8

Innovation and research and development

Introduction

8.1 As Australian manufacturers move up the value chain to producing ever more sophisticated products, innovation becomes increasingly important. An important source of competitive advantage is having a new product not made elsewhere, or a better product than others produce.[1]

8.2 An important source of innovation is research and development (R&D) conducted within companies. It is far from the only source—much innovation involves commercialising research by universities or 'on the job' improvements to processes. This chapter focuses on the R&D part of innovation not because it is necessarily more important than other aspects, but because of its policy issues.

8.3 R&D is defined by the Australian Bureau of Statistics (ABS) as:

> Systematic investigation or experimentation involving innovation or technical risk, the outcome of which is new knowledge, with or without a specific practical application, or new or improved products, processes, materials, devices or services. R&D activity

1 About half of Australian manufacturers are 'innovative': they have introduced a new or substantially improved good, service or process over the past three years, but they are less likely than European firms to rank innovation among the most important drivers of competitiveness; 'Australian Innovation in Manufacturing: results from international survey,' M Dodgson and P Innes, *Exhibit no. 19*, pp. 6 and 17. Of Australian firms introducing new goods or services in 2004 and 2005, 74 per cent reported that the innovations were new to the business only, 20 per cent that they were new to the industry, 15 per cent that they were new to Australia and eight per cent that they were new to the world. For those firms introducing new organisational/managerial processes, 94 per cent reported these were only new to the firm. ABS, *Innovation in Australian Business 2005*, Cat. no. 8158.0, p. 33.

> extends to modifications to existing products/processes. R&D activity ceases and pre-production begins when work is no longer experimental.[2]

8.4 There have recently been some other relevant studies on the topic of innovation and R&D. The Productivity Commission released a major research report, *Public Support for Science and Innovation*, in March 2007, when the committee's hearings had almost concluded. While its analysis could not be tested at hearings, some references are made to it in this chapter. The Standing Committee on Science and Innovation has released two related reports, on *Riding the Innovation Wave: The Case for Increasing Business Investment in R&D* (June 2003) and *Pathways to Technological Innovation* (June 2006), and reference is also made to these where relevant.

8.5 These studies have provided useful information about innovation processes in manufacturing. However, the committee still heard calls for more research to be done in this area. Professor Mark Dodgson, director of the Technology and Innovation Management Centre, University of Queensland—appearing before the committee in a private capacity, noted:

> There is really a paucity of good research into this whole subject ... We have a lot of interested parties doing research that helps their case but we do not have any independent research. I would contrast that very sharply with the US, the UK and European countries, which do a lot of research.[3]

The importance of being innovative

8.6 Technology has long been regarded as an important aspect of economic performance. It is often regarded as a 'third factor' complementing labour and capital in producing output. Since the late 1980s increasing emphasis has been placed on the role of innovation and R&D in improving technology. This 'endogenous growth theory' has gained increasing importance in mainstream economics.[4]

8.7 Economic studies suggest that R&D can generate high returns. A review of the literature by a leading ANU academic, Steve Dowrick, led him to

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2 ABS, *Research and Experimental Development 2004–05*, cat. no. 8112.0, p. 25.

3 Prof M Dodgson, private capacity, *Transcript*, 19 October 2006, p. 4.

4 One influential article was Paul Romer's 'Endogenous technological change', *Journal of Political Economy*, October 1990 and he describes the development of the approach in 'The origins of endogenous growth', *Journal of Economic Perspectives*, Winter 1994.

conclude that rates of return on R&D are over 50 per cent.[5] The Productivity Commission, while emphasising the uncertainties, suggest they could be around 30 to 100 per cent.[6] The OECD also concludes that R&D is an important driver of economic growth.[7] A study found a link between measures of innovation (or successful R&D) and productivity.[8]

8.8 Witnesses also stressed the role of innovation in having manufacturers that can compete in global markets. Professor Dodgson argued:

> You compete with China by doing things that they cannot, and that means being hyperinnovative—producing really exciting products that do new things, delight customers and combine services into products in new and exciting ways.[9]

International comparison of research and development

8.9 Given the apparent importance of R&D in economic performance, concerns are sometimes expressed that Australia, and Australian companies in particular, do less R&D than international competitors.[10]

8.10 Australian businesses spent $8.4 billion on R&D in 2004–05, of which manufacturing accounted for $3.3 billion. Adding in the $2.6 billion spent by government, $4.3 billion by universities and $0.5 billion by other non-profit institutions, Australia's total expenditure on R&D was $15.8

5 S Dowrick, 'A review of the evidence on science, R&D and productivity', paper prepared for the Department of Education, Science and Training (DEST), August 2003. Similar views are cited in *Riding the Innovation Wave*, p.65.

6 Productivity Commission (PC), *Public Support for Science and Innovation*, 2007, p. xx. This draws heavily on S Shanks and S Zheng. 'Econometric modelling of R&D and Australia's productivity', *Productivity Commission staff working paper*, April 2006.

7 OECD, *Sources of Economic Growth in OECD Countries*, 2003. Their tentative estimates of the magnitudes are that an increase in R&D of 0.1 per cent of GDP raises the level of GDP by a little over 1 per cent, or increases the annual growth rate by up to 0.2 percentage points.

8 W Gu and J Tang, 'Link between innovation and productivity in Canadian manufacturing industries', *Economics of Innovation and New Technology*, vol 13, no 7, October 2004. Surprisingly, the Industry Statement 2007 downplays the importance of R&D, commenting 'there is no discernible statistical relationship between R&D spending levels and nearly all measures of business success, including sales and earnings growth, gross and operating profitability, market capitalisation growth, and total shareholder returns'; Department of Industry, Tourism and Resources (DITR), *Global Integration: Changing Markets. New Opportunities, Background papers*, no. 4, p. 19.

