make it happen.

There is much more to innovation than researching, developing and commercialising new technologies. Innovation is about doing new things and doing existing things in new ways. That may mean introducing better products, services, organisational methods, production processes, delivery mechanisms, or marketing techniques. Many submissions to the Review of the National Innovation System noted that, “In the real world most innovation occurs in established firms in existing industries through incremental improvements, involving non-scientific and non-R&D based knowledge such as creative design, marketing, organisational improvement and tooling up.”¹⁰ In Australia, only 15 per cent of innovation-active businesses spend money on R&D.¹¹

Innovation involves generating, diffusing and applying knowledge. It is not a linear process, with an inventor at one end and a customer at the other. There are many players involved, and they interact and influence each other in complex ways. Ideas can come from anywhere and take us in unexpected directions.

Making innovation work requires a workforce with sophisticated skills of all kinds — including leadership and management skills. It also requires cooperative workplaces in which creativity is encouraged. Few organisations command all the skills needed to innovate successfully on their own. They must network and collaborate — locally and globally. Innovation happens because organisations mobilise resources to make it happen; it happens because they invest in innovative capacity. How much they invest is influenced by the opportunities and incentives available to them.

Who are our innovators?

Almost all individuals and organisations participate in the innovation process in one way or another and form part of our national innovation system. They include universities; government research agencies (e.g. CSIRO and National ICT Australia); large and small firms in all industries, including the local operations of international enterprises; public research funding bodies (e.g. the Australian Research Council and the National Health and Medical Research Council); private non-profit organisations (e.g. medical research institutes); joint

¹⁰ *Adding to Australia's Capacity: The Role of Research Universities in Innovation. A Submission from the Group of Eight to the Review of the National Innovation System* (Canberra: Group of Eight, 2008), p. 13.

¹¹ ABS, *Innovation in Australian Business, 2006–07* (cat. no. 8158.0).

research groups (e.g. Cooperative Research Centres); community organisations and interest groups; and consumers of innovative products and services.

The role of government

The Australian Government is an important player in the innovation system. It helps to create the conditions for innovation by managing the economy responsibly, regulating effectively, and making specific investments in education, research and infrastructure — not least transport and communications infrastructure. It maintains a pro-business operating environment, with the emphasis on open competition and the free flow of products, people and ideas, both domestically and internationally. These foundation conditions are as important to a country's innovation performance as specific innovation policies and programs.¹²

The Commonwealth also builds innovation capacity and provides incentives to innovate. It builds capacity by educating and training the workforce (including researchers and managers), facilitating collaboration, brokering partnerships, providing advice, and collecting data. It provides support in the form of grants and tax incentives to overcome market failures that discourage private investment in innovation, not least the reluctance of financiers to provide capital for innovative but untried products. It also funds vital research — especially basic research that would not or could not be done by the private sector. The direct social and economic value of this research should never be underestimated. For example, three-quarters of industry patents in the United States cite the results of publicly-funded science.¹³

The Australian Government is spending \$8.58 billion on science and innovation in 2009–10, compared to \$6.88 billion in 2008–09 — an increase of 25 per cent. The science and innovation budget was \$6.56 billion in 2007–08. A quarter of the Commonwealth's innovation spending goes towards programs that encourage business investment in innovation, including R&D tax incentives. The remainder is shared between the higher education sector, research agencies, and multi-sector initiatives such as the Cooperative Research Centres Program.¹⁴

Finally, the Commonwealth is itself a major provider and consumer of innovative products and services, driving innovation across the economy by demanding new and better inputs from the private sector, and developing new and better ways to deliver its own services, whether in health, education, defence, the administration of justice, or services to business.

The Australian Government looms large in the national innovation system, but it is still only one player among many. In our market-

12 Sarah Box, *OECD Work on Innovation: A Stocktaking of Existing Work*, STI Working Paper 2009/2 (Paris: OECD Directorate for Science, Technology and Industry, 2008).

13 Francis Narin, Kimberly S. Hamilton and Dominic Olivastro, "The Increasing Linkage Between U.S. Technology and Public Science", *Research Policy*, vol. 26 (1997).

14 *The Australian Government's 2009–10 Science and Innovation Budget Tables* (Canberra: Department of Innovation, Industry, Science and Research, 2009).

oriented economy, the main incentive to innovate will always be competition, and the main agents and beneficiaries of innovation will always be private firms and consumers.

How are we different?

The size and structure of our economy and our distance from international markets present Australia with unique innovation challenges and opportunities.

The bulk of the knowledge we rely on is generated abroad, so it is essential that we have the absorptive capacity — the skills and international connections — to identify and adapt the knowledge needed to move Australian industries up the value chain as competition at the low end intensifies.

Australia has a very high proportion of small and medium-sized firms. The availability of finance can be decisive for innovation in these firms, which often lack internal funds and have much more difficulty attracting investment than larger companies — especially now, during the global financial crisis. Small size can also increase the costs of obtaining information.

Australia also has distinctive arrangements for conducting public sector research — through large public research agencies and universities. Any move to increase the contribution public researchers make to the national innovation system must take these arrangements into account.

Australia has unique natural resources and distinctive flora and fauna. We also have very specific resource limitations — water is an obvious example. Our resource profile will inevitably influence our innovation priorities. For example, Australia has the third largest ocean territory in the world, so it makes sense for us to focus on marine science.

Australia has valuable cultural assets, including museum collections that represent vast spans of social, environmental, and geological history. We have valuable human resources, including a multicultural population with an increasingly global outlook. We also face distinctive social challenges, such as Indigenous disadvantage.

The national innovation system must be able to harness these raw materials to create solutions that work not just for Australia, but for the world.

The current state of play

Australia starts the race to secure a place in an increasingly knowledge-based global economy with some pluses and some handicaps. We have a distinguished research record and many new technologies to our credit. Business expenditure on R&D has been rising strongly — or at least it was until the global economic crisis hit. Against that, only a third of Australian firms innovate, and that figure has remained unchanged for many years.¹⁵ Despite the recent surge,

The national innovation system must be able to harness our raw materials to create solutions that work not just for Australia, but for the world.

15 ABS, *Innovation in Australian Business* (cat. no. 8158.0), various issues.

R&D spending has been growing much more slowly in Australia than in many other countries, notably China. Australia's overall R&D spending has grown an average of 8 per cent a year since 1996–97.¹⁶ Business R&D spending actually declined in the late 1990s — for the first time on record — and took years to recover.¹⁷ By way of contrast, China's overall research and development expenditure is growing 22 per cent a year; growth in business spending on R&D is even faster than that, at 28 per cent a year.¹⁸ Nor is it just emerging economies we have to worry about. In the United Kingdom, the proportion of innovation active businesses has risen from 49 per cent in 2001 to 68 per cent in 2007.¹⁹ That is nearly twice the Australian figure.

Australia lags behind the developed economies we like to compare ourselves with on this and many other measures. We spend 2.01 per cent of GDP on research and development.²⁰ The OECD average is 2.26 per cent. Austria, Denmark, Germany, Iceland, Switzerland, Taiwan, and the United States spend more than 2.5 per cent; Finland, Japan, South Korea, and Sweden spend more than 3 per cent; Israel spends more than 4 per cent.²¹ Although innovation is increasingly driven by collaboration, Australia ranks last in the OECD on collaboration for innovation between firms and higher education institutions.²² In 2004, Australia's investment in knowledge — made up of spending on research and development, higher education, and information and communication technologies (as a proxy for technology diffusion) — was below the OECD average.²³ Australian Government expenditure on science and innovation was 22 per cent lower as a share of GDP in 2007–08 than it was in 1993–94.²⁴

Other developed economies have been quicker to grasp the innovation imperative than Australia. The European Union's Lisbon Strategy (2000) commits it to becoming “the most competitive and dynamic knowledge-based economy in the world”, with the emphasis on high-skill jobs, social inclusion, and environmental sustainability.²⁵ In the United States, the Augustine report, *Rising above the Gathering Storm* (2005), warned that America was in danger of losing its technical pre-eminence and proposed twenty measures to avert that danger, several of which have now been taken up by President Obama.²⁶

16 ABS, *Research and Experimental Development, All Sector Summary, Australia, 2006–07* (cat. no. 8112.0), Table 1.

17 ABS, *Research and Experimental Development, Businesses, Australia, 2006–07* (cat. no. 8104.0), Table 1.

18 *OECD Reviews of Innovation Policy: China* (Paris: OECD, 2008), p. 142.

19 *Annual Innovation Report 2008* (London: Department for Innovation, Universities and Skills, 2009), p. 3.

20 ABS, *Research and Experimental Development, All Sector Summary, Australia, 2006–07* (cat. no. 8112.0), Table 1; and ABS, *Australian System of National Accounts, 2007–08* (cat. no. 5204.0), Table 2.

21 *Main Science and Technology Indicators 2008/2* (Paris: OECD, 2008), pp. 18 and 57.

22 *Science, Technology and Industry Scoreboard 2007* (Paris: OECD, 2007), pp. 76–77.

23 *ibid.*, pp. 22–23.

24 *The Australian Government's 2009–10 Science and Innovation Budget Tables* (Canberra: Department of Innovation, Industry, Science and Research, 2009). This figure differs from the one arrived at by the Review of the National Innovation System because science and innovation budget spending for 2007–08 has been revised upwards as new data has come to hand. See *Venturous Australia: Building Strength in Innovation* (Melbourne: Cutler & Company, 2008), p. viii.

25 Conclusions of the Presidency, European Council, Lisbon, 23 and 24 March 2000 (Brussels: Directorate-General for the Presidency, 2000).

26 *Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (Washington, D.C.: National Academies Press, 2005).

The British Government has also been active in this area, starting with the Sainsbury review of science and innovation policy, *The Race to the Top* (2007), which concluded that:

The challenge, therefore, is not to hide behind trade barriers and engage in a race to the bottom, but to refocus government so that it supports knowledge generation, innovation, education, training, infrastructure development ... In today's global economy, investment in science and innovation is not an intellectual luxury for a developed country, but an economic and social necessity, and a key part of any strategy for economic success.²⁷

The government accepted Lord Sainsbury's recommendations in full, and has made rapid progress on implementation, notably through its science and innovation strategy, *Innovation Nation* (2008).²⁸ Its most recent budget includes a £750 million Strategic Investment Fund to support innovation in advanced manufacturing, low-carbon technologies, biotechnology, ICT, and other critical sectors.²⁹

While Australian Government spending on science and innovation fell to 0.58 per cent of GDP in 2007–08, Denmark is steadily increasing government spending on R&D — from 0.89 per cent of GDP in 2008, to 0.94 per cent in 2009, with a target of 1 per cent in 2010.³⁰ In the United States, President Obama has pledged to double funding for federal science agencies over the next decade. The *American Recovery and Reinvestment Act* passed in February this year and the Budget the President presented to Congress a few days later go a long way towards honouring that pledge.³¹

Precisely because we are an advanced country, we have to work harder to maintain our position.

Innovation activity is increasing rapidly across the globe. Australia must redouble its innovation efforts or risk falling behind its competitors and seeing its living standards decline. Precisely because we are an advanced country, we have to work harder to maintain our position. A recent report examined the ability of selected countries, including Australia, to reap the benefits of sixteen applications arising from research in biotechnology, nanotechnology, materials technology, and information technology. The report concluded that Australia was one of only seven countries with the capacity to use all sixteen technologies (Figure 2.1). It also suggested that to maintain their current levels of prosperity, “nations at the top of the development ladder” — such as Australia — “must continually seek to push beyond what they already have.”³²

27 Lord Sainsbury of Turville, *The Race to the Top: A Review of Government's Science and Innovation Policies* (London: HMSO, 2007), p. 22.

28 *Innovation Nation*, Cm 7345 (London: OPSI, 2008).

