



# Promoting Innovation and Commercialisation The Australian Framework

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## **ABSTRACT**

Innovation and commercialisation of research and development (R&D) is essential for the competitiveness of an economy in the increasing globalisation of industry.

This report analyses the data on innovation and commercialisation in the Australian economy to determine the local challenges and opportunities. These are then used to examine the Australian Government policies and initiatives in the areas of publicly funded innovation and business innovation. The report concludes with some lessons from the Australian framework for APEC economies.

## **INTRODUCTION**

The rapid globalisation of industry combined with the shift of the global economy due to the rise of China and India into the high value end of the supply chain creates opportunities and challenges for all economies. Socio-environmental issues such as global warming, water shortages and an ageing population add to the complexity of the challenge. There is an increasing need for individual economies to maximise their international competitiveness.

Australia as an economy with a relatively small domestic market (21 million people) and geographic isolation from other markets particularly needs to utilise innovation to maintain its strong economic performance and quality of life. The OECD estimates that 50% of long-term economic growth in advanced industrial economies is attributable to innovation. There is a general consensus, supported by several reviews, that Australia is good at generating new ideas, but does not effectively commercialise them into products, services and processes.

Innovation is about more than just developing new science or technology. It requires the commercialisation of that science or technology in order to realise the benefits. This might involve new or significantly improved products or services, operational processes or organisational/managerial processes<sup>1</sup>. The benefits might be of direct commercial value to the company implementing the innovation or it could be a public good benefit such as lower environmental pollution.

Australia has a good reputation for competing in the international sporting arena, for example coming 4<sup>th</sup> in the medal ranking at the 2004 Athens Olympic Games. However, when looking at measures of innovation (and adjusting on a per capita basis, which is not done with the Olympics medal ranking) Australia does not rank so highly. The sporting success has in a large part been driven by successful Government policies and a similar focus on policies in the area of innovation and commercialisation is needed to ensure the same success.

## **AUSTRALIAN INNOVATION AND COMMERCIALISATION DATA**

Measuring R&D and innovation is a difficult task. The Australian Department of Education, Science and Training only just released the 2003/2004 National Survey of Research Commercialisation on the 31 August 2007. The question also arises as to what is the appropriate measure. Should the focus be on R&D inputs (such as money spent on labour and capital), R&D outputs (such as number of patents), or innovation outputs (numbers of companies that introduce new or significantly improved goods, services or processes, yield on technology licensing, number of start-up/spin-off companies)?

At least within Australia, with strong open links to the global economy, it is difficult to establish a consistent robust measure of the impact of R&D on overall economic

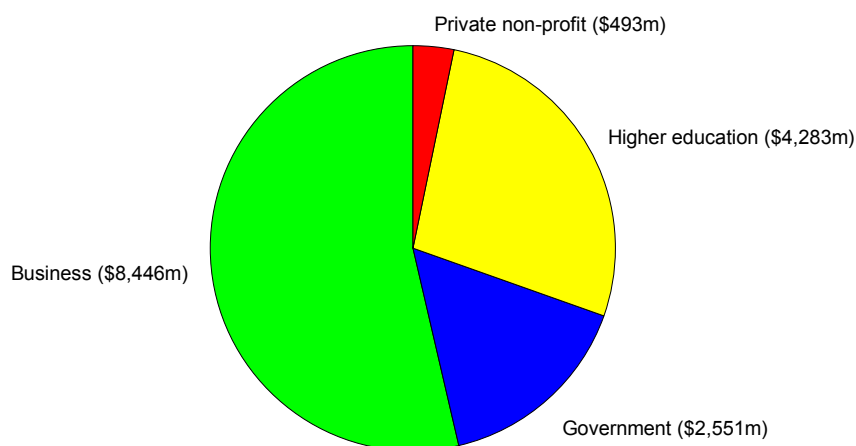
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1 "Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data", 3<sup>rd</sup> Edition, OECD

productivity<sup>2</sup>. The main difficulties arise from the long lags between cause and effect and the complex channels by which R&D impacts on productivity including spillover effects – where benefits are gained that are not captured by the innovator.

