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Pathways to Technological Innovation

House of Representatives
Standing Committee on Science and Innovation

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Foreword

When the Committee undertook to inquire into pathways to technological innovation, it sought to bring together a series of successful case studies and look at the obstacles faced in commercialising research, with a view to making recommendations on fine-tuning Government policies to support innovation. The intention was to consider the impediments that these successful innovators overcame on the path to commercialisation.

However, from discussions with researchers and entrepreneurs and from reading the case studies submitted to the inquiry, it became apparent this approach would only provide part of the picture.

Many successful innovators experienced a smooth pathway to developing their product and finding markets. These are the success stories and they are documented in other publications such as the 2005 report of the Prime Minister's Science Engineering and Innovation Council Working Group, Growing Technology-Based SMEs. These stories are heartening and affirm the calibre of Australian innovation and the strength of some aspects of the Government's innovation support framework.

In addition to these positive case studies though, submissions were made illuminating a range of issues which might impact on the path from technological innovation to commercialisation. From this evidence, a number of difficulties were identified and the Committee heard a different set of stories about innovation that is hampered because of gaps in the innovation support system.

It is apparent from this range of evidence, and the two sets of stories, that some pathways to innovation are well developed and relatively smooth for the Australian entrepreneur or innovating business or research institution. Other pathways are, however, less well formed and the Committee has focussed on the consensus issues from those seeking to innovate in Australia.

Drawing on the consensus issues raised in the evidence to the Committee, the report makes recommendations about improving linkages and collaborations between the public and private sectors, fostering a more entrepreneurial culture in Australia, and better publicising the range of innovation assistance available.

Other recommendations relate to addressing gaps in the assistance available and removing blocks to innovation— access to start-up funding and later stage commercialisation activities such as marketing; proof of concept funding; cultural, promotional and structural issues which may discourage academics from the commercialisation path; and Government procurement policies.

The recommendations are the result of extensive evidence and discussions with a wide range of industries, Government departments, universities and research agencies, peak bodies and individuals with experience in innovation. I thank those who contributed to the inquiry and those who allowed the Committee to visit their premises and see firsthand many of the processes of innovation. At times the inquiry took members of the Committee into technical scientific areas and I thank my colleagues for their dedication to the issues and commitment to grappling with the complexities of innovation. I also thank the Secretariat for its work on venture capital and other specialised areas of tax and corporations law.

Today innovation is recognised as the multitude of pathways that encompass all types of basic research, new technologies and improvements in business processes, from their initiation through to commercialisation or community uptake. Innovation is also recognised as vital to Australia's economic future as it is a means of impacting on long-run economic growth, improving health and social well-being, and addressing environmental threats.

The Committee commends the substantial Australian Government investment made to innovation through Backing Australia's Ability ($3 billion from 2001 to 2006, and an additional $8.3 billion from 2006 to 2011), and recent announcements in the 2006–07 Budget which boost the opportunities for venture capitalists at the early stage of commercialisation, and inject new life into the National Health and Medical Research Council. Given the importance of innovation to Australia's long-run economic performance, there is however always room for improvement.

This report seeks to make a contribution to building a nation that values innovation, addressing gaps in innovation support and removing impediments which may stifle innovation. Through implementation of the recommendations of this report, the Committee hopes that some pathways to technological innovation

will be made easier, thereby strengthening Australia's pathway to increased growth and global competitiveness.

I hope that this report will encourage a broader look at the overall balance of Australia's innovation policy, including issues such as the focus on research intensive R&D. In addition, I hope that policy makers and economists will consider the metrics needed to measure 'successful' innovation, including a broader view of what 'success' may mean given the multitude of pathways and outcomes that innovation now embraces.

Mr Petro Georgiou MP
Chair

Membership of the Committee

Chair	Mr Petro Georgiou MP
Deputy Chair	Mr Harry Quick MP
Members	Mr Anthony Byrne MP (to 10 May 2005)
	Mr Chris Hayes MP
	(from 11 May 2005)
	Mr Harry Jenkins MP
	Dr Dennis Jensen MP
	The Hon Jackie Kelly MP
	The Hon Roger Price MP
	Mr David Tollner MP
	The Hon Danna Vale MP
	Dr Mal Washer MP

Committee Secretariat

Secretary	Dr Anna Dacre
Inquiry Secretary	Dr Alison Clegg
Research Officers	Dr Lea Hill
	Ms Rachelle Mitchell
Administrative Officers	Ms Emma Martin
	Mr Danny Miletic

Terms of Reference

The House of Representatives Standing Committee on Science and Innovation is to inquire into Australian technological innovation and pathways to commercialisation, with particular reference to examples of successful Australian technological innovations that demonstrate strategies to overcome potential impediments and factors determining success.