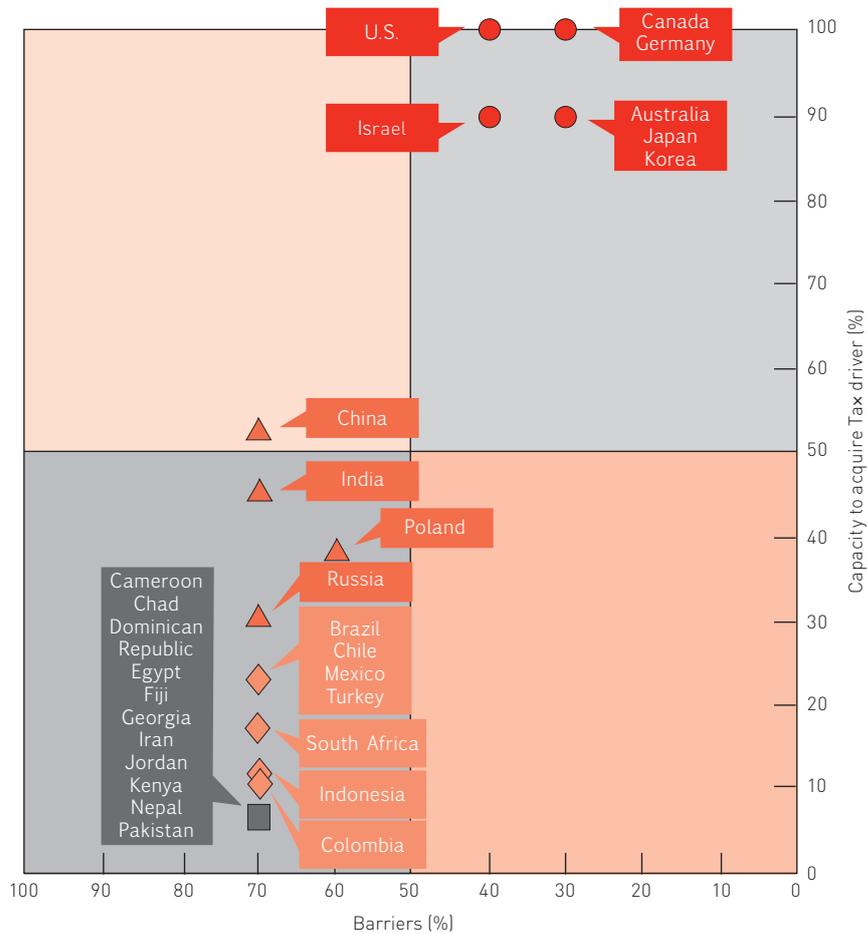
29 *Budget 2009: Building Britain's Future*, HC 407 (London: OPSI, 2009), p. 81.

30 *The Australian Government's 2009–10 Science and Innovation Budget Tables* (Canberra: Department of Innovation, Industry, Science and Research, 2009); and “Offentlig forskning udgør 0,94 procent af BNP næste år”, Ministry of Science, Technology and Innovation, 26 August 2008 (media release).

31 *A New Era of Prosperity: Renewing America's Promise* (Washington, D.C.: Office of Management and Budget, 2009), p. 105.

32 Richard Silbergitt, Philip S. Antón, David R. Howell, Anny Wong and others, *The Global Technology Revolution 2020: Bio/Nano/Materials/Information Trends, Drivers, Barriers, and Social Implications* (Santa Monica, California: RAND Corporation, 2006), pp. 13–14.

Figure 2.1: Selected countries' capacity to implement the top sixteen technology applications



Source: Richard Silbergliitt, Philip S. Anton, David R. Howell, Anny Wong and others, *The Global Technology Revolution 2020: Bio/Nano/Materials/Information Trends, Drivers, Barriers and Social Implications* (Santa Monica, California: RAND Corporation, 2006).

The World Economic Forum has reached a similar conclusion, numbering Australia among those countries that have reached “the innovation-driven stage” of development, at which “companies must compete through innovation ... producing new and different goods using the most sophisticated production processes”; this is the only way such countries can maintain their high wages and living standards.³³

Is our innovation system equal to the task? Do our businesses have the capacity, people, and incentives to bring innovative products and services to market? Do our research institutions have the wherewithal to find solutions to the myriad problems we face? Are there gaps in our support for innovation that may force ideas offshore, costing Australia jobs, businesses, revenue, and intellectual property? Do we have the governance arrangements needed to focus and coordinate our innovation efforts? Do we have the policy framework needed to build an internationally competitive innovation system?

³³ Michael E. Porter and Klaus Schwab, *The Global Competitiveness Report 2008-2009* (Geneva: World Economic Forum, 2008), p. 7.

Innovation is most likely to occur in a supportive public policy environment.

These are not questions we can simply leave the market to answer. The experience of the world's most successful knowledge-based economies tells us that innovation is most likely to occur in a supportive public policy environment. Australia has not had that kind of environment in recent years.

In the higher education sector, there is a widening gap between the funding available and the actual cost of research. Insufficient attention has been paid to the quality of research and research training.

In the business sector, the recent improvement in R&D expenditure is threatened by the global economic crisis. The number of small and medium-sized firms doing R&D remains low, and innovative businesses are still the exception rather than the rule. While collaboration can increase the probability of achieving new-to-the-world innovations by up to 70 per cent, the proportion of Australian firms engaged in collaboration is modest by international standards.³⁴ This reflects deficiencies in public policy and business leadership rather than any lack of opportunities to add value by working with others. International evidence makes this very clear. Two-thirds of America's award-winning innovations now involve collaboration between businesses and researchers in "government agencies, federal laboratories, and research universities"; in the 1970s, it was less than a fifth.³⁵

The culture and management of Australian organisations lags behind the world's best in other areas as well. A survey of manufacturing firms found that "while there is evidence of manufacturers engaging in some innovative business practices, especially towards achieving production efficiencies, they generally fail to appreciate and employ innovation as a decisive competitive strategy".³⁶ More generally, Australia's education and training system does not pay enough attention to the skills required for innovation. Employers complain that they have difficulty recruiting workers with these "soft" skills, which include the ability to solve problems, communicate effectively, and work in teams.³⁷

These are all shortcomings we must repair if Australia is to grow and prosper — especially now, when the global downturn is putting additional pressure on our innovation system. Without countermeasures, the crisis could be especially detrimental to business innovation, discouraging R&D expenditure and reducing the supply of risk capital.

Yet the tough times we are going through also present opportunities for Australia, which remains in a stronger economic position than many of its competitors. They give us the chance to build an innovation system that can help to address today's challenges, while preparing us for a leading role in the new industries and new markets that will open up in the years ahead.

34 *Collaboration and Other Factors Influencing Innovation Novelty in Australian Businesses: An Econometric Analysis* (Canberra: Department of Industry, Tourism and Resources, 2006), p. vi.

35 Fred Block and Matthew R. Keller, *Where Do Innovations Come From? Transformations in the U.S. National Innovation System, 1970-2006* (Washington, D.C.: Information Technology and Innovation Foundation, 2008).

36 Mark Dodgson and Peter Innes, *Australian Innovation in Manufacturing: Results from an International Survey* (Sydney: Australian Business Foundation, 2006), p. 4.

37 *World Class Skills for World Class Industries: Employers' Perspectives on Skilling in Australia — Report to the Australian Industry Group* (Sydney: Allen Consulting Group, 2006), pp. 49-51.

While the global recession has cut federal revenue, the Australian Government will not use this as an excuse for inaction; on the contrary, investment in innovation is an integral part of our response to the crisis. The international slowdown is already making financiers more risk-averse and forcing businesses to reduce what they see as discretionary costs — including spending on R&D.³⁸ The government can counter this by increasing its own investment in innovation and boosting support for innovators in the private sector.

Australia has a terrific future. We have the intelligence, the imagination, and the ambition to become one of the great knowledge economies of the twenty-first century. The Australian Government is determined to create the innovation system needed to make this happen. This will mean increasing opportunities for small entrepreneurial firms in niche areas — not least by improving their access to finance, advice and research. It will mean extending management and workforce skills and supporting workplace development to encourage cultural change and make organisations more agile. It will mean promoting collaboration, including through business networks and clusters. It will mean making international firms feel at home in the Australian innovation system, and making Australia an integral part of their global R&D efforts and supply chains. And it will mean funding our universities and public research agencies to generate knowledge, provide specialist training, collaborate with industry, and host business clusters and communities of knowledge. This is the agenda for Australian innovation.

We have the intelligence, the imagination, and the ambition to become one of the great knowledge economies of the twenty-first century.

³⁸ *Australian Business and the Global Economic and Financial Crisis: Special Survey* (Sydney: Australian Industry Group, 2008), p. 2.

Chapter 3

PRIORITIES AND GOVERNANCE

If we want to make the most of Australia's finite innovation resources, we must set priorities. If we want to deliver on those priorities, we have to ensure that the national innovation system is governed effectively.

National Innovation Priorities

The Australian Government has adopted seven National Innovation Priorities to focus the production, diffusion and application of new knowledge. All of these priorities are equally important. They address the country's long-term weakness in business innovation, and in collaboration between researchers and industry. They also address the need to revitalise public research after a decade of neglect. Six of the seven priorities are supported by concrete policy ambitions, which can be used to measure the country's — and the Government's — performance over time.

The National Innovation Priorities complement Australia's National Research Priorities, which help focus public-sector research. The four National Research Priorities are: an environmentally sustainable Australia; promoting and maintaining good health; frontier technologies for building and transforming Australian industries; and safeguarding Australia.³⁹

Priority 1: Public research funding supports high-quality research that addresses national challenges and opens up new opportunities.

The Australian Government's ambition is to **increase the number of research groups performing at world-class levels**, as measured by international performance benchmarks. Investments in public sector research will continue to be guided by the National Research Priorities, which will be updated periodically to reflect changing circumstances.

³⁹ Commonwealth Parliamentary Debates (Hansard), House of Representatives, 5 December 2002, pp. 9751-9752; *Australia's National Research Priorities: The National Research Priorities and their Associated Priority Goals* (Canberra: Department of Education, Science and Technology, 2003).

Priority 2: Australia has a strong base of skilled researchers to support the national research effort in both the public and private sectors.

Skilled people are the single most important prerequisite for successful innovation. The Australian Government's objective is to **significantly increase the number of students completing higher degrees by research over the next decade.**

Priority 3: The innovation system fosters industries of the future, securing value from the commercialisation of Australian research and development.

The Australian Government rejects the proposition that Australia is a technology-taker, and that policy-makers should not be concerned about the capacity of Australian companies to develop new-to-the-world innovations. It aims to see **a continuing increase in the number of businesses investing in R&D.**

Priority 4: More effective dissemination of new technologies, processes, and ideas increases innovation across the economy, with a particular focus on small and medium-sized enterprises.

The Australian Government's goal is to achieve a **25 per cent increase in the proportion of businesses engaging in innovation over the next decade.** This would bring Australia up to the present European average and — depending on what other countries do — place us in the top third globally.⁴⁰

Priority 5: The innovation system encourages a culture of collaboration within the research sector and between researchers and industry.

Australia has a poor record of collaboration between businesses, between businesses and researchers, and between research agencies. The Australian Government's ambition is to **double the level of collaboration between Australian businesses, universities and publicly-funded research agencies over the next decade.**

Priority 6: Australian researchers and businesses are involved in more international collaborations on research and development.

Australia produces 3 per cent of the world's formal research. Our capacity to innovate depends very much on how effectively we harness and apply the other 97 per cent. The Australian Government has therefore adopted the long-term aim of **increasing international collaboration in research by Australian universities.**

⁴⁰ *Innovation in Europe: Results for the EU, Iceland and Norway* (Luxembourg: Office for Publications of the European Communities, 2004), pp. 17-18.

Public and community sector innovation brings new and better services to individuals and families.

Priority 7: The public and community sectors work with others in the innovation system to improve policy development and service delivery.

Public and community sector innovation brings new and better services to individuals and families. By increasing efficiency, it can also boost national productivity.

Program design

The innovation process is complex and risky. Everything is interconnected. The success of measures to promote R&D may depend on whether firms can get the researchers or the venture capital they need to do the job. Innovation outcomes can be hard to measure, and many experiments end up telling us only what *doesn't* work. Innovation policies and programs must be designed with these conditions in mind.

The Review of the National Innovation System proposed several principles governments could apply to achieve this. It argued that the rationale for intervention and the role of government should be clearly identified; that each intervention should support the development and effectiveness of the national innovation system as a whole; that interventions should reflect and respond to demand-side needs and priorities; that the best-placed jurisdiction should be responsible for design and delivery; and that innovation risk should be assessed, accepted, and incorporated into the design.⁴¹

The Commonwealth, State and Territory Advisory Council on Innovation is working **to have these principles adopted and implemented Australia-wide.**

Better governance

The Review of the National Innovation System argued that the administration of the system should be strengthened and streamlined to make it better at targeting national priorities, coordinating the activities of different governments, and measuring performance.

Bodies with a role in overseeing the system include:

- meetings of Commonwealth, state and territory innovation and industry ministers;
- the Prime Minister's Science, Engineering and Innovation Council, an expert group which advises the Australian Government on science and innovation;
- the Commonwealth, State and Territory Advisory Council on Innovation, a committee of officials responsible for intergovernmental coordination; and
- the Coordination Committee on Science and Technology, a committee of officials responsible for coordinating Commonwealth agencies.

⁴¹ *Venturous Australia: Building Strength in Innovation*, Annex 9: Findings of the Intergovernmental Working Group (Canberra: Department of Innovation, Industry, Science and Research, 2008).

Other ministerial, intergovernmental and interagency bodies touch on innovation issues from time to time.

The Australian Government has already improved the way the system is governed by creating the Department of Innovation, Industry, Science and Research. It unites policy responsibility for many important parts of the system in a single portfolio. It also works closely with agencies responsible for other parts of the system, notably the Department of Education, Employment and Workplace Relations.