### **Overall research and development**

Gross expenditure on R&D within Australia for 2004/2005<sup>3</sup> is shown in Figure 1. Since 1996/1997 this has increased at an average rate of 9.9% per year. Total gross expenditure on R&D is 1.76% of GDP, which is below the OECD average of 2.26%. This gap is attributable to a relative shortfall in the business R&D spending, with publicly supported R&D being 0.7% above the OECD average.



*Figure 1: Australian Gross Expenditure on R&D (2004)*

### **Business research and development**

Business R&D expenditure increased by 16.6% to \$10,081m in 2005/2006<sup>4</sup>, bringing it up to 1.04% of GDP, but still significantly below the OECD average of 1.53%. However, the Productivity Commission notes<sup>5</sup> that if an adjustment is made for the industry structure in Australia considering the domestic added-value, then business R&D expenditure is closer to the OECD average, but still falls short.

Figure 2 shows that the socio-economic reasons for business expenditure on R&D is predominately economically focussed (at 91%).

2 “Econometric Modelling of R&D and Australia’s Productivity”, 2006, Shanks, S. and Zheng, S. Productivity Commission

3 “8112.0 – Research and Experimental Development, All Sector Summary, Australia, 2004-05”, 2006, Australian Bureau of Statistics

4 “8104.0 - Research and Experimental Development, Businesses, Australia, 2005-06”, 2007, Australian Bureau of Statistics

5 “Public Support for Science and Innovation”, 2007, Productivity Commission

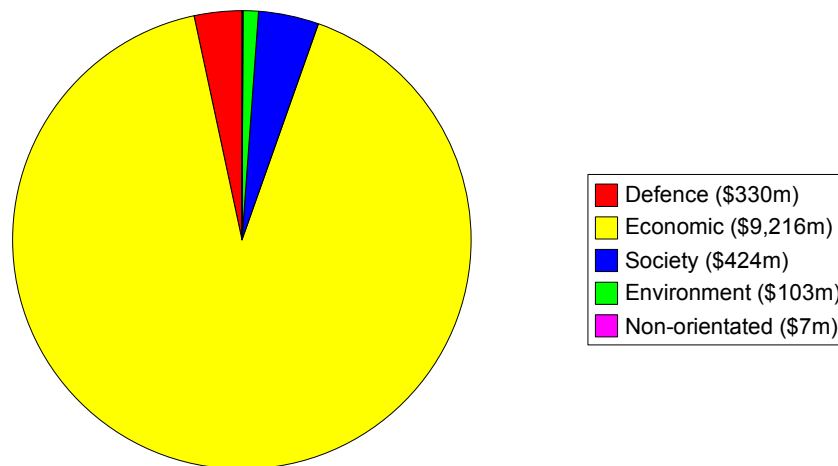


Figure 2: Socio-economic breakdown of business R&D expenditure (2005/2006)

Table 1 shows the breakdown of the level of innovation in Australian businesses<sup>6</sup>. The results shown that only 35% of businesses are actively attempting innovation, while only 33.5% successfully introduced or implemented new goods, services or processes. 12% of businesses started, but did not complete or abandoned an innovation project.

Any new or significantly improved goods or services	19.4%
Any new or significantly improved operational processes	21.6%
Any new or significantly improved organisational/managerial processes	24.9%
<b>Total: any new goods, services, processes (innovating business)</b>	<b>33.5%</b>
Started but did not complete or abandoned	12.2%
<b>Total: innovation active businesses</b>	<b>34.9%</b>

Table 1: Innovation in Australian businesses 2004-2005

Businesses reported an estimated 4.5% (\$40b) of revenue from new goods and services introduced during the survey period with a related expenditure of 1.8% (\$14b) on introducing new goods and services, yielding a return of 285%. An additional 1.9% (\$16b) was spent on introducing new operational or organisational processes<sup>7</sup>. However businesses typically do not keep records that allow accurate reporting on this figures so these should be treated appropriately.

The percentage of businesses innovating by size is shown in Table 2<sup>8</sup>. Smaller companies of less than 20 employees engage in significantly less innovation than larger companies of more than 20 employees.

6 "8158.0 - Innovation in Australian Business, 2005", 2006, Australian Bureau of Statistics

7 Ibid.

8 Ibid.

5-19 employees	28%
20-99 employees	47%
100+ employees	52%

Table 2: Proportion of Australian businesses innovating by size, 2004/2005

When asked about barriers to innovation, innovating companies reported the biggest barriers as direct costs being too high (32%), market related barriers (37%) and lack of skilled staff (28%)<sup>9</sup>.