Innovation is the path of conceiving, developing and implementing ideas through to the generation of products, process and services. It gives economic value to a nation's knowledge.

To assist in its inquiry, the Committee seeks to compile a series of case studies of successful technological innovations, and the pathways to commercialisation. Submissions are sought detailing successful examples of Australian technological innovations. Submissions are also sought with particular reference to successful innovations, on issues such as:

- pathways to commercialisation;
- intellectual property and patents;
- skills and business knowledge;
- capital and risk investment;
- business and scientific regulatory issues;
- research and market linkages;
- factors determining success; and
- strategies in other countries that may be of instruction to Australia.

List of Abbreviations

ABF	Australian Business Foundation
ABS	Australian Bureau of Statistics
ACDS	Australian Council of Deans of Science
ACIP	Advisory Council on Intellectual Property
ACS	Australian Computer Society Inc
AEEMA	Australian Electrical and Electronic Manufacturers' Association
AFC	Australian Film Commission
AFTRS	Australian Film, Television and Radio School
AGC	Australian Geoscience Council
AGP	Australian Growth Partnerships
AIA	Australian Innovation Association
AIC	Australian Institute for Commercialisation
AIG	Australian Industry Group
AIIA	Australian Information Industry Association
AIMS	Australian Institute of Marine Science
ANSTO	Australian Nuclear Science and Technology Organisation
ANTA	Australian National Training Authority
ANZAAS	Australian and New Zealand Association for the Advancement

	of Science
ARC	Australian Research Council
ATO	Australian Taxation Office
ATSE	Australian Academy of Technological Sciences and Engineering
AVCC	Australian Vice-Chancellors' Committee
BAA	Backing Australia's Ability
BCA	Business Council of Australia
BERD	Business Expenditure on Research and Development
BIF	Biotechnology Innovation Fund
BIHECC	Business–Industry–Higher Education Collaboration Council
CASR	Collaboration and Structural Reform (Fund)
CCST	Coordinating Committee on Science and Technology
CHASS	Council for Humanities, Arts and Social Sciences
COMET	Commercialising Emerging Technologies
CRC	Cooperative Research Centre
CRP	Commercial Ready Program
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCITA	(Australian Government) Department of Communications, Information Technology and the Arts
DEST	(Australian Government) Department of Education, Science and Training
DITR	(Australian Government) Department of Industry, Tourism and Resources
DSTO	(Australian Government) Defence Science and Technology Organisation
EMDG	Export Market Development Grant

ESVCLP	Early Stage Venture Capital Limited Partnerships
EU	European Union
FMA	Financial Management Accountability (Act 1997)
GEM	Global Entrepreneurship Monitor
GDP	Gross Domestic Product
HECS	Higher Education Contribution Scheme
HEFCE	Higher Education Funding Council for England (UK)
HEIF	Higher Education Innovation Fund (UK)
HEROBC	Higher Education Reach Out for Business and Community (Scheme)
ICGS	Integrated Company Growth Services
ICIP	Industry Cooperative Innovation Program
ICT	Information and Communications Technology
IGS	Institutional Grants Scheme
IIF	Innovation Investment Fund
IP	Intellectual Property
IR&D	Industry Research and Development
ISIC	International Standard Industrial Classification
KCA	Knowledge Commercialisation Australasia
MBA	Masters of Business Administration
MLA	Meat and Livestock Australia
MRI	Medical Research Institute
NCGP	National Competitive Grants Program
NCP	National Competition Policy
NCVER	National Centre for Vocational Education Research

NHMRC	National Health and Medical Research Council
NIAS	National Innovation Awareness Strategy
NIC	National Innovation Council
NIQTL	National Institute of Quality Teaching and Leadership
NRP	National Research Priority
OECD	Organisation of Economic Cooperation and Development
PCT	Patent Cooperation Treaty
PDF	Pooled Development Funds
PFRA	Publicly Funded Research Agencies
PFRI	Publicly Funded Research Institutes
PMSEIC	Prime Minister's Science, Engineering and Innovation Council
PSF	Pre-Seed Fund
R&D	Research and Development
RDC	Rural Research and Development Corporation Chairs Committee
ROI	Return on Investment
RQF	Research Quality Framework
RTS	Research Training Scholarships
SBEP	Small Business Entrepreneurship Program
SBIR	Small Business Innovation Research (USA)
SET	Scientific, Engineering and Technical
SIA	Science Industry Australia
SME	Small to Medium Enterprise
TPP	Technological Product and Process Innovation

TRIPS	Trade Related Aspects of Intellectual Property Agreement
UK	United Kingdom
US(A)	United States of America
VCLP	Venture Capital Limited Partnership
VET	Vocational Education and Training
WIPO	World Intellectual Property Organisation

List of Recommendations

3 Innovation and Commercialisation Policy and Program Framework

Recommendation 1

The Committee recommends that the Australian Government better promote the assistance that is available for businesses to locate the most appropriate innovation support programs.