The government will continue to increase cooperation and coordination between Commonwealth agencies. Its aim is to minimise duplication, build critical mass, and promote cross-disciplinary understanding. The Centre for Groundwater Research and Training co-funded by the Australian Research Council and the National Water Commission is a good example of how this can work. The new Australian Climate Change Science Framework is even more ambitious. It will focus and extend Australia's capabilities in fundamental climate system science by harnessing resources across government and the research sector.⁴²

Prime Minister's Science, Engineering and Innovation Council

The next step is to reinvigorate the Prime Minister's Science, Engineering and Innovation Council. Under the leadership of the Chief Scientist, the council provides advice on technical, economic, environmental and social aspects of science and technology; helps keep Australia's research and innovation priorities up-to-date; and raises community awareness. Most importantly, it is establishing formal structures to look over the horizon and provide the strategic foresight needed to support long-term, whole-of-government policy development.

Chief Scientist for Australia

Australia's new full-time Chief Scientist will play a pivotal role, both as executive officer of the Prime Minister's Science, Engineering and Innovation Council, and in her own right. She will be an adviser to government and a champion of science and research in the community, with a special brief to promote science as a career and help break down the cultural barriers that inhibit collaboration between researchers and industry. The Chief Scientist will also chair the coordination group that will be established to implement the Australian Climate Change Science Framework.

Coordination Committee on Innovation

The Coordination Committee for Science and Technology will be renamed the Coordination Committee on Innovation and given expanded responsibilities. As well as improving the coordination of policies and programs, it will coordinate advice on cross-portfolio innovation matters; gather and disseminate information on local and

⁴² *Australian Climate Change Science: A National Framework* (Canberra: Department of Climate Change, 2009).

international innovation trends; coordinate cross-portfolio input to international forums and programs; and report on the implementation of Australia's innovation and research priorities.

Streamlining programs

Governments in Australia run some 155 programs to support business innovation — forty-five administered by the Commonwealth and 110 by the states and territories. The Review of the National Innovation System and others have argued that this proliferation is confusing and inefficient.

The Australian Government will work with its state and territory counterparts to address this problem. The Commonwealth, State and Territory Advisory Council on Innovation has been asked to secure national agreement on a set of principles for innovation program design, in line with the findings of the Review of the National Innovation System (as discussed above). Once agreement has been reached, **all governments will be asked to assess existing and proposed programs against these principles.** The Commonwealth will also join with the states and territories in examining the feasibility of developing **a new portal that will enable firms to access all Australian business innovation programs in one place.**

Measuring performance

The Australian Government has a duty to measure the impact of specific innovation initiatives and the performance of the system as a whole. This is the only way to be sure that policies are working and resources are being put to the best possible use. Indicator analysis, scorecards, and case studies are all commonly used for this purpose, but they only tell part of the story. Econometric analysis has the potential to tell us much more about how well the system is doing.⁴³ So do studies linking innovation data to statistics of other kinds — financial, administrative, environmental, social and so on.⁴⁴

The Australian Government will work to **collect better data on innovation and develop new, more sophisticated analytical capabilities.** It will also produce **an annual report on the performance of the national innovation system.** The report will identify new opportunities and challenges, and provide regular updates on implementation of the National Innovation Priorities.

Measurement is the only way to be sure that policies are working and resources are being put to the best possible use.

43 ABS, *Explorations of Innovation and Business Performance Using Linked Firm-Level Data* (cat. no. 1351.0.55.020).

44 Brian Sloan, *Developing the Linkage Between Policy and Innovation Measurement* (Brussels: European Commission, 2001).

Chapter 4 SKILLS AND RESEARCH CAPACITY

Australia's public sector researchers do 78 per cent of our basic research and 89 per cent of our research in the humanities, arts, and social sciences.

Innovation takes many forms, but it still relies heavily on formal research and development. This is obviously true of technological innovation, but it is also true of innovation in other spheres — whether it be in social policy, business management, or the creative arts. Australia's capacity for paradigm-shifting, new-to-the-world innovation still depends very much on how many researchers we have, how good they are, what research equipment and facilities they have access to, and how well connected they are to industry and the wider world. It also depends on the availability of innovation skills more broadly defined in the general workforce, and on the quality of management.

Public research

While industry does three-fifths of Australia's research, nearly all of it is applied research and experimental development, and hardly any of it is in the humanities, arts, and social sciences. That's why Australia's public research capacity is critical to the national innovation system. It generates knowledge and ideas that lead to new and improved products, processes, policies and programs. Australia's public sector researchers do 78 per cent of our basic research (pure and strategic) and 89 per cent of our research in the humanities, arts, and social sciences. This kind of research yields important economic, social, environmental and cultural benefits for Australia, but the private sector is unlikely to do it because these benefits can rarely be captured by individual firms. It is precisely because delayed returns and uncontrollable spill-overs discourage private investment in basic research that public investment is essential. Public researchers also do their share of applied research and experimental development to address immediate, practical problems — in fact, this accounts for over half of their activity.⁴⁵

Action to expand the capacity of public research institutions can be expected to bring even higher economic and social returns — especially if it is accompanied by action to make the results of public research widely accessible. The pay-off may be indirect and a long time coming, but that makes it no less real. Astronomy and space science, for example, have not only helped us understand our place in the universe; they have also given rise to new commercial applications in

⁴⁵ ABS, *Research and Experimental Development, All Sector Summary, Australia, 2006-07* (cat. no. 8112.0).

medical and industrial imaging, telecommunications, remote sensing, and transport and logistics.

International evidence suggests that up to three-quarters of private-sector patents draw on public-sector research.⁴⁶ The availability of this research — through publications and collaborations — reduces the cost of innovation to industry and can stimulate the development of new capabilities and clusters of activity. Research in some areas — including biotechnology and nanotechnology — has the potential to transform industries across the economy. A strong public research sector also makes Australia more attractive to foreign firms and institutions looking to tap new ideas and augment their R&D capabilities.

Public research does more than supply ideas to industry, of course. It also generates knowledge Australia can use to protect the environment, improve people's health, make communities stronger and fairer, and enrich our culture.

The public research system also trains Australia's research workforce, producing people with specific skills and tacit knowledge that can be applied in government, industry, and the research sector itself to generate home-grown innovations and help us absorb innovations from elsewhere.

University research

Most public sector research is done by universities. They also do most of the research training in Australia. The importance of universities to innovation systems can not be overstated:

the role of universities is crucial. They are powerful drivers of innovation and change ... They produce people with knowledge and skills; they generate new knowledge and import it from diverse sources; and they apply knowledge in a range of environments. They are also the seedbed for new industries, products and services and are at the hub of business networks and industrial clusters of the knowledge economy.⁴⁷

We depend so much on universities, in fact, that if their performance slips, the whole innovation system suffers. It is therefore essential that we keep them working well — not just by some standard we set ourselves, but as measured against the world's best. An internationally competitive economy begins with an internationally competitive innovation system — and that begins with internationally competitive universities. Australia has very good universities that do a great deal of fine research, but in today's cut-throat world, that is not enough. Our universities must be able to demonstrate genuine and consistent excellence in everything they do — whether it is teaching, research, engaging with the community, or collaborating with industry. We are not quite at that level yet, and reform is needed to get us there.

We depend so much on universities, in fact, that if their performance slips, the whole innovation system suffers.

46 Francis Narin, Kimberly S. Hamilton and Dominic Olivastro, "The Increasing Linkage Between U.S. Technology and Public Science", *Research Policy*, vol. 26 (1997). More generally, see Ammon J. Salter and Ben R. Martin, "The Economic Benefits of Publicly Funded Basic Research: A Critical Review", *Research Policy*, vol. 30 (2001).

47 *Opportunity for All in a World of Change: A White Paper on Enterprise, Skills and Innovation* (London: Department of Trade and Industry, 2001).

Australia funds university research through competitive project grants and performance-based block grants that give institutions some flexibility in setting research directions. The competitive grants meet direct research costs (or a proportion of them), while the block grants are designed to meet the indirect costs of research — equipment, materials, and so on — and the cost of research training. Most competitive grants are awarded by the Australian Research Council and the National Health and Medical Research Council.

The Australian Government has already increased university research funding — both by creating new research awards and fellowships, and by establishing the Education Investment Fund. Universities received \$580 million for research and teaching infrastructure in the fund's first round, plus \$321 million for research infrastructure and \$481 million for teaching infrastructure in the second. They have also received \$1 billion for teaching facilities from the Better Universities Renewal Fund and the Teaching and Learning Capital Fund for Higher Education. A third round of the Education Investment Fund will be conducted in 2009–10.

The government's policy ambition for the next decade is to progressively increase the number of research groups performing at world-class levels, as measured by international performance benchmarks. Australia can devote only so much money to research, so the Commonwealth will continue to use the National Research Priorities — updated as required — to concentrate activity in areas of strategic importance in which we are genuinely internationally competitive. Once it is established, Excellence in Research for Australia (ERA) will measure research quality against international benchmarks. It will revolutionise university research by enabling the Commonwealth to link funding to performance. The Australian Research Council has been designing and developing ERA in consultation with the sector since early in 2008. The new funding provided in the 2009–10 Budget will accelerate this work.

The Australian Government's next priority is to address the gap in funding for indirect research costs. Many of our competitors already spend more on public research than we do, and they contribute more to meeting the indirect costs associated with that research. Under **Sustainable Research Excellence in Universities**, universities will be able negotiate agreements with the Government for additional funds to meet indirect research costs. The new arrangements will eventually be worth more than twice as much as the current Research Infrastructure Block Grants Scheme. The government's aim is to raise average support for indirect research costs to 50 cents for each dollar of competitive project grant funding by 2014.

The new funding will, however, be conditional. It will be used to drive institutional reform, achieve research excellence, and increase collaboration.

It is especially important that we get university researchers working more effectively with industry — and with each other. The **Joint Research Engagement Scheme** will advance the first objective by supporting research collaboration between universities, industry and end-users. Funding under this scheme will be allocated on the basis of

demonstrated research excellence and demonstrated ability to attract funding from other sources. The Joint Research Engagement Scheme will refocus resources previously available under the Institutional Grants Scheme. The **Collaborative Research Networks Scheme** will advance the second objective by helping smaller, regional, and less research-intensive universities team up with other institutions to increase their research capacity. Researchers and research teams will be encouraged to organise themselves into hubs and spokes, with resources concentrated in the most appropriate research centres and departments (the hubs), where they can be accessed by scholars around the country (the spokes).

To ensure that the value of institutions' funding is maintained over time, the Government will replace the current inadequate **indexation** arrangements for research block grants from 2012 with an index that better recognises the cost pressures on universities.

The Australian Government will introduce **mission-based compacts** with universities to provide a framework for jointly achieving our reform objectives. It will work with each university to develop a compact that defines the university's particular mission and describes how it will fulfil that mission and meet the Australian Government's policy goals.

Mission-based compacts will promote excellence and build capacity and international competitiveness in the university sector. They will enhance institutional autonomy and sectoral diversity, while encouraging collaboration and increased participation in higher education by under-represented groups. They will help universities achieve the highest standard of research and research training by enabling all researchers to work in first-class conditions and in first-class company.

Compacts will facilitate the distribution of performance-based funds and the alignment of institutional activity with national priorities. Rather than micromanaging universities or tying them up in red tape, the Australian Government will work in partnership with the sector, defining clear and consistent targets for improvement and reform that will trigger reward payments. Compacts will be compatible with existing formula-based grant processes. They will give individual universities the chance to capitalise on their strengths and articulate the unique role they play in the higher education system, the innovation system, and their local regions and communities.

The Australian Government's plans to expand higher education and uncap the supply of places impose important responsibilities on our teaching and research institutions. Specialisation within the sector will increase and missions will be more diverse. Universities will identify and negotiate their own pathways and alliances. The Commonwealth will work cooperatively with institutions to prepare for these changes.

Compacts will be in two parts, one covering teaching and learning and the other covering research. The Minister for Innovation, Industry, Science and Research will be responsible for the research elements and the Minister for Education will be responsible for the teaching and learning elements. The two departments will jointly develop with each

university a compact reflecting a whole-of-university mission and a coordinated response to the Government's reform agenda.

The aim of mission-based compacts and the Government's other university reforms is to drive excellence, build sustainability, provide transparency, and promote collaboration and responsiveness in Australia's university research sector.

Public research agencies

The balance of Australia's public research is done by publicly-funded research agencies (with a small amount done directly by government departments). The largest agencies are the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the Defence Science and Technology Organisation, the Australian Nuclear Science and Technology Organisation, and the Australian Institute of Marine Science. They account for around 80 per cent of total budget expenditure on public research agencies. Other agencies include the Australian Antarctic Division, the Australian Bureau of Meteorology, National ICT Australia, the Australian Institute of Aboriginal and Torres Strait Islander Studies, and the Rural Research and Development Corporations. State and territory research agencies also contribute to the public research effort, as do museums, galleries, libraries, and other scientific and cultural repositories.

The value of these organisations to the national innovation system lies partly in their capacity to undertake research — basic, strategic and applied — that would not normally be done by universities or industry; and partly in their capacity to collaborate and share infrastructure both among themselves and with industry and overseas organisations. The Australian Institute of Marine Science, for example, has working relationships with more than ninety organisations in twenty-one countries.

Some of these agencies do more than research. For example, CSIRO manages national research facilities and national collections. The Australian Nuclear Science and Technology Organisation manages the Access to Major Research Facilities Program, which is funded by the Commonwealth to give Australian researchers access to overseas resources such as the European Organisation for Nuclear Research (CERN), synchrotrons and astronomical observatories. All public research agencies help to inform government policy and decision-making.