9 Prof M Dodgson, private capacity, *Transcript*, 19 October 2006, p. 4.

10 For example, the Standing Committee on Science and Innovation noted in *Riding the Innovation Wave* 'that Australia's level of business expenditure on R&D is relatively low … when compared to OECD countries'.

billion (of which about $3.8 billion was spent on manufacturing R&D). Almost 120 000 person-years were devoted to R&D activity.[11]

8.11 The $15.8 billion spent on R&D was the equivalent of 1.8 per cent of GDP, which placed Australia around the middle in a ranking of OECD economies. However, as the largest OECD economies (the United States, Japan and Germany) have above average R&D spending, Australia was below the OECD average R&D spending of 2.3 per cent of GDP.[12]

8.12 Australia does *not* have a 'target' for R&D. Nor do some high R&D economies such as Japan and the United States. However, a number of economies do have explicit targets, which aim to lift their R&D spending further above the 1.8 per cent in Australia (Table 8.1).

Table 8.1 R&D spending (% to GDP): actual and target

	Actual (2005)	Target
Australia	1.8	No target
Austria	2.4	3.0 by 2010
Canada	2.0	Top 5 in OECD
China	1.2	2.5 by 2020
Estonia	0.9	1.9 by 2010
Finland	3.5	4.0 by 2010
France	2.1	3.0 by 2010
Germany	2.5	3.0 by 2010
Greece	0.6	1.5 by 2010
Ireland	1.3	2.5 by 2013
Japan	3.2	No target
Netherlands	1.8	3.0 by 2010
New Zealand	1.1	OECD average for public R&D
Sweden	3.9	4.0
Taiwan	2.6	3.0 by 2006
United Kingdom	1.7	2.5 by 2014
United States	2.7	No target

Sources: Productivity Commission, Public Support for Science and Innovation, March 2007, p. 563; OECD, Main Science and Technology Indicators, December 2006; OECD Science, Technology and Industry Outlook 2006. Values for Australia, China, Japan, Netherlands, Taiwan, UK and US refer to 2004 and NZ to 2003.

11 ABS, *Research and Experimental Development 2004–05*, Cat. No. 8112.0.

12 Australia also lags behind most of the other higher-income OECD countries, but interestingly above Ireland (often regarded as the model for manufacturing). As Australia aspires to be a niche rather than mass manufacturer, it could be argued the relevant comparison is with the higher-income economies. If the comparison is restricted to *business* R&D, the $8.4 billion represents 0.9 per cent of GDP. Again Australia is ranked among the middle of the OECD economies but spends less than the OECD average of 1.5 per cent of GDP, according to Australian Bureau of Statistics, *Research and Experimental Development, Businesses, 2004–05*, Cat. No. 8104.0. In both cases Australia was also below the OECD average in 2000–01 and 2002–03.

8.13 These targets are sometimes used to argue that Australia should set such a target.[13] However, the targets are not always well-specified. Many European countries have adopted the EU's target of three per cent announced in its 'Lisbon strategy' in 2002. Sweden and Finland, which were already above this target, are aiming for four per cent, while others have set more modest targets. Canada aims to exceed the OECD average; it would obviously be impossible for the majority of OECD countries to do this. Overall, there does not appear to be rigorous reasoning behind the choice of target levels; most countries seem to just choose as a target a level a bit above where they are now. Nor does it seem that many countries are likely to achieve their targets.[14]

8.14 An important caveat about using international comparisons to argue that Australia does too little R&D is made by the Productivity Commission:

> Comparisons of input ratios are usually a conceptually unsound basis for assessing optimal investment in R&D. Nothing says that 'high' input ratios are necessarily better than 'low' ones, since it is possible to both under- or over-invest in R&D. For most other inputs — such as labour or capital — the usual interest is not in maximising inputs per output, but rather maximising its inverse (output per input or productivity).[15]

8.15 A 2005 study by Davis and Tunny, two Treasury economists, splits the OECD data into components of R&D and show that Australian businesses do similar amounts of 'basic research' to their international peers, less 'applied research' and much less 'experimental development'.[16] Australian non-businesses (government, academia etc) do a relatively large amount of applied research, so that total Australian spending on applied research is comparable to that in other OECD countries. Overall then, Australia appears to do a reasonable amount of 'R' but falls behind on 'D'.

8.16 This view that Australians are better at inventing than commercialising agrees with anecdotal evidence. Australians invented the atomic

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13 A target for *business* R&D of 1 per cent of GDP was recommended by the Standing Committee on Industry, Science and Resources, in their report *Getting a Better Return* (September 2001). As business R&D had risen to 0.95 per cent of GDP in 2004–05, the 'target' may have been reached.

14 PC, *Public Support for Science and Innovation*, 2007, pp. 567-8 suggests that only Sweden and Malta among the OECD economies are on track to meet their 2010 targets. The average R&D to GDP ratio actually *fell* slightly in the European Union between the announcement of the 'Lisbon' target in 2002 and 2005.

15 PC, *Public Support for Science and Innovation*, 2007, p. 43.

16 G Davis and G Tunny, 'International comparisons of research and development', *Economic Roundup*, Spring 2005, pp 63-82.

absorption spectrophotometer, the black box flight recorder and the orbital engine but all were commercialised overseas.

8.17 It also accords with views expressed by experts in new technologies. For example, Dr Peter Binks, chief executive officer, Nanotechnology Victoria commented:

> I am not convinced that we need more R&D performed …. The big gap is being able to support industries in evaluating new technologies … the best role, in particular, for the federal government is around creating the infrastructure to support the uptake of those technologies.[17]

8.18 However, this view is challenged by the Productivity Commission:

> There is evidence of widespread success in commercialisation across all sectors of the Australian economy, which belies a commonly expressed pessimistic view of Australia's capabilities.[18]

8.19 Another conclusion from the Davis and Tunny study is that 'the relationship between R&D and more direct measures of innovation does not appear to be strong or stable across countries'.[19]

8.20 In making international comparisons, it is important to note that total spending on R&D is also a function of a country's industrial structure. Given Australia's industrial structure – significant mining and rural sectors and less high-tech manufacturing – even if Australia had relatively high R&D within each individual industry, it would still have relatively low overall R&D relative to GDP.[20] Putting it another way, adjusting for its industrial structure Australia's R&D spending is not a significantly smaller share of GDP than the OECD average.