The majority of innovating businesses (73%) reported having no formal methods in use to protect their intellectual property (IP). Copyright and trademarks was the most common method (20%) used to protect IP, followed by patents (7%). Smaller (5-19 employees) innovating businesses were less likely to use formal IP protection (22%) than large (100+ employees) businesses (42%). Informal protection methods included secrecy (23%), complexity of product design (8%) and frequent changes to product design (6%)<sup>10</sup>.

**Publicly funded research and development**

Of the nearly \$6b of Government funding of innovation, the majority of this (80%) is directed towards public sector agencies such as universities and research institutes in the form of grants or operating budgets, as shown in Figure 3<sup>11</sup>. The funding to the business sector is mostly provided through a tax concession arrangement (55%), with the remainder as grants under a range of programs.

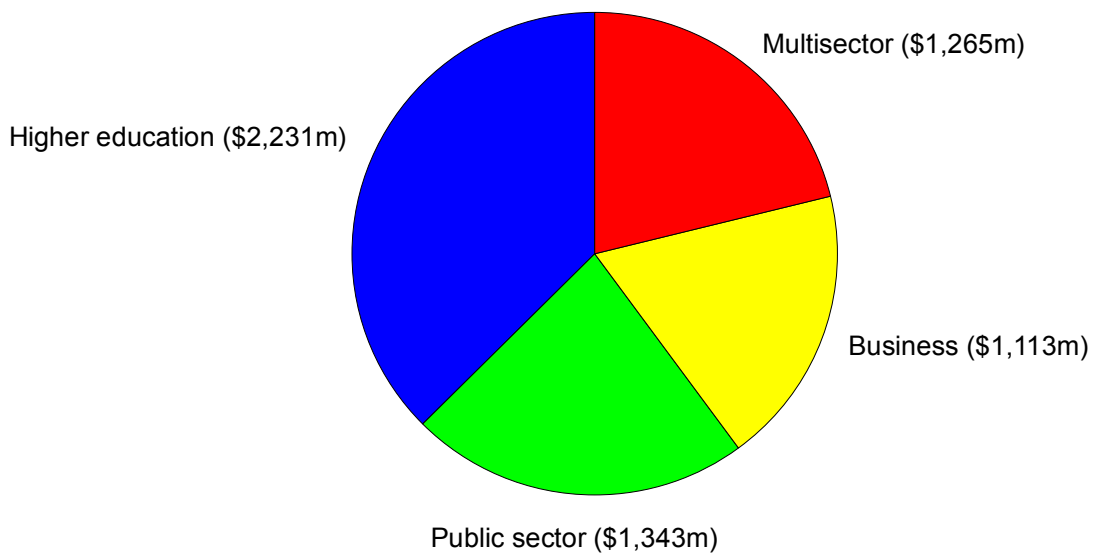


Figure 3: Breakdown of Australian Public Funding for R&D (2005/2006)

In the area of commercialising R&D produced within publicly funded research institutes (including universities), Table 3 shows that Australia is lagging the US, UK and Canada in

9 Ibid.

10 Ibid.

11 Op. cit. Productivity Commission

a number of key measures<sup>12</sup>. The table shows the number of invention disclosures, licensing, options and assignments (LOA) income (in US\$'000) and number of start-up companies per US\$100m invested into the R&D activities.

Commercialisation measure	Australia	US	UK	Canada
Invention disclosures	23	41	45	40
LOA income (US\$'000)	1,031	3,357	1,005	1,333
Start-up companies	0.7	1.1	3.6	1.4

Table 3: Commercialisation comparison per US\$100m R&D expenditure (2004)

The Australian Institute for Commercialisation in a 2005 submission to Government<sup>13</sup> estimates that less than 1% of public research funding in Australia is directed towards commercialisation activities, while international studies have shown that a level of 1.5% to 5% is required to achieve strong financial return on R&D expenditure.

Figure 4 shows the breakdown of venture and equity capital according to the stage of development of the company being invested into<sup>14</sup>.