CSIRO occupies a special place in the innovation system — and in the national psyche. It does research in a host of disciplines and employs more than 6,400 people at over fifty sites across Australia. The Productivity Commission has observed that, "Aspects of CSIRO's approach to priority setting and performance management may have wider applicability to other parts of Australia's innovation system."⁴⁸

The Australian Government will use CSIRO initiatives such as the National Research Flagships Program and the CSIRO ICT Centre as models for linking public and not-for-profit researchers with industry

All public research agencies help to inform government policy and decision-making.

48 *Public Support for Science and Innovation* (Canberra: Productivity Commission, 2007), p. 490.

and the wider Australian community. The capacity of public research agencies will also be strengthened by the collaborative infrastructure to be built under the Super Science Initiative (see below), and funding for National ICT Australia will be extended.

Cooperative Research Centres

Originally established in 1990, the Cooperative Research Centres Program has been instrumental in promoting public-private research partnerships. The Australian Government has invested \$3 billion in 168 CRCs since the program began.

Last year's review of the program by Professor Mary O'Kane was strongly supportive, but proposed a number of improvements.⁴⁹ The government has accepted the main recommendations of the review and revised the program guidelines accordingly.⁵⁰ Among other things, public good has been restored as a key objective eligibility for funding has been extended to the humanities, arts and social sciences; more emphasis has been placed on the needs of end-users; funding flexibility has been increased; and CRCs will now be funded for up to ten years, subject to rigorous review. The Australian Government invests over \$155 million a year in the program through annual selection rounds. The new guidelines are being used in the current (eleventh) funding round, with successful applicants due to be announced in July 2009.

Sectoral research

Primary industry research — Primary industry (agriculture, fisheries and forestry) has been a focus of public sector research in Australia since the nineteenth century, and the Commonwealth, states and territories are still very active in the field today. The Australian Government supports this effort through Rural Research and Development Corporations, various Cooperative Research Centres, universities, and CSIRO, which devotes about a third of its budget — some \$300 million annually — to agricultural research.

Medical research — Australia spends over \$3 billion a year on health-related research, and is a world leader in the field.⁵¹ Universities account for almost half this expenditure. The Australian Government funds medical research mainly through the National Health and Medical Research Council, which offers competitive grants to universities and to private, non-profit medical research institutes affiliated with universities and hospitals.

Defence capability research — Defence capability research is undertaken by the publicly-funded Defence Science and Technology Organisation in collaboration with other research agencies and defence industry. This includes public-private partnerships such as the Defence Materials Technology Centre, which has brought industry, the

49 *Collaborating to a Purpose: Review of the Cooperative Research Centres Program* (Canberra: Department of Innovation, Industry, Science and Research, 2008).

50 *Program Guidelines: Cooperative Research Centres Program* (Canberra: Department of Innovation, Industry, Science and Research, 2008).

51 ABS, *Research and Experimental Development, All Sector Summary, Australia, 2006-07* (cat. no. 8112.0).

Australian Defence Force, and research agencies together to work on smart materials for next-generation armaments. A Defence Industry Innovation Centre will be added to the Enterprise Connect network in 2009–10 to increase the innovation capabilities of small and medium-sized businesses in the defence sector.

Research training

The innovation system relies heavily on the research training provided by Australia's universities and funded by the Australian Government.

The Research Training Scheme funds universities to provide places for domestic students doing higher degrees by research. The Australian Postgraduate Awards Scheme helps meet the living costs of research students. The Commercialisation Training Scheme funds universities to teach research students the skills needed to bring innovations to market. The Australian Research Council offers Australian Postgraduate Awards (Industry), International Postgraduate Research Scholarships, and a number of fellowship programs. These include the 1,000 Future Fellowships for mid-career researchers delivered in the 2008-09 Budget, and the improved Australian Laureate Fellowships for senior researchers. As part of its Super Science Initiative, the Government is delivering a further short-term boost, with 100 three-year **Super Science Fellowships** for early-career researchers — fifty to be offered in 2010, and fifty in 2011. Universities also offer their own fellowships.

The Review of the National Innovation System, the Review of Australian Higher Education, and the House of Representatives inquiry into research training and research workforce issues all recommended increasing support for research students, including by raising the Australian Postgraduate Award stipend. Starting in 2010, the Australian Government will lift the stipend by more than 10 per cent from \$20,427 to \$22,500. This comes on top of the Government's program to double the number of awards by 2012, starting with 1,000 new awards in 2009. Together, these measures will help Australian universities attract and retain high-performing research students and boost completion rates.

Concern has also been expressed about the lack of clear career paths for research students, and the training system's failure to teach them skills that will make them attractive to private sector employers, and equip them to do collaborative, multidisciplinary research. The House of Representatives inquiry found that preparing people for research careers must begin at school; that training the research workforce of the future will require a high degree of collaboration between universities and industry; and that inadequate funding for research training and research careers remains a fundamental obstacle to realising Australia's full innovation potential.⁵²

The Commonwealth will develop a research workforce strategy to address these issues and to ensure that Australia is not caught short of research skills as the academic workforce ages. The strategy will look ahead to 2020. Work has already begun on an analysis of supply and demand in the market for research skills.

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52 *Building Australia's Research Capacity* (Canberra: House of Representatives Standing Committee on Industry, Science and Innovation, 2008), pp. vi–vii.

Research infrastructure

Australia's research infrastructure includes all "the assets, facilities and services which support research across the innovation cycle and which maintain the capacity of researchers to undertake organised research."⁵³ As the problems studied become more complex, so does the infrastructure needed to develop collaborative and multidisciplinary solutions — often involving researchers from a variety of disciplines in the physical and human sciences. For example, climate change, astronomy, genomics and other data-intensive fields of inquiry all depend on large-scale ICT capabilities in data computation, integration, storage, and distribution.

The majority of funding for research infrastructure comes from the Australian Government, but state and territory governments and private sector organisations also contribute significant amounts. Commonwealth funding is through block grants to universities, appropriations to public research agencies, and competitive and collaborative programs — including, since 2008, the Education Investment Fund. The National Collaborative Research Infrastructure Strategy has funded large projects to support work in priority fields. Landmark facilities such as the Australian Nuclear Science and Technology Organisation research reactor, the Australian Synchrotron, and the Australian Square Kilometre Array Pathfinder radio-telescope have been funded individually.

The government recognises that Australia's public research capability has been constrained by underinvestment in strategic research infrastructure. Redressing this requires careful planning, close collaboration between stakeholders, and rigorous priority-setting. It is essential that expensive equipment is shared — that it is accessible to as many researchers in as many institutions as possible. Quality infrastructure can also attract international scholars to Australia, giving local researchers access to new knowledge, and adding to the country's innovation capacity.

The National Collaborative Research Infrastructure Strategy has been effective in marshalling Commonwealth, state, territory, not-for-profit, and industry resources to fund major research facilities. The Integrated Marine Observing System, the Australian National Fabrication Facility, and the Australian Plant Phenomics Facility are good examples. The lessons learned from delivering the strategy have informed the development of the *Strategic Roadmap for Australian Research Infrastructure*, released in September 2008.

The Australian Government will continue to fund critical research infrastructure in accordance with the roadmap. The Government will establish a **National Research Infrastructure Committee** to provide strategic advice on future research infrastructure investments, including landmark projects. The new committee will help the Government and the sector identify gaps, avoid duplication, and ensure that institutional investments and national investments are complementary.

It is essential that expensive equipment is shared — that it is accessible to as many researchers in as many institutions as possible.

53 *Final Report of the National Infrastructure Taskforce* (Canberra: Department of Education, Science and Training, 2004).

Over the next four years, a **Super Science Initiative** will address three of the priorities identified in the roadmap: space science and astronomy, marine and climate science, and future industries (biotechnology, nanotechnology and ICT). The initiative is worth \$1.1 billion, including \$901 million for infrastructure that will make a lasting contribution to Australian science.

The space science and astronomy component will include a new Australian National Centre of Square Kilometre Array Science in Perth, additional funding for the Anglo-Australian Observatory, and funding for an Australian Space Science Program and a Space Policy Unit. The marine and climate science component will include a new deep-sea research vessel to replace the ageing *RV Southern Surveyor*, extensions to the Integrated Marine Observing System, and new capacity at the Australian Institute of Marine Science. The future industries component will include funding for DNA sequencing and bioinformatics infrastructure to support bio-molecular research, facilities for the fabrication of new materials, and augmented facilities at the Australian Nuclear Science and Technology Organisation.

All three components will include the development of advanced ICT platforms and high-performance computing. The government is mindful that advances in ICT accounted for a quarter of Australia's output growth and a third of our labour productivity growth in the 1990s.⁵⁴ It is determined to harness the power of ICT to boost productivity in the new century — not only through the Super Science Initiative, but through other initiatives such as the Information Technology Industry Innovation Council, National ICT Australia, Small Business Online, and the Digital Education Revolution. The centrepiece of the Commonwealth's information technology strategy is the National Broadband Network. It will inspire new solutions and capabilities, not only in fibre-optics and wireless, but also in satellite technology.

There will also be a strong research focus in the Australian Government's new Clean Energy Initiative. Organisations building solar and carbon capture and storage projects under the initiative will partner with research organisations that have a track record in the field to investigate and overcome the scientific challenges associated with making these technologies work on a large scale. The initiative includes \$400 million for infrastructure to support this research. The depth and rigour of the project's research program will be an important criterion for assessing bids. Information about the research will be made publicly available through the Global Carbon Capture and Storage Institute and the Australian Solar Institute, as part of Australia's contribution to accelerating the adoption of clean energy technologies worldwide.

The marine and climate science component of the Super Science Initiative takes us an important step closer to achieving the objectives of the new Australian Climate Change Science Framework.⁵⁵ The framework will guide the development of Australia's capabilities in fundamental climate system science. It will help us marshal the people and infrastructure needed to understand the impact of climate change

54 Paul Gretton, Jyothi Gali and Dean Parham, *Uptake and Impacts of ICTs in the Australian Economy: Evidence from Aggregate, Sectoral and Firm Levels* (Canberra: Productivity Commission, 2002), p. 67.

55 *Australian Climate Change Science: A National Framework* (Canberra: Department of Climate Change, 2009).

on the atmosphere, on coasts and oceans, on water resources, and on extreme weather events – particularly in the southern hemisphere. The applied R&D supported by the Clean Energy Initiative will complement this work.

Innovation skills

Successful innovation requires many different creative, management, organisational, teamwork and entrepreneurial skills. It depends on the ability of individuals “to build and foster relationships that provide for knowledge sharing, scenario planning, collaboration, flexibility and lateral thinking, business management and promotion and marketing skills.”⁵⁶ The importance of these skills was recognised by the Australia 2020 Summit, where the Productivity Stream proposed that the nation should, “Invest more in knowledge, skills, imagination and learning capability.”⁵⁷

The proportion of skilled employees in the workforce has increased steadily over the past decade, and this trend is expected to continue.⁵⁸ The challenge now is to move beyond the skills required today and start developing the skills — especially innovation skills — we will need tomorrow. Australia needs to get better at business strategy, marketing, logistics, design and organisation. This will mean improving the skills and tapping the creativity of all workers alike. It will mean creating workplaces that are open to change, new ideas, and continuous innovation in day-to-day decision-making. It will also be necessary to change attitudes to risk.

The Australian Government is developing these skills through Enterprise Connect and through its support for Innovation and Business Skills Australia, which is redefining the skills needed for “a flexible, innovative and adaptable workforce” by broadening its focus from skills development to capability building — with the emphasis increasing on the skills needed for innovation, leadership, and making connections between people and organisations.⁵⁹

Most important of all, however, is the Commonwealth’s multi-billion-dollar Education Revolution. It is preparing young Australians for the future by giving them the skills they will need to participate fully in a knowledge-based economy and a democratic society. A national curriculum in the seven key learning areas — English, mathematics, science, history, geography, languages, and creative arts — will be implemented in 2011. It is particularly important that we build technology skills — as the Commonwealth is doing through the National Secondary School Computer Fund and related initiatives. It is equally important that we reverse the historic decline in the study of science and maths. The Australian Government has already introduced new incentives to increase undergraduate enrolments in these subjects, and it will build

It will mean creating workplaces that are open to change, new ideas, and continuous innovation in day-to-day decision-making.

56 *Submission to the Review of the National Innovation System* (Sydney: NSW Business Chamber, 2008), p. 8.

57 *Australia 2020 Summit: Final Report* (Canberra: Department of Prime Minister and Cabinet, 2008), p. 10.

58 ABS, *Labour Force, Australia, Detailed Quarterly, August 2008*, (cat. no. 6291.0.55.003).

59 *Blueprint for Action on Innovation* (Melbourne: Innovation and Business Skills Australia, 2007); and *Scoping the Need for High Level Innovation System Qualifications/Skill Sets* (Melbourne: Innovation and Business Skills Australia, 2008).

hundreds of new high school science laboratories under the Science and Language Centres for 21st Century Secondary Schools Program. It is also increasing support for the science outreach and communication activities of Questacon, which are complemented by CSIRO's science education program and the activities of state and territory science centres.