Conclusions

8.21 The committee encourages companies to be innovative, realising this is often a prerequisite for lifting productivity and succeeding in global markets. Innovation may result from improving or redesigning processes as well as from formal research and development. In a free market firms should undertake the innovation and research that they believe will improve their profitability.

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17 Dr P Binks, Nanotechnology Victoria (NanoVic), *Transcript*, 15 March 2007, pp. 2–3.

18 PC, *Public Support for Science and Innovation*, 2007, p. xxii.

19 G Davis and G Tunny, 2005, p 63.

20 G Davis and G Tunny, 2005 and PC, *Public Support for Science and Innovation*, 2007.

8.22 The commonly expressed concerns that Australia allocates a smaller proportion of its national income to research and development than do other OECD countries are overstated as they fail to take account of Australia's industrial structure.

Government support for research and development

8.23 The benefits from R&D discussed above do not of themselves justify any government intervention to encourage it. Given the benefits that accrue to companies from R&D, in a free market businesses will undertake it, in the areas they judge will be of most benefit. With hindsight, some of the expenditure will not be productive, while some will generate huge returns.[21] This is in the nature of research and is not undesirable.

8.24 Probably the main contribution government can make to encouraging the private sector to undertake R&D is to provide a sound economic background which gives the private sector the confidence to undertake projects with long-term returns.

8.25 The justification for government measures to encourage R&D is that it has some 'public good' characteristics. Some of the benefits from it may accrue (or 'spill over') to the rest of the economy rather than just to the firm undertaking it. Dr Peter Burn, associate director, public policy, from the Australian Industry Group, described these 'positive externalities':

> Expenditure on research and development generates external benefits. A company generates more for society than the benefits it accrues for itself, so from a social point of view there is an impediment to the optimal amount of private spending on research and development just by leaving the market to itself.[22]

8.26 The parts of R&D most likely to benefit the broader community rather than just the individual firm tend to be more at the R than the D end. The 'truly original idea' with wide ramifications is more likely to come from pure research than process improvements. These may be most likely to come from universities and research organisations.

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21 It is reminiscent of the saying attributed to the US retailer John Wanamaker: 'Half the money I spend on advertising is wasted; the trouble is I don't know which half'.

22 Dr P Burn, Ai Group, *Transcript*, 29 August 2006, p. 12. S Dowrick suggests that the total social rates of return to R&D are around ten percentage points higher than the private returns to the company undertaking it; 'A review of the evidence on science, R&D and productivity', paper prepared for the Department of Education, Science and Training (DEST), August 2003.

8.27 Among companies, technological breakthroughs may be most likely to originate from 'start-ups' than from established companies.[23] For example, in the field of nanotechnology, it was noted that work was being done in the field by universities, government research organisations and small companies whereas:

> Companies like BlueScope Steel, Amcor, BHP Billiton and Rio Tinto are all looking at nanotechnology activities, not necessarily investing right now but keeping a watching brief and developing relationships.[24]

8.28 Dr John Raff, deputy chairman and founder of Starpharma Ltd:

> Would like to see far more, I suppose, nurturing and love for the smaller structures, which are the innovators coming through, than for the larger, established organisations.[25]

Forms of government support for R&D

8.29 Governments support R&D in six broad ways. Firstly, they directly fund research work by universities and institutions such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australian Nuclear Science and Technology Organisation and Defence Science and Technology Organisation. These tend to concentrate on research and do less development work.

8.30 It is sometimes suggested that public investment 'crowds out' industry R&D, for example, by drawing scientists away from industry. However, the available empirical evidence seems to suggest that public R&D is more of a complement to private R&D than a competitor.[26]

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23 This seems the predominant view in Australia now. For example, Starpharma's Dr Raff asserted: 'worldwide, larger organisations are not the innovators'; *Transcript*, 15 March 2007, p. 15. PC state that 'smaller firms with a greater R&D focus are more likely to perform genuinely new and more widely-utilised research'; *Public Support for Science and Innovation*, pp. 34 and 386. This emphasis on smaller firms contrasts with the view attributed to the Austrian economist Joseph Schumpeter that large monopolies are the wellsprings of innovation. Some US data suggests that in the past large firms conducted more R&D relative to their sales than did small firms, but more recently the positions have reversed, possibly due to the growth of internet-related companies (of course there are many 'corner store' types of small business than do no R&D, although they may still innovate); P Samuelson and W Nordhaus, *Economics*, 2005, pp. 193–7. An interesting account of how research has moved from large monopoly companies to small firms and universities is given in *The Economist*, 3 March 2007.

24 Dr P Binks, Nanotechnology Victoria, *Transcript*, 15 March 2007, p. 2.

25 Dr J Raff, Starpharma Ltd, *Transcript*, 15 March 2006, p. 14.

26 The Dowrick 2003 survey concludes 'business R&D is complementary to public sector civilian R&D – raising investment in one sector stimulates the productivity of the other' — S Dowrick, 'A review of the evidence on science, R&D and productivity', paper prepared for DEST,

8.31 Secondly, governments encourage R&D by allowing companies monopoly rights for limited periods over innovations arising from their R&D. This is done through creating intellectual property rights through patents and copyrights. Some submissions said that getting patents was a slow process in Australia, particularly if there was a challenge to them.

8.32 Thirdly, governments encourage businesses R&D by providing grants.[27] Fourthly, they provide tax concessions. Grants and tax concessions are discussed in the following two sections.

8.33 Fifthly, governments may support R&D by encouraging foreign firms to conduct some R&D in the domestic market. Australia is unlikely to become a major global R&D centre if it just relies on local companies. The Department of Industry, Tourism and Resources has noted that Australia is home to only two of the top 1 000 global corporate R&D spenders.[28]

8.34 Attracting multinationals to conduct R&D in the domestic economy was an important element in the Irish 'success story' (discussed in Appendix F). Inward R&D by foreign firms is encouraged by Invest Australia. While an important consideration for multinational companies deciding where to locate R&D activities is the cost, the House of Representatives Science and Innovation Committee noted:

> A second consideration for major international corporations is the extent to which a country is 'innovation friendly'. This involves factors such as the availability of university, government and commercial research institutions, 'the availability of a world-class telecommunications infrastructure' and 'the capacity for IT enablement', the presence of 'leading-edge customers to stimulate demand [and] innovation', 'world-class skills availability with a focus on excellence in vocational training/teaching/research', 'culture training in entrepreneurship' and the availability of

August 2003. The PC 2007 report opines that 'there is strong evidence that displacement [of corporate R&D by funding for universities] is small' (p. 109).