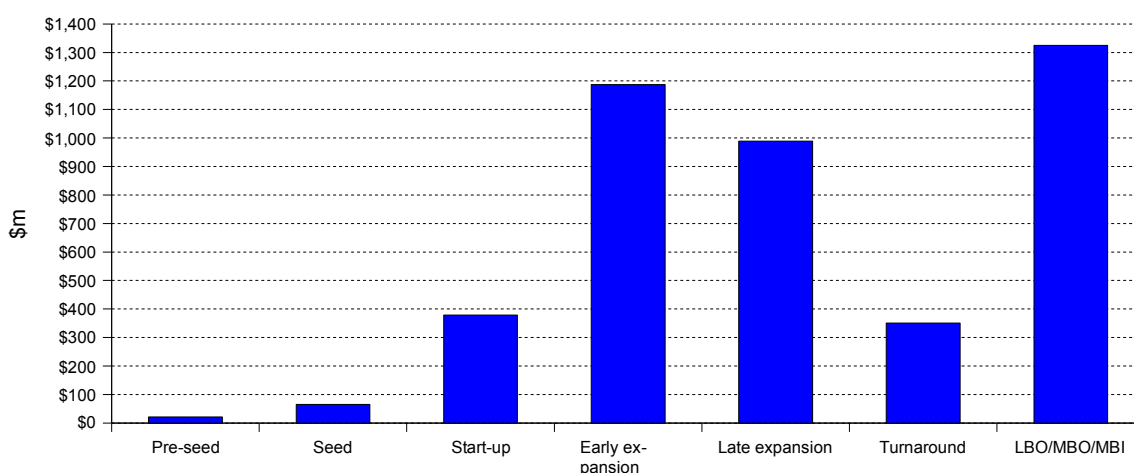


Figure 4: Venture and private equity investment by investee stage (2005/2006)

## Analysis of Australian data

Analysis of the data on Australian innovation and commercial leads to the following insights:

- Government R&D expenditure is above OECD average, while business R&D expenditure is below
- business R&D expenditure is primarily undertaken with an economic focus
- only 35% of businesses are actively attempting innovation, with smaller businesses innovating less than larger businesses
- the major barriers to innovation for businesses are costs, market related and lack of skilled staff

12 "National Survey of Research Commercialisation for Years 2003 and 2004", 2007, Department of Education, Science and Training

13 "Submission to the House of Representatives Standing Committee on Science and Innovation: Inquiry into Pathways to Technological Innovation", 2005, Australian Institute for Commercialisation

14 "5678.0 - Venture Capital and Later Stage Private Equity, Australia, 2005-06", 2007, Australian Bureau of Statistics

- formal and informal methods of IP protection are not used by the majority of businesses
- commercialisation of publicly funded research falls short by international comparisons
- there is an apparent lack of privately available early stage commercialisation funding.

This suggests that innovation within Australia could be best enhanced by focussing on:

- encouraging businesses to innovate more, particularly small businesses
- improving the commercialisation of publicly funded R&D to maximise the benefits of existing public investment
- ensuring the availability of commercialisation and IP skills through training and intermediaries
- ensuring adequate supply of early stage commercialisation funding.

The next two sections examine current Australian Government policies and initiatives within the context of these insights.

## **PUBLICLY FUNDED INNOVATION**

Public funded research is important both to allow for innovation in the goods and services supplied by the Government (including public goods such as environmental, education, defence and health) and to provide for industry and economy wide innovation where the individual return to a business can not be justified or captured. To be economically efficient, public funding needs to be structured to minimise the amount of private investment it displaces that otherwise would have taken place.

### ***University research commercialisation***

Universities have long been considered to provide two main roles, that of teaching and basic research. The supply of trained science and engineering graduates is one established channel for university research work to propagate into industry.

The term technology transfer is often used to refer to the process of moving university research into industry, however a more effective model is that of engagement. This brings in industry input at an early stage and helps to align the research with industry needs. The cooperative research centres (discussed below) are one means of facilitating this.

Most Australian universities have created some form of commercialisation unit, however, their effectiveness varies between institutions with only the largest universities being able to develop dedicated commercialisation units with sufficient scale and expertise<sup>15</sup>.