Australia must learn from the example of successful knowledge-based economies around the world:

While these economies are diverse and complex, with distinctive systems of governance and public policy, there is arguably a single common thread in their success — investment in human capital and infrastructure. It is this investment, through a mix of government, business and education institutions, which creates innovation capacity at national and regional levels. This capacity in turn underpins the development of more specific innovation capabilities at the organisational level, where it counts for growth, employment and competitiveness.⁶⁰

That is why the 2009-10 Budget also delivers landmark reforms and increased funding for university teaching and learning. Australia will move to a student-centred system, underpinned by a national regulatory and quality agency. There will be new resources to promote equity — with the ambition that, by 2020, 20 per cent of new undergraduate students will come from low socio-economic backgrounds. Student income support will be reformed to ensure that it goes to those who need it most. The indexation of block grants for teaching and learning will be put on a more realistic footing. These reforms serve two aims: they will ensure that the nation's talents are not wasted, and they will ensure that every Australian who can benefit from a university education gets a fair go.⁶¹

60 Roy Green, "Competing through Innovation: An International Perspective", in Ian Marsh (ed), *Competing from Australia*, CEDA Growth 58 (Melbourne: Committee for Economic Development of Australia, 2007).

61 Further information on the Australian Government's reform agenda for university teaching and learning can be found in the Ministerial Statement and the response to the Review of Australian Higher Education by the Minister for Education, which formed part of the 2009-10 Budget documentation.

Chapter 5

BUSINESS INNOVATION

The world will emerge from the present crisis more competitive, more connected, and hungrier than ever for new ideas and technologies.

Business innovation translates creativity into jobs. The Australian Government's ambition is to increase the proportion of businesses innovating by 25 per cent, and lift the number doing R&D.

The market gives business powerful incentives to innovate, but the signals it transmits to individual firms are often weak, mixed, and disconnected from the here and now. Even businesses that are good at spotting innovation opportunities may lack the capacity to exploit them. This is especially true of smaller firms. Governments around the world overcome these obstacles by offering incentives and support for business innovation. With the global recession forcing firms to focus on immediate problems at the expense of long-term investments in new products and processes, the case for government intervention is more compelling now than ever.⁶²

The world will emerge from the present crisis more competitive, more connected, and hungrier than ever for new ideas and technologies. Australia must be ready. Globalisation has already "increased the pressure on OECD countries to move up the value chain and engage in a continuous process of adjustment and innovation."⁶³ That pressure will intensify as emerging economies increase their share of global output. Innovation will be the difference between winners and losers in the race to the top. The empirical evidence is clear: Australian businesses that innovate are more than twice as likely to report increased productivity and 63 per cent more likely to report increased profitability than businesses that don't.⁶⁴ Innovation makes them more competitive by enabling them to differentiate their products and services, target niche markets at home and abroad, and participate effectively in global supply chains.

The OECD has suggested that the best way to promote innovation is by providing stable economic conditions and low interest rates; reducing anti-competitive regulation; increasing the availability of internal and external finance; expanding public research; providing fiscal incentives; and being open to foreign R&D.⁶⁵ The Australian Government has acted on all these fronts — including by doing everything it responsibly can to cushion the Australian economy from the global crisis. It has

62 *Australian Business and the Global Economic and Financial Crisis: Special Survey* (Melbourne: Australian Industry Group, 2008).

63 *Innovation and Growth: Rationale for an Innovation Strategy*, (Paris: OECD, 2007).

64 ABS, *Characteristics of Australian Business, 2006–07* (cat. no. 8167.0).

65 *Going for Growth 2006* (Paris: OECD, 2006).

created favourable conditions for innovation through competition reforms, trade negotiations, strong macroeconomic policies, and measures to improve the business environment. It has also dramatically increased Australia's investment in skills and education, and created new instruments for accelerating innovation across the economy, most notably Enterprise Connect.

Firm-based support

One future focus of the Australian Government's industry and innovation policies will be on building innovation capacity and performance at the enterprise level. The Review of Australia's Automotive Industry argued that:

given the competitive pressures the industry is experiencing, a greater emphasis on improving productivity, reforming work and management practices, and promoting a productive workplace culture will be required if the Australian industry is to remain competitive in the longer term. While volume, economies of scale and innovation (broadly defined) remain the key determinants of productivity in the industry, more needs to be done to encourage high-performance workplaces and cost-competitive supply chains.⁶⁶

The Review of the Australian Textiles, Clothing and Footwear Industries noted that all industries in high-wage, globalised economies like Australia's depend for their success on:

the development of innovative capability at the level of the enterprise and workplace. This is driven not only by research and technology development but also by the increasing emphasis on business model transformation, market-led organisational change and the integration of firms into external collaborative networks and supply chains.⁶⁷

It is especially important that we build the innovation capacity of smaller firms. Australia has a high proportion of small and medium-sized businesses, and they are less likely to innovate or do R&D than large ones.⁶⁸ While new business models and information and communication technologies offer Australian businesses direct access to global supply chains and distant markets, many small firms lack the technical capacity to exploit these possibilities. They are also often starved of capital — and the global financial crisis has made matters worse. These constraints make it hard for smaller Australian firms to develop and commercialise new ideas. Too often, this means ideas are forced offshore, where the value they create is captured by our competitors.

There is clearly scope to boost the innovation capacity and performance of smaller Australian firms, including by encouraging collaboration with larger firms and public research institutions. This is

There is clearly scope to boost the innovation capacity and performance of smaller Australian firms, including by encouraging collaboration with larger firms and public research institutions.

66 *Review of Australia's Automotive Industry* (Canberra: Department of Innovation, Industry, Science and Research, 2008), p. 84.

67 *Building Innovative Capability: Review of the Australian Textiles, Clothing and Footwear Industries* (Canberra: Department of Innovation, Industry, Science and Research, 2008), p. 100.

68 *Public Support for Science and Innovation* (Canberra: Productivity Commission, 2007), pp. 45, 84, 479 and passim. See also the ABS surveys of business R&D (cat. no. 8104.0) and business innovation (cat. no. 8158.0).

precisely why the Government established Enterprise Connect, and why it has revised the Cooperative Research Centres Program guidelines to get more small and medium-sized firms involved.

The Australian Government has introduced several measures to build the innovation capacity of smaller firms during the global downturn. One of them is Small Business Online, which will help small businesses go online and improve their e-commerce capabilities. Another is the Small Business and General Business Tax Break, which allows small firms to claim a bonus 50 per cent tax deduction and larger firms to claim bonus tax deductions of 30 per cent or 10 per cent on eligible assets. Firms can use these deductions to ease the cost of acquiring new equipment and technology, including business vehicles and computer hardware.⁶⁹

The Australian Government already provides considerable support for business innovation — particularly through the R&D Tax Concession. Partly as a result of this, business expenditure on R&D has grown quite rapidly in recent years, although it is still below the OECD average as a proportion of GDP. Commonwealth support for other innovation activities, including organisational change, concept-proving, and commercialisation, is more modest. This situation is not unique to Australia; most developed countries favour tax incentives for R&D to encourage business innovation, and this preference has become more marked in recent years.⁷⁰

So, where to from here? We know that there is more to innovation than R&D. We know that firm-based incentives increase innovation, especially in businesses that face financial constraints — and that includes many smaller firms.⁷¹ We also know that larger firms are critical to Australia's innovation effort; 70 per cent of our business R&D is done by firms with 200 or more employees, and we can't afford to see this capacity compromised. Finally, we know that more and more international firms are outsourcing their innovation activities to whichever location they believe is best equipped to support them. This has created fierce competition between knowledge-producing countries to attract foreign R&D investment.

Australian Government support for business innovation must reflect these conditions. It must target firms of all sizes and in all sectors. It must recognise the complexity of the innovation process and the different forms innovation can take. Above all, it must be responsible. To justify the community's investment, all programs and incentives must achieve explicit goals that can be measured against objective benchmarks, they must induce business to do more than it would have done without public support, and they must have no adverse effects.

69 The 30 per cent and 10 per cent bonus deductions originally applied to all firms. See *Updated Economic and Fiscal Outlook* (Canberra: Department of the Treasury, 2009), p. 21. Both deductions were increased to 50 per cent for smaller firms in the 2009–10 Budget. For further information, visit www.treasury.gov.au.

70 *Science, Technology and Industry Outlook 2008* (Paris: OECD, 2008), pp. 26–27 and 80–82.

71 Florence Jaumotte and Nigel Pain, *Innovation in the Business Sector*, OECD Economics Department Working Paper no. 459 (Paris: OECD, 2005); and *Innovation and Growth: Rationale for an Innovation Strategy* (Paris: OECD, 2007).

Tax incentives

The Commonwealth currently offers four tax incentives for business R&D: the 125 per cent R&D Tax Concession, the 175 per cent Incremental (Premium) Concession, the 175 per cent International Premium Concession, and the R&D Tax Offset. Around 7,000 businesses are registered for these incentives, which are expected to be worth around \$1.4 billion in 2009–10.

The premium concessions are supposed to reward firms that increase their R&D spending over time, but a 2007 review found that they were too complex and did not influence R&D spending decisions. The R&D Tax Offset allows firms turning over less than \$5 million and spending up to \$1 million on R&D to claim a cash refund instead of a deduction if they are in tax loss. The same 2007 review found that the R&D Tax Offset had encouraged small firms in tax loss to increase their R&D investment. It also warned, however, that the \$5 million turnover limit excluded many small, innovative companies, and that the \$1 million R&D expenditure limit had the perverse effect of discouraging firms from spending more than that amount.⁷²

The Review of the National Innovation System recommended that the R&D tax concessions and offset should be replaced by a less complex and more predictable R&D tax credit. It also recommended that all R&D undertaken in Australia should be eligible for the credit, regardless of who owned the intellectual property. Finally, the review recommended that the definition of research and development should be tightened to ensure that only genuine R&D qualifies for tax incentives.

The Australian Government has accepted the thrust of these recommendations. It will introduce a new **R&D Tax Credit** to replace the R&D Tax Concession, the incremental and international premiums, and the R&D Tax Offset from 2010-11. There will be:

- a 45 per cent refundable tax credit for Australian-owned firms turning over up to \$20 million a year; and
- a 40 per cent non-refundable tax credit for all other firms.

The eligibility criteria for the R&D Tax Credit will be tightened to ensure that only genuine R&D receives support. The government will talk to industry about this and other aspects of the new system, with a consultation paper to be released in mid-2009.

The 45 per cent R&D Tax Credit is equivalent to a 150 per cent tax concession. It doubles the base tax incentive for smaller firms, restoring support to the level that prevailed before 1996 — with the added advantage that companies can access the credit whether they are in tax profit or tax loss. Around 5,500 smaller firms will potentially be better off. The 40 per cent R&D Tax Credit is equivalent to a 133 per cent tax concession. It raises the base R&D tax incentive for larger firms by a third, and opens it to international companies that hold their intellectual property offshore.

The 45 per cent R&D Tax Credit is equivalent to a 150 per cent tax concession. It doubles the base tax incentive for smaller firms, restoring support to the level that prevailed before 1996.

⁷² *New Elements of the R&D Tax Concession: Evaluation Report* (Canberra: Department of Industry, Tourism and Resources, 2007).

The tax credit is expected to induce more R&D for several reasons. First, it tilts support in favour of small and medium-sized businesses, which are more responsive to fiscal incentives. Second, it makes cash refunds available to more firms, including capital-starved start-ups in biotechnology and other high-tech industries. Third, it is simpler and more predictable than the present tax concession. Fourth, it increases certainty by uncoupling the level of R&D support from the corporate tax rate. And fifth, it is consistent with international best practice. Tax credits are already used in the United States, Japan, and many parts of Europe. The new system will be familiar to international firms headquartered in these places, making Australia a more attractive destination for foreign R&D investment in defence, pharmaceuticals, and a host of other industries.

Because such a significant change cannot be introduced immediately, the Commonwealth will raise the amount of R&D spending small firms can claim under the R&D Tax Offset from \$1 million to \$2 million in 2009–10. This will help small, high-tech firms to keep innovating during the global downturn.

Commercialisation

Firms doing quality research and producing great ideas may still fail for want of support during the commercialisation phase. The market cannot always be relied on to provide this support. Private investors are generally reluctant to back early-stage ventures that look risky or products they don't understand. Many firms find it impossible to attract the private investment needed to prove and commercialise their concepts — typically \$5 million to \$15 million. This has forced some to list publicly before their technology or their business model was ready, with disastrous results. The passage from experimental development to commercialisation is so treacherous that high-tech start-ups call it the valley of death. The global financial crisis has made this valley considerably wider.