27 An alternative, but uncommon, model for funding R&D is for governments to award prizes for breakthroughs in specific areas. For example, in 1714 the British government offered £10-20 000 for practical ways of measuring longitude at sea. The prize was won by John Harrison for his very accurate sea-going clocks. (See D Sobel, *Longitude*, Walker & Co, London, 1996.) In 1887 the New South Wales government announced a £25 000 prize (roughly equivalent to $10 million today) for a biological method to eradicate rabbits. Despite eminent scientists such as Louis Pasteur entering, no prize was awarded.

28 Cited by PC, *Public Support for Science and Innovation*, 2007, p. 586.

> companies 'that can function as partners when the R&D project requires the use of outside resources'.[29]

8.35 Finally, governments may persuade firms to undertake more R&D in other ways. At a public hearing in Melbourne, NEC told the committee that, in the past, they were induced to place some R&D activity in Australia by 'more or less a stick … [being told to] do the necessary conditions or you do not get government business'. They thought 'probably the days are over'[30] when this approach could be used, in part as it would now be inconsistent with commitments in trade agreements.

8.36 Another witness thought there were still governments who intervened to encourage R&D in these sorts of ways. Professor Dodgson stated:

> The presumption that the state does not intervene in manufacturing in other countries is seriously wrong. American manufacturing depends completely on American government policies; procurement is one example.[31]

8.37 Not all these forms of support involve government outlays and the costs of some are hard to measure. The Productivity Commission's estimate is that 'total funding of science and innovation by the Australian Government has actually fallen slightly as a share of GDP between 1981-82 and 2005-06'.[32]

Grants for research and development

8.38 The bulk of assistance grants are aimed at strengthening industry's innovative outlook and are administered by AusIndustry. These include:

- Innovation Investment Fund programme (a venture capital programme discussed in Chapter 5);
- Commercial Ready;
- Commercialising Emerging Technologies;
- Industry Cooperative Innovation Programme; and
- Intermediary Access (a new programme announced in May 2007).

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29 House of Representatives Science and Innovation Committee, *Riding the Innovation Wave: The Case for Increasing Business Investment in R&D*, 2003, pp. 57–8.

30 Mr B McManus, NEC, *Transcript*, 15 March 2007, pp. 27–8.

31 Professor M Dodgson, private capacity, *Transcript*, 19 October 2006, p. 14.

32 PC, *Public Support for Science and Innovation*, 2007, p. 37.

Supplementing these are also some state government schemes, although these concentrate on agriculture rather than manufacturing.

Commercial Ready (CR)

8.39 CR is a merit-based suite of grant programmes for SMEs, supporting innovation and its commercialisation. It provides matching grants to support R&D, 'proof of concept'[33] work and early stage commercialisation. The scheme provides annual grants from $50 000 to $5 million.

8.40 CR began in 2004 as part of the *Backing Australia's Ability*[34] strategy with a $1 billion programme allocation. In the 2007-08 Budget it was extended until 2011 with a further $32 million programme commitment for applicants applying for funding up to $250 000. The grants are competitive, with one of the five criteria on which projects are assessed being the 'national benefit' of the project and another that it would not proceed 'satisfactorily' without the support. Successful applicants receive up to half the project cost, subject to a ceiling of $5 million.

8.41 It appears the CR programme helped Starpharma, a dendrimer nanotechnology company, to commercialise. Starpharma stated:

> We have had a lot of support from the Australian Government through R&D Start programs, Commercial Ready and P3.[35]

8.42 The Productivity Commission concluded that 'there is robust evidence indicating that the Commercial Ready programme supports too many projects that would have proceeded without public funding assistance' and recommended changes to the governance of the programme.[36] However, it noted that a number of organisations, such as the Australian Industry Group and the Department of Industry, Tourism and Resources (DITR), disputed this conclusion.

8.43 Science Industry Australia (SIA) wants CR extended to cover larger companies:

> This turnover criterion which confines eligibility … to SMEs with an annual turnover of less that $50m is unrealistic for science industry companies that operate in the global business environment and rely on world class innovation for their

33 'Proof of concept' work includes activities to establish a technology's commercial viability.

34 Australian Government, *Backing Australia's Ability – Building our Future through Science and Innovation,* 2004.

35 Dr J Raff, Starpharma Ltd, *Transcript*, 15 March 2007, p. 9.

36 PC, *Public Support for Science and Innovation*, 2007, Finding 10.9, p. 420.

> competitive advantages … the relatively few larger Australian science industry companies that compete in world markets and contribute to Australia's economic and social welfare are denied access to many Government innovation support measures.[37]

8.44 This agrees with the report of the Standing Committee on Science and Innovation, *Pathways to Technological Innovation*, June 2006, which recommended the government review the thresholds. This issue appears to have been ameliorated by an increased threshold to an annual turnover over $100 million, announced by the Minister for Industry, Tourism and Resources, Mr Ian Macfarlane, in August 2006.

8.45 A more effective use of grant funding may be possible if successful firms returned some of the profits resulting from R&D to the scheme. This could also discourage firms from applying for grants for projects they would still undertake without the grant.