Previously there has been little incentive for academics to commercialise. Their job performance evaluation as researchers is typically based on academic publications in journals and conferences. The commercial returns to the university seldom reflect the benefits to society that can be achieved by greater commercialisation.

One component of the “Backing Australia's Ability” package announced in 2004 is the Research Quality Framework (RQF) currently being introduced with the first funding round to occur in 2009. It bases a substantial amount of university funding on the research of the institution. The intent of the RQF is to identify and reward the high quality and high impact research. The research assessment includes a consideration of impact as defined by the social, economic, environmental and cultural benefit of the research to the community.

While the endeavour to measure research quality and impact is encouraging, there is still some level of concern in the academic community about the details of the measurement

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15 Op. cit. Productivity Commission

methodology. The level of documentary processes required under the RQF could be an administrative burden.

### ***Cooperative research centres***

The cooperative research centre (CRC) program was established in 1990 to strengthen collaborative links between industry, research organisations and educational institutions. CRCs operate on a joint public-private basis. The CRC program requires long-term industry involvement in order to receive funding. There are currently 56 CRCs operating in the six sectors of:

- environment (13)
- agriculture and rural-based manufacturing (15)
- information and communication technology (5)
- mining and energy (7)
- medical science and technology (8)
- manufacturing technology (8).

CRCs also have a training role in producing more industry orientated graduates.

The CRC program is best suited for long-term large scale research programs, and the industry partners are typically large companies. The focus of the CRCs also seems to have narrowed to public support of commercialisation of industrial research rather than the original objectives of producing broad economic, social and environmental benefits.

The commercialisation model of creating direct spin-off companies by shifting the majority of a research team into the new company can de-skill the originating CRC. Additionally, the skills required in the commercial phase are different to those of the research phase and some researchers may be more effective (and satisfied) remaining in the research environment. The newly formed spin-off company could then draw on consulting services from the originating CRC to assist with the commercialisation process. A fair financial compensation arrangement would be needed to cover the research team members who do not move across.

### ***IXC Australia***

IXC Australia is a commercialisation intermediary established by the Australian Government and the Australian Industry Group (a chamber of commerce). IXC operates using a trusted intermediary model to facilitate and manage the IP exchange between organisations. Using a network of scientists and technologists as IP consultants, IXC allows client organisations to control their IP while searching for mutual opportunities and avoiding IP contamination. This is particularly useful for interactions between large and small organisations.

IXC has established a UK branch and is looking to expand to Canada, Chile, India, The Netherlands, New Zealand and Malaysia.

### ***Australian Institute of Commercialisation***

The Australian Institute of Commercialisation (AIC) was established by the Australian Government as a commercialisation intermediary between research organisations and industry. Services provided include:

- early stage advice and commercialisation consulting services
- commercialisation training and skills development
- industry events such as a Commercialisation Expo

- TechFast – assist businesses to access technology and matching with partners for collaborative innovation projects (includes up to \$50,000 funding per company)

## **BUSINESS INNOVATION**

In promoting business innovation, the challenge for the Government is to encourage private investment that would not have otherwise been made while generating total society benefits sufficient to cover the costs associated with the policy implementation.

Large companies are increasingly shifting to effectively outsourcing their innovation and research by allowing SMEs to undertake the risky initial commercialisation phase. The larger company then utilises the innovation results through a portfolio approach at a later stage by acquisitions, mergers, licensing or subcontracting to the SME.

Traditional Government policy mechanisms to promote business innovation has involved direct targeting of specific businesses through subsidies in the form of tax relief or grants. These are being complemented by alternative options that focus on market based approaches to improve the innovation environment for all businesses, such as increasing the availability of early stage venture capital.

### ***R&D tax concession***

The R&D tax concession is the largest channel for public funding of business R&D in Australia. Companies conducting eligible R&D activities can retrospectively claim for R&D expenditure in the previous year. Program requirements include the business having an R&D plan and keeping appropriate financial records. The basic tax concession allows a 125% concession which, at Australia's business tax rate of 30%, provides assistance of 7.5 cents per eligible dollar.

The program also provides for a tax offset for small companies (particularly those in a tax loss situation) to still receive immediate benefit from the program. A 175% premium concession rate is available for companies that increase their eligible R&D spending above their average spending of the prior three years. The premium rate provides a benefit of 22.5 cents in the dollar.