Australian Government programs that respond to this market failure include Commercialising Emerging Technologies (COMET) and venture capital vehicles such as the Innovation Investment Fund. The Review of the National Innovation System argued for a more coordinated approach, with support to match “the various identifiable stages of an innovative firm's life”.⁷³

Commonwealth Commercialisation Institute

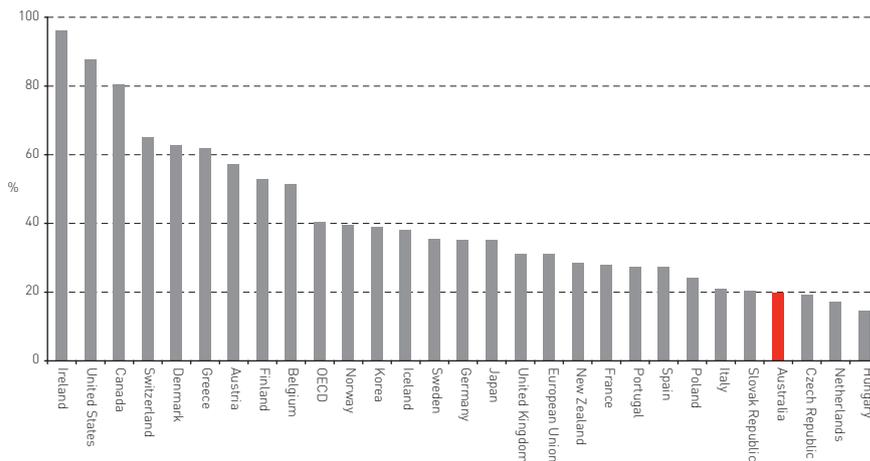
To this end, the Australian Government will establish a new Commonwealth Commercialisation Institute to bring research, business and finance together to help commercialise new ideas and technologies. The design of the institute and its programs will be refined in consultation with stakeholders.

73 *Venturous Australia: Building Strength in Innovation* (Melbourne: Cutler & Company, 2008), p. xiv.

Venture capital

Venture capital is “high risk private equity capital for typically new, innovative or fast growing unlisted companies”.⁷⁴ It is one way of financing experimental development, proof-of-concept activities, and commercialisation. The main impediment to venture capital markets working effectively is the asymmetry of information between the firm and financial institutions, which cannot accurately gauge the likely success of a project. For want of better knowledge, the institutions do not invest. This disinclination to back unfamiliar and unproven ideas has been reinforced by the global economic crisis. The problem is even more acute in Australia, where the venture capital market is much less supportive of high-tech firms than the OECD average — we rank a dismal twenty-fourth out of twenty-seven countries on this measure (Figure 5.1).⁷⁵ Such investment as there is goes mainly to firms at the early expansion and late expansion stages; there is negligible investment in firms at the pre-seed, seed, and start-up stages.⁷⁶

Figure 5.1: Share of high-technology sectors in total venture capital, 2005



Source: *Science, Technology and Industry Scoreboard 2007* (Paris: OECD, 2007).

The Australian Government, like governments elsewhere, has addressed these market failures with measures to give innovative firms better access to venture capital — especially using tax incentives and equity to attract private sector investment. Taxation-based initiatives include the Venture Capital Limited Partnerships Program and the Early Stage Venture Capital Limited Partnership Program. Equity-based initiatives include the Innovation Investment Fund.

74 ABS, *Venture Capital and Later Stage Private Equity, Australia, 2006–07* (cat. no. 5678.0), p. 17.

75 *Science, Technology and Industry Scoreboard 2007* (Paris: OECD, 2007), p. 39.

76 ABS, *Venture Capital and Later Stage Private Equity, Australia, 2006–07* (cat. no. 5678.0), Table 3 and p. 10.

The government aims to see the Australian venture capital industry continue to increase its investment in high-tech, early-stage firms.

By helping companies pass safely through the valley of death, these measures maximise returns on public investment in business R&D, which may not be fully realised if the research is not commercialised. They also minimise the leakage of Australian ideas and industry development opportunities to other countries.

The Australian Government will **continue to use these instruments to increase the supply of venture capital when markets fail.**

For example, it announced a new \$83 million Innovation Investment Follow-on Fund in March 2009. The Government aims to see the Australian venture capital industry continue to increase its investment in high-tech, early-stage firms. In line with the recommendations of the Review of the National Innovation System, the Government will also intensify its efforts to connect Australian firms with the international venture capital market.

Government-industry partnerships

The Australian Government wants to accelerate innovation not just in individual firms, but across entire industries and the economy as a whole.

Enterprise Connect

Enterprise Connect is primarily a vehicle for delivering firm-level support. It promotes innovation and enterprise improvement among smaller Australian firms — not least by reducing the cost of finding, acquiring and adapting information, and by strengthening links between small firms and other actors in the innovation system.⁷⁷ Enterprise Connect is a national network of manufacturing and innovation centres. It has already provided over 1,600 business reviews and supported over 500 tailored advisory services to help drive innovation and change. It is fast developing connections with universities and public research agencies that will help unlock their knowledge for wider application by Australian businesses.

The advisory boards established to guide each of the network's twelve centres and the manufacturing network as a whole are an important link between the Commonwealth and industry. The advisory boards include union and research-sector representatives, and they work closely with Industry Innovation Councils.

The Australian Government will draw on these relationships improve and extend Enterprise Connect's capabilities. In addition to providing services to individual firms, we anticipate that Enterprise Connect will continue to develop and may include regional clusters and networks uniting businesses, researchers and educational institutions. At the same time, the Government will use a survey developed by the London School of Economics and McKinsey & Company to investigate the correlation between management quality and firm success in Australia.

⁷⁷ *Diffusing Technology to Industry: Government Policies and Programmes* (Paris: OECD, 2007).

It will use the results of this survey to refine the services Enterprise Connect offers its clients.⁷⁸

Industry Innovation Councils

The Australian Government is establishing a series of Industry Innovation Councils to promote dialogue and develop long-term strategies for boosting innovation and productivity. The councils include innovation leaders from business, unions and professional organisations, universities and research agencies, and government (Commonwealth, state and territory). They champion innovation in industry, facilitate cooperation between different players in the innovation system, and forge links with other organisations, including Enterprise Connect and its advisory boards. The councils will provide strategic advice on innovation priorities to the Australian Government — including, where appropriate, through the Prime Minister’s Science, Engineering and Innovation Council.

To date, councils have been established for the built environment, automotive, future manufacturing, and information technology industries. A Textiles, Clothing and Footwear Industries Innovation Council will be established as part of the TCF innovation package announced in the 2009–10 Budget. The Minister for Innovation, Industry, Science and Research may also establish working groups to address the needs of particular sectors, like the Pharmaceuticals Industry Strategy Group that reported in December 2008. **The Commonwealth will maintain a continuous dialogue with industry about how we can maximise business innovation.**

Investment partnerships

The Australian Government is forging advisory partnerships with industry to gather intelligence and ideas. It is also building investment partnerships to transform critical industries and prepare them for the twenty-first century. The Commonwealth understands that governments must work with business to secure new investment and create jobs. It does not believe that the vital work of transforming industries and renewing the Australian economy can be left to the market alone. Governments can and should take the lead in this great nation-building project, and that is what the Australian Government is doing. Three examples will suffice.

A New Car Plan for a Greener Future is a partnership between the Commonwealth and the automotive industry supported by the Automotive Industry Innovation Council. It aims to make the industry economically and environmentally sustainable by 2020. It is potentially worth more than \$22 billion — \$6.2 billion from the Australian Government, and at least \$16 billion from the industry.

The National Low-Emissions Coal Initiative is a partnership between the Commonwealth, state governments, industry, and researchers to drive the development and application of low-emissions coal technologies.

⁷⁸ Nick Bloom et al, “Management Practice and Productivity: Why they Matter”, *Management Matters* (July 2007).

*Governments
must work
with business
to secure new
investment and
create jobs.*

It is supported by the National Low-Emissions Coal Council. The Australian Government's investment of \$500 million is expected to be matched by at least \$1 billion from industry and the states.

Rural Research and Development Corporations are a partnership between the Australian Government and primary industry to increase Australia's agricultural R&D effort. They are a legacy of the innovation policy renaissance in the late 1980s and early 1990s that also gave us the Cooperative Research Centres Program and Australia's first R&D Tax Concession. The councils invest around \$540 million in research and knowledge diffusion each year, with every two dollars the Australian Government contributes matched by three dollars from industry.⁷⁹

The Australian Government believes that government-industry partnerships are the best foundation for promoting innovation and growth. This belief will underpin the Commonwealth's approach to innovation in business and beyond.

79 *Measuring Economic, Environmental and Social Returns from Rural Research and Development Corporations' Investment* (Canberra: Council of Rural Research and Development Corporations' Chairs, 2008), p. 11.

Chapter 6

PUBLIC SECTOR INNOVATION

The size of the Australian Government's contribution to the economy gives it plenty of scope to stimulate innovation through its own activities.

Australia's governments — Commonwealth, state, territory, and local — account for around a fifth of our GDP. Commonwealth activity alone represented 8 per cent of GDP in 2007–08.⁸⁰ The size of the Australian Government's contribution to the economy gives it plenty of scope to stimulate innovation through its own activities. It can do this in three main ways. First, by demonstrating innovative approaches to procurement and service delivery. Second, by creating a regulatory environment that favours innovation, not least in relation to intellectual property. And third, by improving the flow of information under its control to consumers, researchers and industry.

Innovative services

The Australian Government agrees with the Review of the National Innovation System that a readiness to experiment and evaluate is critical to developing new and better government services; we must be willing to learn as we go.⁸¹ To this end, it will encourage and respond to feedback from the public about how it can improve services; extend the use of delivery platforms we know work well; and test new solutions. In particular, the Commonwealth will investigate ways of managing the risk inherent in implementing new and creative ideas.

The Commonwealth will also **increase the use of ICT, including Web 2.0 technologies, to improve policy development and service delivery.** The Australian Government's new National Broadband Network will make high-speed, information-rich online services available to all Australians. It will revolutionise the way we do business and access government programs — including education and healthcare. It will also open up a new era of e-democracy. The Early Childhood Education Online Forum that ran from March to April 2009 provided a foretaste of what this could mean. The forum allowed people from all parts of Australia to share their views about the Commonwealth's Early Years Learning Framework and the early childhood education issues that matter to them. The Tax Issues Entry System established by Treasury and the Australian Taxation Office is another example (www.ties.gov.au). It allows tax professionals and the community to raise minor policy and administrative issues relating to the tax and superannuation systems.

80 ABS, *Australian System of National Accounts, 2007–08* (cat. no. 5204.0), Tables 2 and 5.

81 *Venturous Australia: Building Strength in Innovation* (Melbourne: Cutler & Company, 2008), pp. 130–135.

The United Kingdom proposes to create what it calls a Whitehall Hub of Innovation to “capture and disseminate learning about public sector innovation”, build the innovation capacity of policy-makers, and create the conditions for innovation at the front-line of service delivery.⁸² The Australian Public Service Management Advisory Committee and the Australian National Audit Office are examining the recommendations of the Review of the National Innovation System, and the capacity of the public sector to implement them. A new strategy will promote new workplace and management practices that encourage creative priority-setting, program delivery and problem-solving. It will increase the Government’s internal innovation capacity, and serve as a model for business and community organisations.

Innovative procurement

The Australian Government is a big buyer of private sector goods and services. Agencies subject to the *Financial Management and Accountability Act* reported 69,493 contracts worth \$26.3 billion in 2007-08. Fifty-five per cent of the contracts and 37 per cent of the dollars went to smaller firms. The Australian Government will drive innovation in the private sector by being a demanding and discerning customer. It will favour innovative solutions and work with suppliers to translate new ideas into better outcomes for Australian taxpayers and Australian industry. The Commonwealth is already reassessing its ICT procurement policies in response to the Review of the Australian Government’s Use of Information and Communication Technology (the Gershon review) with a view to furthering these objectives. Among other things, the review recommended action to safeguard suppliers’ intellectual property rights and increase participation by small and medium-sized businesses.⁸³ More generally, the new *Commonwealth Procurement Guidelines* released in December 2008 take it as axiomatic that, “Agencies should seek to ensure that wherever possible their processes allow for suppliers to provide innovative solutions to their requirements.”⁸⁴

The Commonwealth’s aim is to stimulate home-grown innovation. The government is a firm believer in free trade, and it takes Australia’s World Trade Organisation and bilateral trade treaty obligations very seriously. The government is also very mindful, however, that these international agreements give Australia considerable scope to support its own innovators. For example, the WTO rules allow members to aid the development of small and medium-sized firms, including through government procurement. They permit local preference in the supply of certain goods and services, including research and development. The same is true of our free-trade agreements. For instance, our treaty with the United States permits both countries to give preference to their own small businesses. It also exempts the Australian Industry Capability Program operated by the Department of Defence. The Government’s commitment to strengthening Australia’s national security over the

82 *Innovation Nation*, Cm 7345 (London: OPSI, 2008), pp. 8 and 73.

83 Sir Peter Gershon, *Review of the Australian Government’s Use of Information and Communication Technology* (Canberra: Department of Finance and Deregulation, 2008), Rec. 6.3 (intellectual property), Rec. 6.4 (smaller firms), Rec. 6.5 (open tender threshold).