8.46 One approach would be for the government to receive an equity stake in the project. This could work like the venture capital scheme in Israel whereby the government will 'fund the R&D side of it and then they can be bought out by the private sector'.[38]

8.47 Another, perhaps simpler, approach along similar lines would be to have some R&D grants take the form of income-contingent loans, modelled on the HECS scheme for university students.[39] These would be repaid if the R&D results in commercial success. This could have three advantages. Firstly, as earlier 'grants' are repaid, more funds would become available for new 'grants'. Secondly, it would be more likely to lead to 'additionality'; firms would not bother applying for loans for conservative projects with guaranteed returns they would undertake anyway, but would apply for more marginal, risky and innovative projects, which may be those more likely to generate spill-over benefits. Thirdly, it would build in automatic monitoring of whether the assistance scheme was succeeding in generating a reasonable number of commercial successes. The Productivity Commission note that 'repayable schemes have been widely used overseas, and in some countries they are major forms of R&D support'.[40]

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37 Science Industry Australia (SIA), *Submission no. 7*, p. 5.

38 Mr S Ciobo MP, *Transcript*, 22 November 2006, p. 18.

39 PC, *Public Support for Science and Innovation*, 2007, suggests looking at 'introducing loan repayment mechanisms, rather than straight grants' (p. xxviii). It was also advocated in C Emerson, *Vital Signs, Vibrant Society*, 2006, p. 130 and Centre for International Economics, 'A review of the R&D start program', cited in PC, 2007, p. 422.

40 PC, *Public Support for Science and Innovation*, 2007, p. 421.

Commercialising emerging technologies programme (COMET)

8.48 The COMET programme provides small innovative businesses with a package of assistance to enable them to commercialise their activities. The programme is delivered by paying for private sector business advisers who offer advice on linkages to other parties for collaboration and venture capital. The total financial assistance available under COMET is capped at $120 000 per customer.[41]

8.49 COMET started under the umbrella of *Backing Australia's Ability* in 2001, with $40 million in funds to 2004-05. In 2004 it was extended to June 2011 under *Backing Australia's Ability – Building Our Future Through Science and Innovation* and allocated an additional $100 million. The DITR website states:

> This means some 200 companies per annum can be supported with mentoring and commercialisation management advice; ... In the five years to July 2004, firms supported under COMET raised around $275 million in capital and over 500 strategic alliances, licenses and other agreements to enable their businesses to grow. [42]

8.50 There was a suggestion that successful CR and/or COMET grant applicants could be linked up with the CSIRO to see if applied research activities could be undertaken. CSIRO commented:

> There is no special relationship that CSIRO has in that process of obtaining grants with AusIndustry. I think it is fair to say, though, that CSIRO is looking at ways in which we can more effectively work with industry, especially SMEs, I might add, who often depend upon Commercial Ready and COMET grants and the like.[43]

Industry cooperative innovation programme (ICIP)

8.51 The ICIP aims to assist business collaboration on product or process innovation, particularly between manufacturers. This programme was

41 DITR, *COMET Customer Information Guide*, Version 2.1, July 2005, COMET Section, p. 3.

42 'Commercialising Emerging Technologies (COMET) Program', DITR, 16 March 2007 <http://www.industry.gov.au/content/itrinternet/cmscontent.cfm?objectID=5483ACCB-97CA-1838-61B239AE0868E468> as viewed, 5 June 2007.

43 Mr G Redden, CSIRO, *Transcript*, 22 March 2007, p. 13.

announced in 2004 and has funding until 2011 with a commitment of around $25 million.[44]

8.52 Innovation projects may include project scoping through to implementing innovation in production. There must be a consortium of at least three entities and the applicant (at least one member of the consortium) must be a non-tax exempt company incorporated in Australia. The programme provides funding of up to $3 million.

8.53 The ICIP was praised by the Australian Electrical and Electronic Manufacturers Association as enabling collaborative research to be undertaken by advanced manufacturers, the results of which fed into their industry action agenda, but they had concerns that it did not assist companies wanting to collaborate overseas.[45] The programme has never actually excluded international entity collaboration but as this was not explicitly stated in the guidelines, there was a misconception that the programme funded domestic collaboration only. New programme guidelines were gazetted in March 2007 to clarify this issue.

8.54 SIA also referred to the need for collaborative international innovation:

> With the internationalisation of Australian industry, and industry's greater use of open innovation, government should provide additional support to encouraging international linkages between manufacturers and offshore R&D.[46]

Intermediary Access Programme (IAP)

8.55 The IAP was announced in the Industry Statement 2007. The five year $20 million IAP will fund 50 per cent, up to a $50 000 cap, of the cost of intermediary services to link up to 150 SMEs with possible technology partners using 'trusted third parties' to protect commercial-in-confidence information. This is in line with a recommendation of the National Manufacturing Forum (NMF) for the development of 'innovation intermediaries'. The new programme will use two providers; the InnovationXchange (a not-for-profit global knowledge network) and the Australian Institute for Commercialisation's Techfast.[47]

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44 'Industry Cooperative Innovation Programme', DITR, 2 April 2007, viewed 5 June 2007, <http://www.industry.gov.au/content/itrinternet/cmscontent.cfm?objectID=6DB4057B-65BF-4956-B9DCEB2ED81BB5DD>.

45 Mr A Robinson, Australian Electrical and Electronic Manufacturers' Association, *Transcript*, 7 December 2006, p. 15.

46 SIA, *Submission No. 7*, p. 7.

47 'Strategic Directions to Boost Australian Manufacturing,' National Manufacturing Forum (NMF), *Exhibit no. 22*, pp. 27–8. Further information about the InnovationXchange network is

8.56 The South Australian Government submission supported the use of TechFast.[48] The NMF praised the work of the InnovationXchange:

> It is bringing companies together to share their IP in a way that does not prejudice the privacy of their intellectual property. A manufacturing advisory service could give information about the role of that body and again help that organisation's extension to other states which are not currently engaged.[49]

8.57 It is difficult at this stage to determine whether the IAP facilitates international collaborative activities, even though the intermediary organisations sponsored by the programme operate internationally.

8.58 The programme was officially announced on 1 May 2007, but ironically AusIndustry's 'fact sheet'[50] states it commenced on 31 December 2006. Irrespective, the committee did not receive any evidence about the programme in the course of the inquiry.