The main problem with the current structure of the R&D tax concession is that the 125% concession rate is paid out on R&D that would most likely have been performed in the absence of the program. That is, it does not effectively promote behavioural additionality. The Productivity Commission has recommended some changes including<sup>16</sup>:

- limiting the 125% concession rate to small firms
- basing the 175% rate on incremental spending above a fixed base of R&D to sales ratio
- using a narrow definition of R&D to require it to be both innovative **and** highly risky (rather than the current condition of being one **or** the other).

This also focusses the funding on early stage innovation where there is an absence of private funding rather than the less risky later stage commercialisation.

### ***Government grants***

There are a number of Government grant schemes available such as Commercial Ready (replacing R&D Start), Commercialising Emerging Technologies and a range of sector specific grants. Grant mechanisms typically operate on a competitive merit-based scheme. Grant systems have operated with various degrees of success, mostly due to the difficulty of the grant committee evaluating the grant applications under conditions of information asymmetry.

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16 Op. cit. Productivity Commission

An alternative to direct grants is a non-recourse loan mechanism rather than a straight subsidy. This has the advantage of shifting the risk analysis and evaluation back onto the business and reduces the information asymmetry of Government evaluated grants.

### ***Early stage venture capital funding***

The Australian Government has established two early stage venture capital funding programs, one aimed at commercialising research from the public sector and the other focussed on the private sector.

The Pre-Seed Fund provides \$78m of Government funding (plus additional funds from other sources) over a ten year period through four early stage venture capital funds managed by venture capitalists. The funds operate on a similar basis to venture capital funds with an equity investment in the start-up company and provision of management and technical advice to develop the technology. Fund managers are limited to \$1m investment per company or project (which must have originated in a university or public sector agency) and to divest their investment at the appropriate time to later stage investors.

The Innovation Investment Fund pools \$221m of Government funding with \$137m of private funding that is managed through seven venture capital funds managed by venture capitalists. Investee companies can receive up to a maximum of \$4m.

The Government has also created a special investment vehicle through the Early Stage Venture Capital Limited Partnership. This allows a venture capital fund that focuses on early stage investment to be set up that provides investors with complete tax exemption on both revenue and capital gains that pass through the ESVCLP.

## **LESSONS FOR APEC ECONOMIES**

The main lessons from the Australian experience that are applicable across APEC economies are:

- good measurement of R&D inputs and outputs is helpful for benchmarking against other economies and for focussing Government policies appropriately
- determine where the innovation bottlenecks are and the local challenges and opportunities
- research that produces public good benefits requires public funding
- publicly funded research requires focus on developing the commercialisation channels to maximise the economic and social benefits
- commercialisation skills of researchers and intermediaries may need to be developed
- promotion of business innovation is shifting from company targeted to market based

## **BIOGRAPHY**

Craig Skinner is a Principal Consultant with Isoparity based in Melbourne, Australia. Craig specialises in assisting organisations to deal with the impact of changing technology, competition and regulation and has worked extensively in Asia Pacific and the Middle East. He has over ten years experience of providing consulting advice and has worked with telecoms operators, vendors, investment banks, governments and regulators.

Craig's specialities include telecommunications regulation, spectrum policy and pricing, technology strategy, technology due diligence and market assessment, telecommunications network costing and cross-cultural training.

Craig joined Isoparity from Ovum Consulting where he was a Senior Consultant. Prior to Ovum Consulting, Craig was a Project Manager with Telstra Mobile Networks and a

Research Engineer with Telstra Research Laboratories.

Craig is often invited to speak to industry on a range of topics including telecommunications regulation, mobile telecommunications developments and technology strategy. He has conducted workshops on interconnection, USO and regulation of next generation networks for regulators and telecoms operators across Asia Pacific. Craig is an active member of the IEEE Communications Society, being the Current Chair of the IEEE Communications Society Victorian Chapter. Craig is a committee member of the Australia China Friendship Society.

Craig has a BSc in Applied Mathematics and a BEng in Electrical and Electronic Engineering, both with First Class Honours from the University of Western Australia, and has recently completed an MBA at the Melbourne Business School. He is currently studying Mandarin Chinese.