84 *Commonwealth Procurement Guidelines*, Financial Management Guidance No. 1 (Canberra: Department of Finance and Deregulation, 2008), p. v.

next two decades will create many new opportunities for local defence innovators, including on the Future Submarine Program and the Joint Strike Fighter Program.⁸⁵

The Australian Government will **re-energise existing mechanisms for ensuring that local suppliers have access to government and private sector tenders**. These include the intergovernmental Australian Industry Participation National Framework — which encourages a consistent approach to maximising Australian participation in investment projects here and overseas; the Supplier Access to Major Projects Program — which matches Australian suppliers to project opportunities; the Industry Capability Network — which makes information about Australian industry capabilities available to the proponents of major projects; and the Enhanced Project By-law Scheme — which requires proponents applying for tariff concessions to develop and implement an Australian industry participation plan.

The Commonwealth will also give Australian industry the best possible chance of winning contracts by building innovation capacity through Enterprise Connect, Industry Innovation Councils and the other measures outlined in this agenda.

Innovative regulation

Smart regulation can actually create competitive advantage.

Flexible and effective regulation is needed to support innovation and the growth of knowledge. Regulation should be competition-friendly and technology-neutral to encourage the widest possible range of solutions. It should be simple, easy to understand, stable, and consistently enforced. The cost of compliance should be as low as possible.

Smart regulation can actually create competitive advantage. For example, the Review of the Australian Textile, Clothing and Footwear Industries recommended the introduction of an Australian Ethical Quality Mark.⁸⁶ This would differentiate Australian products in a crowded international market and make them more attractive to customers who base their purchasing decisions on moral and environmental considerations. The Commonwealth will ask the new Textiles, Clothing and Footwear Industries Innovation Council (another recommendation of the review) to investigate this idea.

⁸⁵ *Defending Australia in the Asia-Pacific Century: Force 2030* (Canberra: Department of Defence, 2009).

⁸⁶ *Building Innovative Capability: Review of the Australian Textiles, Clothing and Footwear Industries* (Canberra: Department of Innovation, Industry, Science and Research, 2008), pp. 110–111.

Emerging and enabling technologies

The Australian Government is building a culture of continuous regulatory improvement by encouraging creative relationships between regulators, those they regulate, and the wider community. This is especially important in areas where technology is developing rapidly. The Commonwealth will establish a **National Enabling Technologies Strategy** to capitalise on the opportunities offered by biotechnology and nanotechnology — including by achieving the best possible regulation. The strategy will fund biotechnology and nanotechnology measurement laboratories and research to establish measurement standards for regulators and industry. It will also create the policy capacity to deliver regulatory consistency across the Government, and to advance international efforts to address health, safety, and environmental concerns. These technologies will help us conquer hunger and disease, carbon-dependence and climate change. They will spawn new products, new processes, new industries, and thousands upon thousands of jobs in the coming decades. The Australian Government wants to build community confidence in biotechnology and nanotechnology by providing reliable information, responsible safeguards, and wide access to the benefits they will bring. That is what the National Enabling Technologies Strategy will achieve.

Intellectual property

The function of the intellectual property system is to stimulate innovation. Patents, trade marks, copyright and other protections exist to give creators a reasonable chance of profiting from their investment in whatever it is they have created — typically by granting them an exclusive right to exploit the creation for a specified time. The trick is to get the balance right: too little protection will discourage people from innovating because the returns are uncertain; too much protection may discourage people from innovating because the pathways to discovery are blocked by other intellectual property owners.

There is no consensus on how much protection is just right, but many observers believe policy-makers around the world have erred on the side of excessive protection, granting patents for obvious and trivial inventions, and producing impassable “patent thickets” that choke further innovation, especially in fields where progress is cumulative.⁸⁷ The Review of the National Innovation System certainly felt this was the case in Australia, “where intellectual property rights are too easily granted, and where they are ambiguously defined”.⁸⁸ The review recommended that, “Patent law should be reviewed to ensure that the inventive steps required to qualify for patents are considerable, and that the resulting patents are well defined, so as to minimise litigation and maximise the scope for subsequent innovators.”

87 Sadao Nagaoka and Kenneth Flamm, “The Chrysanthemum Meets the Eagle: The Co-evolution of Innovation Policies in Japan and the United States”, in Sadao Nagaoka et al (eds), *21st Century Innovation Systems for Japan and the United States: Lessons from a Decade of Change* (Washington, D.C.: National Academies Press, 2009), p. 17.

88 *Venturous Australia: Building Strength in Innovation* (Melbourne: Cutler & Company, 2008), p. 84.

Better information produces better decisions. The free flow of information fuels innovation.

The Australian Government will consider options for reform in light of the issues raised by the review. Australia's intellectual property laws already acknowledge the value of openness to innovation. They allow for public access to intellectual property and re-use under certain conditions. Shared ownership is permitted, including under creative commons and open source licences. Nevertheless, the degree of inventiveness needed to obtain a patent is lower in Australia than in other countries. One option may be to bring Australia into line with our trading partners and competitors by addressing this. As well as facilitating domestic innovation, this would simplify intellectual property management and reduce costs for Australian firms doing business internationally.

There may also be merit in creating a more open innovation environment by giving researchers better access to patented inventions for non-commercial study and experiment. It has been argued that researchers should be able to ascertain the current state of knowledge without being concerned about infringing other people's property rights. Among other things, this would enable Australia to use its innovation resources more effectively and avoid reinventing the wheel, remembering "that up to 30 per cent of all R&D projects are merely a duplication of existing technology".⁸⁹

Given the legal and technical complexity of the intellectual property system, the Commonwealth will not make changes without consulting fully with stakeholders. IP Australia has already started on this.

In the meantime, the Commonwealth will **improve intellectual property education for researchers and business**. The government's aim is to ensure that new Australian ideas are translated into new wealth and new jobs for Australia. Raising the standard of intellectual property management will help us achieve that aim.

Innovative information management

Better information produces better decisions. The free flow of information fuels innovation. The Australian Government controls mountains of information, and it is determined to make more of this vast national resource accessible to citizens, businesspeople, researchers, and policy-makers.

Commonwealth agencies such as the Australian Bureau of Statistics, the Bureau of Meteorology, and Geoscience Australia already gather, analyse, and disseminate information in the public interest. The Australian Government wants to build on this foundation. The technology needed to make information universally accessible already exists; advances in ICT and construction of the National Broadband Network will remove whatever technical obstacles remain. That still leaves some knotty policy questions to deal with — for example, about intellectual property rights, privacy, security, and cost — but the Australian Government is determined to work through these questions. It will start by taking steps to develop **a more coordinated approach to Commonwealth information management, innovation, and engagement** involving the Australian Government Information Management Office and federal agencies.

⁸⁹ Lord Sainsbury of Turville, *The Race to the Top: A Review of Government's Science and Innovation Policies* (London: HMSO, 2007), p. 68.

Information Commissioner

The government proposes to **appoint a statutory Information Commissioner**, who will provide advice on information policies and practices, including Commonwealth freedom of information reform. The Commissioner will help the Government develop a more consistent and coordinated approach to managing information and making it accessible to the community. Subject to parliamentary approval, the Information Commissioner will start work on 1 January 2010.

Cooperation between governments

The Australian Government will **speed implementation of the National Government Information Sharing Strategy** endorsed by the Online and Communications Council of Ministers in December 2008. The strategy encourages government agencies — Commonwealth, state, territory, and local — to share information that will help deliver better services to the community.

Government innovation and social change

Public sector innovation is not just a matter for politicians and officials. It concerns everyone. “Policy innovation and evidence-based policy making is at the heart of being a reformist government. Innovation can help us deliver better policy and better outcomes for the whole community.”⁹⁰ By taking its place in the vanguard, the Commonwealth will demonstrate techniques and create capabilities that can be exploited by businesses and community organisations throughout Australia.

Public sector innovation is not just a matter for politicians and officials. It concerns everyone.

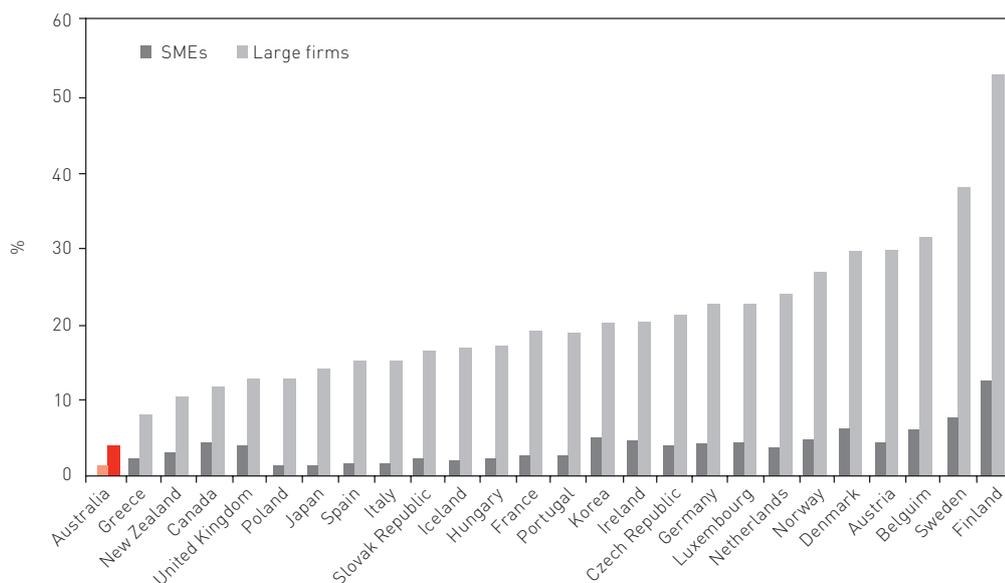
90 Kevin Rudd, “Address to Heads of Agencies and Members of the Senior Executive Service”, Canberra, 30 April 2008.

Chapter 7

LINKS AND COLLABORATION

Australia's innovation system is handicapped by fragmentation, duplication and a lack of coordination. Business-to-business and research-to-business links are poor. We rank last in the OECD on rates of collaboration between firms and universities (Figure 7.1).⁹¹ Australia's connections to global research and business networks are also inadequate, and our distance from the knowledge-intensive economies of the northern hemisphere is still a problem, even in the digital age. The emergence of (relatively) nearby China and India as innovation superpowers may favour us, but we should not deceive ourselves: New Delhi is a lot closer to London than it is to Sydney, and Beijing is just as handy to Los Angeles as it is to Melbourne. As the volume of knowledge grows, complex technologies proliferate, and supply chains become more specialised, it is getting harder and harder to innovate in isolation. Networking and collaboration are essential. Australia's weakness in this area puts us at a serious disadvantage.

Figure 7.1: Firms collaborating in innovation with higher education institutions, 2002–04

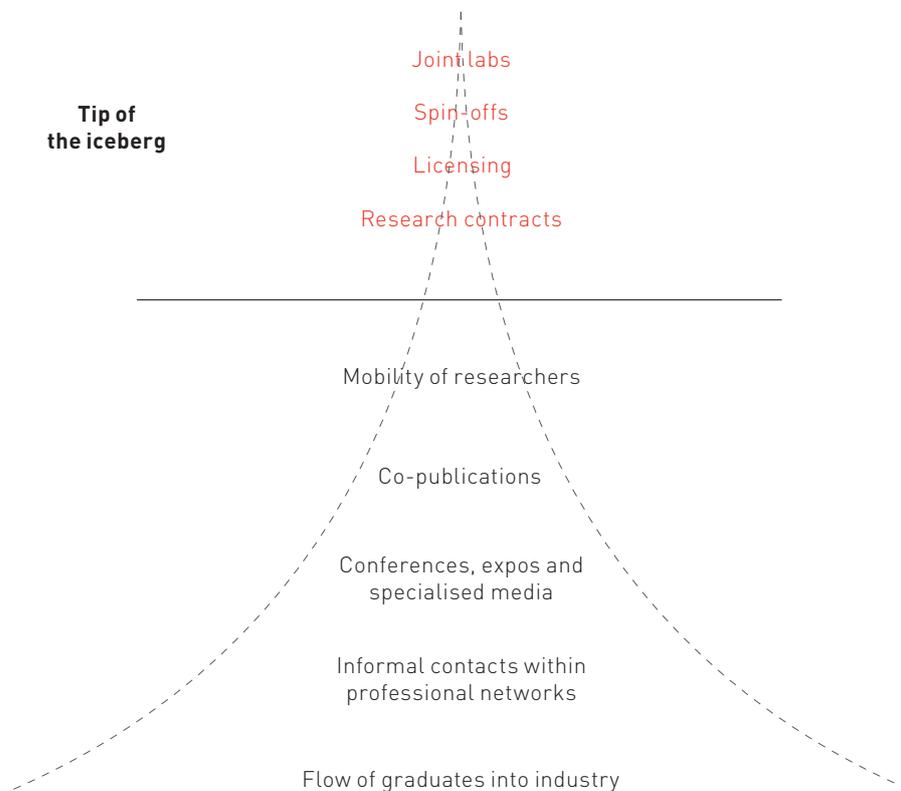


Source: *Science, Technology and Industry Scoreboard 2007* (Paris: OECD, 2007).