Industry-specific grant programmes

8.59 There are also a number of industry-specific grant programmes. Examples include the Pharmaceuticals Partnership Programme and parts of the Automotive Competitiveness and Investment Scheme (ACIS). Under the ACIS scheme, rather than a direct payment, car manufacturers can receive a rebate on the duties they pay on imported components. The rebate is equivalent to 45 per cent of eligible R&D (up to a maximum of five per cent of the previous year's sales). A looser definition of eligible R&D is used than for other schemes. Car manufacturers are allowed to include 're-engineering and modification of existing products and processes' and this forms the bulk of the R&D supported.[51] The R&D component of ACIS cost $128 million in 2004–05.[52]

8.60 This concerns the Productivity Commission, who warn that the effectiveness of government assistance for R&D is reduced as 'a few

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at <www.ixc.com.au> and Techfast at <www.ausicom.com>. InnovationXchange Australia Ltd (IXC) was developed in Victoria, Australia in 2003 and the model has already been licensed to the UK as IXC UK.

48 South Australian Government, *Submission no. 26*, p. 14.

49 Mr R Herbert, NMF, *Transcript*, 22 November 2006, p. 4.

50 AusIndustry, Intermediary Access Programme fact sheet, viewed 13 May 2007, <http://www.ausindustry.gov.au/library/IAPfactsheetdot20070307121930.pdf>.

51 PC, *Public Support for Science and Innovation*, 2007, p. 438.

52 PC, *Public Support for Science and Innovation*, 2007, p. 382.

relatively declining sectors – such as the auto industry – have benefited disproportionately through special sectorally-specific R&D programs'.[53]

Conclusions

8.61 The committee accepts that fundamental research which benefits the broader economy, rather than just the company undertaking it, may be undersupplied in the free market so there is a case for government support. This can be provided through a competitive grants scheme along the lines of Commercial Ready. The scheme should focus on R&D with wide benefits that would not be undertaken otherwise. It need not be limited to smaller enterprises, although they may often better fit these criteria. Consideration should be given to making contingent loans as well as grants, as this will replenish the available funds and so allow more encouragement for R&D. The scheme should be simple for firms to access, with straightforward compliance requirements.

8.62 The committee identified scope in bringing together applied research activities with small innovative manufacturers by linking the successful grant applicants of either COMET or Commercial Ready to a relevant CSIRO research area or flagship. The process could be administratively simple but provide much capacity for interaction between industry and research institutions early in product or process development cycle.

8.63 One of the biggest advantages of the ICIP programme is its international collaborative approach which, based on evidence received, has until recently been viewed by industry as domestically oriented. However, although providing funding for international efforts, the programme may not fully achieve its aims because Australian companies have little way of linking with international consortia without government facilitation.

8.64 The newly announced Intermediary Access Programme may enable better facilitative links for manufacturers entering an ICIP arrangement; but at this stage it is unclear whether the IAP provides funding for international facilitative links. At this stage the two programmes appear divorced.

53 PC, *Public Support for Science and Innovation*, 2007, p. xxi.

Recommendation 18

8.65 **The committee recommends that successful Commercialising Emerging Technologies (COMET) and Commercial Ready grant applicants are linked up with the CSIRO to foster better industry applied research at the small to medium manufacturing level.**

Research and development tax concession

8.66 There are three elements of the current R&D Tax Concession:

- Companies can deduct up to 125 per cent of qualifying expenditure incurred on R&D activities when lodging their corporate tax return.
- Companies can deduct 175 per cent of that part of R&D exceeding its average level over the past three years under the 'Incremental (Premium) Tax Concession'. It was announced on 1 May 2007 that this concession would be extended to foreign-owned companies.
- Under the 'R&D Tax Offset' programme, small firms can obtain the full benefit of their tax concession claim, regardless of whether they are in profit or not; i.e. if they are not liable for tax, they will receive a payment.[54] This is restricted to firms with R&D between $20 000 and $1 million and with group turnover below $5 million.

8.67 The R&D tax concession was originally set at 150 per cent when it was introduced in 1985 but cut to 125 per cent in 1996. Along with the reduction to the company tax rate, this has reduced its value from 23 per cent (i.e. 0.50 of 46 per cent) of R&D spending to 7.5 per cent (i.e. 0.25 of 30 per cent) now.

8.68 Unlike grants, tax concessions apply to *all* R&D, regardless of its quality. Views differ about whether this is a good or bad thing. Those most sceptical about the ability of governments or their advisers to 'pick winners', or judge which R&D is 'high quality', laud supporting that R&D which companies themselves see as most beneficial. They characterise the tax concession as 'market driven'.

54 For example, a firm spending $100 000 on R&D eligible for the 125 per cent deduction will be given a tax benefit of: Tax rate × (1+concession rate) × R&D = 0.3 × 1.25 × $100 000 = $37 500.

8.69 Alternatively, others view such tax concessions as 'blunt measures with no quality control'[55] and argue that firms are most likely to choose R&D that is of specific benefit to themselves rather than to the broader economy. They also warn that some of any apparent increase in R&D following the introduction of tax concessions may reflect accountants (mis)classifying more expenditure as R&D, rather than a true increase in research activity. They advocate requiring firms to compete for more targeted funding of R&D likely to have wider benefits.

8.70 Views differ about whether these tax concessions have in practice actually lead to more R&D (known as 'additionality') or just provided a windfall gain for companies based on R&D they would have undertaken without the concession. For example, NEC told the committee that:

> Our business plans—which we submit to the board—do not include any allowance for the R&D tax concession. We do not include it because we are not confident that the Government will retain it at any particular time. It has been varied significantly over the time that we have been involved in R&D and exports. We would want a commitment covering 10 years during which its conditions would not be decreased or touched if we were to include it in our board financial documents. At the moment, it is an after-the-act collection by the accountants and it goes into general revenue. Essentially, it does not affect the R&D activity.[56]

8.71 Similarly, SIA pointed out that:

> Larger companies in the Australian science industry argue that the compliance costs of obtaining R&D support under the Tax Concession Scheme exceed the financial benefits it provides. With the recent reductions in company tax, any benefits have been eroded further. As a consequence, Australia's R&D support measures have little impact on the competitiveness of the larger Australian-based science companies.[57]

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55 Professor M Dodgson, private capacity, *Transcript*, 19 October 2006, p. 14.

56 Mr B McManus, NEC, *Transcript*, 15 March 2007, p. 26. Some similar points were made to the Productivity Commission's inquiry. One submission to them said 'I am yet to meet a technology manager who claims that there is a connection between the availability of the concession and the amount of R&D undertaken in his or her organisation!'; PC *Public Support for Science and Innovation*, 2007, p. 391.

57 SIA, *Submission no. 7*, p. 5. Similarly, PC cite a submission to them which claimed that the 'concession does not warrant the significant compliance work associated with registering projects and maintaining records of relevant expenditure'; PC, *Public Support for Science and Innovation*, 2007, p. 375.

8.72 During site visits, the committee heard from some companies that tax concessions do not drive decisions and that grants are more effective. Other companies may hold similar views but not wish to say so, reasoning that the concession may be just removed rather than improved or replaced, and so they will face higher tax bills.

8.73 The Productivity Commission concludes in its 2007 report:

> The extent to which the basic R&D tax concession stimulates additional R&D is low, particularly for large firms.[58]

8.74 The Productivity Commission's quantitative cost-benefit study of the 125 per cent tax concession is inconclusive; with a range from a net social benefit of around $230 million to a net social loss of a similar magnitude.[59]

8.75 Other inquiries have heard similar views. Former Australian Chief Scientist, Dr Robin Batterham, said 'my own opinion … is that, in the large company areas, the taxation concession is somewhat marginal in terms of any additionality of R&D'. Similarly, Productivity Commission Chairman, Mr Gary Banks, stated:

> By and large the evidence seemed to be that most firms regarded the tax concession as something which gives them a little bit more of cash flow but did not really fundamentally affect their R&D decision-making. That was at 150 per cent.[60]

8.76 The 1997 Mortimer Report[61] recommended that the tax concession be cut to 100 per cent. It argued this was still a concession, as R&D was a form of capital expenditure which would otherwise not be able to be fully deducted in the year the expenditure was incurred (but like the purchase of a machine or building would be depreciated over the years).

8.77 It is possible that the current tax concession (or even the previous 150 per cent concession) is too small to have an effect but a much larger concession would have a significant impact. Of course, a much larger concession would imply a much larger cost to revenue, so this would represent a considerable gamble.

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58 PC, *Public Support for Science and Innovation*, 2007, Finding 10.2, p. 392. They also cite on p. 388 earlier studies that about 90 per cent of the R&D earning the concession would have occurred without the scheme.

59 PC, *Public Support for Science and Innovation*, 2007, p. 390.

60 *Riding the Innovation Wave,* p. 93. Tellingly, the witness supporting the concession was an accountant, who might be regarded as having a vested interest in a more complex tax system.

61 *Going for Growth: Business Programs for Investment, Innovation and Export*, June 1997, a review of business programmes undertaken for the Government by Mr D Mortimer, then chair and CEO of TNT, and a secretariat from the DITR.

8.78 It has been observed that R&D expenditure tends to rise and fall with industry profitability.[62] For example, in Australia recently, the mining industry has been very profitable and has strongly expanded its R&D.[63] One interpretation of this is that when profits are high, firms think 'might as well stick it in R&D', implying that 'a lot of the R&D tax concession is going into industries that would have done R&D anyway'.[64]

8.79 Compared to its OECD peers, Australia provides relatively generous tax concessions for R&D (but relatively little direct support).[65] A number of countries have R&D tax allowances, with the United Kingdom having a similar scheme with a rate of 150 per cent.[66] But other countries having a tax concession is no more an argument for such a concession here than noting other countries have tariffs or subsidies is an argument for having them here. Furthermore, some of these countries are questioning the usefulness of the concessions. Ireland discontinued its R&D tax allowance in 2001. Furthermore, international comparisons do not suggest that businesses in countries with more generous concessions do more R&D.[67]

8.80 Expenditure on training workers also has potential spillover benefits, most obviously if the workers leave for another company after the training. Some capital expenditure on new equipment embodying technological advances may be a way in which new R&D contributes to greater productivity. Similar arguments could be made for spending to reduce carbon emissions, improve workplace safety or provide more generous parenting leave. It is not obvious that the spillover benefits from R&D are so much higher than those from other meritorious forms of company

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62 PC refers to numerous international studies finding that R&D spending is 'excessively' responsive to retained earnings. PC, 2007, p. 84. However their own econometric exercise did not find this result in Australia.

63 Between 2002–03 and 2004–05, the mining sector increased R&D spending by 35 per cent, compared to a 20 per cent rise by manufacturing. ABS Cat No. 8104.0.

64 Dr C Emerson, *Transcript*, 29 August 2006, p. 86. The Standing Committee on Science and Innovation report a witness from a company saying something similar; 'R&D is something off the side that we spend some money on if times are good.'; *Riding the Innovation Wave,* p. 51.

65 G Davis and G Tunny, 'International comparisons of research and development', *Economic Roundup*, Spring 2005, pp. 63–82, pp. 72-3. The OECD also refers to Australia's 'generous tax incentive programmes' and notes that Finland, Germany, Iceland, New Zealand, Sweden and Switzerland do not offer any tax concessions for R&D, while Australia is the only OECD economy to offer direct financial support for foreign direct investment in R&D; *OECD Science, Technology and Industry Outlook 2006*, pp. 24, 69, 142 and 242.

66 A recent study found that only about half the companies claiming the UK tax concession said that it affected their spending on R&D, according to a document obtained under the Freedom of Information Act; 'Half of research tax credits are wasted', *The Observer*, 14 January 2007.

67 G Davis and G Tunny, 2005, p. 73.

expenditure that R&D deserves to be singled out for favourable tax consideration.