91 *Science, Technology and Industry Scoreboard 2007* (Paris: OECD, 2007), p. 77.

The Australian Government will address this by improving links and promoting collaboration between groups and individuals; between institutions and sectors; between researchers and industry; and between businesses and their customers, suppliers, and competitors. In some cases, this may just mean persuading people to talk to each other. Formal collaboration is the tip of the iceberg, which is underpinned by many less formal links (Figure 7.2). Firms in the United States and the United Kingdom regard informal contacts as the most important type of university-industry interaction contributing to innovation, ahead of graduate employment, research publications and technology licensing.⁹² In other cases, it will be necessary to establish more formal partnerships, resource-pooling arrangements, exchanges of personnel, and lines of communication.

Figure 7.2: Industry–science relationships



Source: *Benchmarking Industry–Science Relationships* (Paris: OECD, 2002).

Collaboration increases innovators’ capacity to absorb new knowledge, recruit new people, and develop new skills. It enables them to reduce costs by eliminating duplication, achieving economies of scale, and democratising access to expensive infrastructure. It spreads the risks and maximises the rewards associated with innovation. International collaboration builds capacity in this country and beyond, facilitates access to new knowledge (most of which is created outside

⁹² Andy Cosh, Alan Hughes and Richard Lester, *UK PLC: Just How Innovative Are We?* (Cambridge: Cambridge-MIT Institute, 2005), p. 8.

Formal collaboration is the tip of the iceberg, which is underpinned by many less formal links.

this country), attracts foreign investment, and extends Australia's global influence.

These benefits are well documented and widely understood. Successful Australian innovators identify collaboration as a key value.⁹³ International evidence confirms that collaboration is a bigger influence on business performance than strategic orientation or the opportunities inherent in the market environment.⁹⁴ IBM's global chief executive officer survey found that, "Extensive collaborators outperformed the competition in terms of both revenue growth and average operating margin."⁹⁵ If anything, collaboration is even more important for smaller firms:

External linkages, both public (including higher education institutions) and private, benefit SME innovation. These linkages can be important sources of knowledge that directly strengthen the technological competences of the SMEs and hence their competitive advantage. Collaboration with customers, suppliers, higher education institutions, even competitors, allows firms to expand their range of expertise, develop specialist products, and achieve various other corporate objectives.⁹⁶

Australian manufacturers who collaborate are much more likely to produce new-to-the-country and new-to-the-world innovations than those who don't.⁹⁷ In the United States, "large firms acting on their own account for a much smaller share of award-winning innovations, while innovations stemming from collaborations with spin-offs from universities and federal laboratories make up a much larger share".⁹⁸ It is hardly surprising that the OECD believes "improved innovation performance requires more intensive collaboration between the different actors of innovation processes".⁹⁹

93 Graham Hubbard, "Innovation in Winning Organisations in Australia: Myths and Realities", in *Inside the Innovation Matrix: Finding the Hidden Human Dimensions* (Sydney: Australian Business Foundation, 2008), p. 4.

94 *Meetings Around the World: The Impact of Collaboration on Business Performance* (Palo Alto, California: Frost and Sullivan, 2006), p. 7.

95 *Expanding the Innovation Horizon — Global CEO Study 2006* (New York: IBM, 2006), p. 27.

96 Andy Cosh, Xiaolan Fu and Alan Hughes, *Management Characteristics, Collaboration and Innovative Efficiency: Evidence from UK Survey Data*, Working Paper no. 311 (Cambridge: Centre for Business Research, 2005), p. 8.

97 *Collaboration and Other Factors Influencing Innovation Novelty in Australian Businesses: An Econometric Analysis* (Canberra: Department of Industry, Tourism and Resources, 2006), p. vi.

98 Fred Block and Matthew R. Keller, *Where Do Innovations Come From? Transformations in the U.S. National Innovation System, 1970–2006* (Washington, D.C.: Information Technology and Innovation Foundation, 2008).

99 *Public-Private Partnerships for Research and Innovation: An Evaluation of the Australian Experience* (Paris: OECD, 2004).

Researchers and industry

The Australian Government's instruments for increasing collaboration between researchers and industry include the revitalised Cooperative Research Centres Program, the new Joint Research Engagement Scheme, new investments in strategic research infrastructure, the new Commonwealth Commercialisation Institute, and Enterprise Connect. These initiatives are discussed in Chapters 4 and 5.

Enterprise Connect will play an increasingly important part in brokering partnerships and grooming smaller firms for collaboration with their peers, larger firms, and the research sector. Its Researchers in Business Program will improve the circulation of researchers between industry and the academy. Enterprise Connect will also encourage the development of regional innovation clusters and networks, giving firms the opportunity and the resources to add value through collaboration. Its Innovative Regions Centre is already piloting a Mapping the Connections Project to assess the potential for cluster development in northern Adelaide. The project will produce results that can be applied in other regions. Enterprise Connect will also work more closely with the Industry Innovation Councils, Austrade, the Industry Capability Network, and CSIRO. CSIRO already gives it technical advice, and CSIRO Small and Medium Enterprise Engagement Managers have been co-located in Enterprise Connect centres to give smaller firms even better access to the organisation's expertise.

CSIRO itself has much to teach us about collaboration. Its National Research Flagships Program has involved more than 400 industry and research partners in large-scale, long-term, cross-disciplinary research collaborations. The Flagship Collaboration Fund supports participation in the program by researchers from universities and other public research agencies in Australia and overseas. CSIRO has also established an Small and Medium Enterprise Engagement Centre to help smaller innovative firms access and apply science and technology, build relationships with research providers, and participate in research activities. Similarly, the CSIRO ICT Centre shares its expertise and discoveries with the private sector through consultancies, contract research, licensing, partnerships, and co-investments. The Australian Government will examine how the collaboration models developed by CSIRO can be extended and applied in other parts of the national innovation system.

It is essential that we bridge the cultural divide that still separates the research and business communities. This will require adjustment on both sides. Researchers and business too often take an instrumental view of each other, expecting immediate answers to self-interested questions. Researchers cold-call industry with their latest bright idea; businesspeople cold-call researchers with their latest problem. This is not collaboration. Collaboration is about building lasting relationships based on shared trust, shared goals, and shared respect for each party's expertise.

Researchers need to understand that working with industry can extend their capabilities and steer their work in fresh directions. It can lead

Collaboration is about building lasting relationships based on shared trust, shared goals, and shared respect for each party's expertise.

to new research, better-focused research, and research that makes a difference in the real world. Enterprise Connect's Researchers in Business Program has been established to give researchers a taste of how industry operates, while building people-to-people links between research organisations and the business community.

Industry needs to understand just how much the research sector has to offer. In Australia, as in other countries, the challenge "is not about how to increase the supply of commercial ideas from the universities into business. Instead, the question is about how to raise the overall level of demand by business for research from all sources."¹⁰⁰ Only a tiny number of Australian businesses — one or two per cent — get ideas for innovation from public-sector researchers.¹⁰¹ The Australian Government's ambition is to double the level of collaboration between business, universities and public research agencies over the next decade. In pursuit of this ambition, the Government will contribute \$15 million to the cost of establishing a new **Royal Institution of Australia** in Adelaide, which will act as a national science and technology exchange, forging links between the world of science and the world of commerce.

Collaboration between researchers

Individual researchers in Australia's universities and public research agencies collaborate reasonably well with each other, but there is considerable scope to increase institutional and strategic collaboration.¹⁰² Australia has finite resources and scattered research institutions; specialisation, networking, and collaboration will enable us to achieve critical mass and a degree of excellence in research that would not otherwise be possible. The Australian Government will use mission-based funding compacts and the new Collaborative Research Networks to advance these objectives. These initiatives are described in Chapter 4. More generally, the Government will use research funding programs to reward collaboration and knowledge exchange between institutions and research groups.

International engagement

The exposure of Australian firms to global markets and supply chains has increased both the necessity and the opportunities for innovation. The demands of international competition have compelled outward-looking firms to achieve high levels of creativity and productivity. At the same time, going out to meet the world has given these firms direct access to the latest ideas in technology, organisation, management, and marketing. The Australian Government believes this is the path all Australian industries must ultimately follow. The innovation policies and

100 Richard Lambert, *Review of Business-University Collaboration: Final Report* (London: HMSO, 2003), p. 3.

101 ABS, *Innovation in Australian Business, 2006–07* (cat. no. 8158.0). The bureau reports that 2.6 per cent of innovation-active businesses use ideas from universities and 4.1 per cent use ideas from government agencies. Only 36.8 per cent of Australian businesses are innovation-active.

102 *Review of Closer Collaboration Between Universities and Major Publicly-funded Research Agencies* (Canberra: Department of Education, Science and Training, 2004), p. 1.

programs for industry described in this agenda are designed precisely to arm local firms for global competition.

The twenty-first-century innovation landscape is characterised by a single world trading system, an increasingly integrated global production system, and a rapidly evolving international R&D system. More and more firms are looking to offshore subsidiaries and partners for new ideas: “R&D investment abroad by multinational firms has grown strongly as [their] strategies focus on global technology sourcing. This involves building networks of distributed R&D globally in order to tap into local knowledge and develop sources for new technology development.”¹⁰³ Australia has everything to gain from winning a place in these networks, but we are starting from some way behind. Less than 3 per cent of Australian R&D is financed from abroad, compared to 17 per cent in the United Kingdom and 8 per cent across the European Union.¹⁰⁴ Moreover, the competition for this kind of investment is intensifying, as emerging economies expand their scientific and research capabilities. The share of global research and development performed by non-OECD countries increased from 11.7 per cent in 1996 to 18.4 per cent in 2005, and it continues to rise.¹⁰⁵

The things that attract foreign R&D investment include a good supply of scientific and technical workers; an effective national innovation system, with strong public research institutions, science parks, and a reliable system of intellectual property protection; and government incentives.¹⁰⁶ The Australian Government is working on all these fronts to make Australia a more attractive investment location. The increased support for public research described in Chapter 4 is critical. So is the new R&D Tax Credit described in Chapter 5. Foreign firms will be eligible for the 40 per cent credit (but not the refundable 45 per cent credit), even if the intellectual property is owned overseas. The aim is to attract new investment that will expand Australia’s overall innovation capacity and generate spill-over benefits for the domestic economy.

Australia’s public sector researchers are themselves increasingly international in their outlook, and it is the Commonwealth’s ambition to increase international collaboration in research by Australian universities and public research agencies over the next decade. The government will pursue this ambition first and foremost by using Excellence in Research for Australia to ensure that our university researchers can hold their own in international company.

The Commonwealth will also support dialogue between researchers, collaborative research projects, and joint research infrastructure. The National Health and Medical Research Council also supports international engagement in research — for example, through the Human Frontiers in Science Program and the International Cancer Genome Consortium.

The aim is to attract foreign R&D investment that will expand Australia’s overall innovation capacity and generate spill-over benefits for the domestic economy.

103 *Moving Up the Value Chain: Staying Competitive in the Global Economy* (OECD: Paris, 2007), p. 23.

104 *Main Science and Technology Indicators 2008/2* (Paris: OECD, 2008), p. 25.

105 *Science, Technology and Industry Outlook 2008* (Paris: OECD, 2008), p. 21.

106 *World Investment Report 2005: Transnational Corporations and the Internationalization of R&D* (New York and Geneva: United Nations Conference on Trade and Development, 2005), p. 161.

The last eighteen months have seen a renewed commitment to international collaboration in research. Among other things, the Commonwealth has opened the CSIRO Flagship Collaboration Fund and important Australian Research Council awards and fellowships to international researchers. It has also expanded Australia's role in iconic collaborations such as the European Molecular Biology Laboratory and the Square Kilometre Array radio-telescope. The 2009–10 Budget includes funding for an EMBL partner laboratory in Melbourne and an Australian National Centre for SKA Science in Perth.

The Australian Government will continue to promote Australian participation in international research partnerships and networks. This will include exploring how Australia may be able to better cooperate and coordinate with countries of a similar size (accounting for 2–3 per cent of global innovation), with which we share common interests or complementary capabilities. For researchers as for industry, the future is global.

PREPARING FOR THE TWENTY-FIRST CENTURY

The Australian Government is creating jobs for today by building infrastructure for tomorrow. That includes infrastructure to harness Australia's creativity and apply it in ways that will increase our prosperity and our quality of life. It is not enough just to have great ideas; we must also be able to translate those ideas into products and processes that have what it takes to grab attention in a fiercely competitive world. That is what Australia's innovation system does, and why it is essential that we make it stronger.

Innovation will make Australia more productive and increase our capacity to build new industries, attract new investment, and create new jobs — both now and in the decades to come. It also promises us happier lives — with better health, more time for friends and family, more security, and more opportunities for all Australians to reach their full potential. Most importantly of all, it will give us the tools we need to heal and protect the environment. These are the things Australians want. They are noble goals, and they are all within our reach. It will take creativity, cooperation, and the courage to try new things, but we can achieve them. The time to start is now.