8.81 Furthermore, Australia's dividend imputation scheme will often offset the tax concession for R&D from the Australian shareholders' viewpoint as the:

> Imputation system … credits individual shareholders with the amount of company tax paid. When no company tax is paid because of the tax concession given at the company level, shareholders receive unfranked dividends and pay the tax themselves. There is a 'clawing back' of the tax concession, so that overall … investors looking at a company doing R&D have no incentive to provide capital to that company in addition to the incentive that it would have if it were not undertaking the R&D.[68]

8.82 The incremental tax concession may generate more 'additionality' than the basic concession, but it may also have perverse incentives in encouraging firms to make their R&D spending more variable.[69] It does not reward consistently high R&D and firms cannot increase R&D indefinitely.

8.83 On the other hand, there are many, such as SIA, who argue the tax concessions do have an important influence:

> Industry and commentators have argued that since the Government lowered the R&D tax concession from 150 per cent to 125 per cent in 1996, business expenditure on R&D as a percentage of Australia's gross domestic product has declined.[70]

8.84 Such opinions lead the ACCI to call for the concession to be increased:

> Business has supported the R&D tax concession as an effective policy instrument addressing a market failure…. Business supports the restoration of the concession to 150 per cent.[71]

8.85 A similar view was put by the Australian Manufacturing Workers' Union:

> The axing of the 150 per cent R&D tax concession in 1996 was a major factor in manufacturing R&D, going from 10 per cent per annum real growth in the decade to the mid 1990s, to negative growth over the 1995-96 to 2001-02 period …. Restoring the 150

68 Dr P Burn, Ai Group, *Transcript*, 29 August 2006, p. 12.

69 PC, *Public Support for Science and Innovation*, 2007, p. 405.

70 SIA, *Submission no. 7*, p. 5.

71 Australian Chamber of Commerce and Industry, *Submission no. 33*, p. 22-23.

> per cent R&D tax concession and leaving it unchanged for at least a decade warrants serious consideration.[72]

8.86 DITR interviewed 116 firms in 2005 and concluded:

> The study found that the R&D tax concession increases the size of investment in individual R&D projects, brings forward R&D expenditure on projects to enable faster completion with higher commercial results, and encourages investment in projects that otherwise would not be undertaken.[73]

8.87 Even if the concession is effective, there are some companies which do not benefit. It is of limited use to newly established companies in innovative areas as they will not be making profits in their early years of operation and so not paying tax. This is a particular problem if, as argued above, it is these small nimble companies whose R&D has the most external benefit. The 'tax offset' component tries to address this problem by allowing the benefit to be cashed out, but this only applies to companies with R&D below $1 million, so does not apply to many new firms.[74]

8.88 Another type of company that does not fully benefit from the scheme is one which holds its intellectual property overseas. In the Industry Statement 2007, it was announced that businesses which hold their intellectual property overseas would now be eligible for the 175 per cent premium concession, but they are still ineligible for the standard 125 per cent concession.[75] The Statement argues that:

> Making Australia a more attractive place for world class innovation will boost investment, expand our skills base and help anchor the local arms of leading multinationals in Australia.[76]

8.89 The House of Representatives Standing Committee on Science and Innovation, in its June 2006 report, *Pathways to Technological Innovation*, also examined the R&D tax concessions. Several submissions 'questioned whether this was sufficient for businesses to actually increase their

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72 Australian Manufacturing Workers' Union, *Submission no. 34*, p. 15 and p. 65. They also presented the results of opinion polling showing strong public support for a tax concession for companies undertaking R&D. The Australian Council of Trade Unions also supported 'a higher level of R&D incentive through the tax system'; *Submission no. 27*, p. 26.

73 DITR, 'Submission to the Productivity Commission study into science and innovation', September 2006.

74 PC report comments 'there appear to be firms not increasing their R&D beyond the $1 million dollar mark to ensure they retain access to the Offset'. Productivity Commission, *Public Support for Science and Innovation*, 2007, p. 397.

75 DITR, *Global Integration: Changing Markets: New Opportunities,* p. 9.

76 DITR, *Global Integration: Changing Markets: New Opportunities,* p. 9.

expenditure on R&D activities'.[77] They also noted concerns about compliance costs. However, the Committee also received submissions from companies benefiting from the tax concession and did not recommend significant changes to its operation for domestic companies.

8.90 All tax concessions complicate the tax system to some extent.[78] Provisions to avoid their abuse may increase compliance costs.[79] Generally, free market economists prefer tax systems with broad bases and low rates. Tax concessions, even for worthy goals, make this harder to achieve. The government reduced the R&D tax concession from 150 to 125 per cent as a move towards a more uniform and less distortionary tax system.

Conclusion

8.91 There are doubts about the extent to which the existing R&D tax concessions are effectively inducing additional R&D, especially given the reduction in the company tax rate. The concessions may not be the optimal form of incentive. Replacing the concessions with increased grants would allow for a more targeted approach, although grants may have disadvantages, such as administrative costs and risks of favouritism.

8.92 The committee recognises that there may be benefits to Australia from conducting R&D here, even if the intellectual property rights are held offshore. R&D and design activities, rather than production, will increasingly form the basis for Australia's involvement in global manufacturing. The committee commends the recent decision to allow companies holding intellectual property offshore access to the 175 per cent premium concession and believes the same argument is applicable to the standard 125 per cent scheme.

77 Standing Committee on Science and Innovation, *Pathways to Innovation*, p. 168.

78 PC report cites PriceWaterhouse Coopers as commenting that 'the incremental 175% tax concession is already an extremely complex piece of legislation'; Productivity Commission, *Public Support for Science and Innovation*, 2007, p. 408.

79 Examples of abuse involving non-R&D activity being misrepresented as R&D to obtain the tax concession are given in Productivity Commission, *Public Support for Science and Innovation*, 2007, p. 378.

Recommendation 19

8.93 **The committee recommends that the design of the R&D tax concession scheme be examined in the light of the recent report by the Productivity Commission and the evidence assembled in this inquiry. The examination should include the eligibility rules, in particular the extent to which foreign-owned companies conducting R&D in Australia are able to benefit from the concession.**

If such an examination leads to the R&D tax concession being reduced then the funds saved should be used for increased grants where a convincing case can be made for them.