Increased promotion to be considered includes:

- the provision of prominent links in all publicity materials and on Australian Government innovation websites to program assistance available through AusIndustry initiatives and the National Innovation Council website; and
- disseminating promotional information and liaising more closely with industry organisations and peak bodies.

Recommendation 2

The Committee recommends that the Australian Government Department of Education, Science and Training establish a working group to improve the coordination of Australia's innovation policy framework.

Specifically the working group should consider initiatives to:

- further strengthen cross-portfolio dialogue to enhance the whole-of-government understanding of innovation policy needs; and
- improve cross-portfolio program coordination, so as to ensure continuity of support throughout the innovation process.

4 Human Capital—Knowledge and Skills

Recommendation 3

The Committee recommends that the Department of Education, Science and Training, in conjunction with the Australian Vice-Chancellors' Committee and publicly funded research agencies:

- conduct a study into jurisdictional, promotion, mobility and cultural issues in publicly funded research agencies and universities which may impede an entrepreneurial culture and innovation; and
- develop options for universities and publicly funded research agencies to provide governance structures and incentives which encourage business and entrepreneurial skills and commercial outcomes within these organisations.

Recommendation 4

The Committee recommends that the Department of Education, Science and Training expand its annual *Australian Science and Innovation System: A Statistical Snapshot* to include the following data:

- the number of students with combined science, engineering, technology/business/commerce degree qualifications;
- state and territory breakdowns of science, engineering, technology graduates;
- breakdown by subject and qualification of the number of foreign citizens with science, engineering, technology qualifications graduating from Australian universities; and
- science, engineering, technology graduate workforce participation rates.

Recommendation 5

The Committee recommends that the Australian Government establish a dedicated whole-of-government taskforce to develop a series of measures targeting the early development of entrepreneurial skills in the education system (including the early school years) and the broader community. To inform the development of these measures, the Committee recommends that the taskforce draw upon the expertise of educators, researchers and industry specialists.

5 Connecting Knowledge, People and Markets

Recommendation 6

The Committee recommends that IP Australia implement strategies to promote the uptake of the innovation patent, and report to the Australian Government Minister for Industry by 30 June 2007 on the following:

- the increased level of uptake for the innovation patent; and
- the effectiveness of the innovation patent in reducing costs for small to medium sized enterprises.

Recommendation 7

The Committee recommends that the Attorney-General request the Advisory Council on Intellectual Property to review Australia's intellectual property system to determine the capacity for reduction in the misuse of the system.

Recommendation 8

The Committee recommends that the Australian Government, through the Department of Foreign Affairs and Trade, pursue the enforcement of intellectual property legislation during trade and diplomatic negotiations with China.

Recommendation 9

The Committee recommends that the Australian Government review Intellectual Property legislation according to National Competition Policy Agreements and establish an Intellectual Property legislation system of periodic re-review.

Recommendation 10

The Committee recommends that the Australian Government give priority consideration to the Commonwealth Scientific and Industrial Research Organisation's proposal for an Australian Growth Partnerships program to engage small to medium enterprises in demand driven collaborations with publicly funded research agencies.

Recommendation 11

The Committee recommends that the Australian Government request the Business Industry Higher Education Collaboration Council to examine and develop the business case for third stream funding to universities.

Recommendation 12

The Committee recommends that the Australian Government introduce a funded cluster development program to encourage the Australia-wide development of clusters which bring together innovation in research, business and education.

6 Life Cycle Support and Funding for Innovation and Commercialisation

Recommendation 13

The Committee recommends that the Australian Government introduce a funded proof of concept scheme, based on the Group of Eight Innovation Stimulation Fund proposal and providing the following for university research projects with high potential for commercial outcomes:

- matched Australian Government and university funding investment in the suggested ratio of 3:1;
- a maximum funding per project of $100 000; and
- funded for an initial three year period to a maximum Australian Government investment of $45 million.

Recommendation 14

The Committee recommends that the Australian Government implement additional support mechanisms to specifically assist the progression of innovation through pathways other than the formation of start-up companies.

Recommendation 15

The Committee recommends that the Australian Government assess the revenue implications and potential economic returns of extending the R&D Tax Concessions eligibility to include Australian based subsidiaries of multinational companies.

Recommendation 16

The Committee recommends that the Australian Government Department of Industry, Tourism and Resources extend the support available to provide for later stage commercialisation activities, such as market identification, marketing and sales strategies.

This support may be provided either by extending the range of activities eligible under the Commercial Ready Program or by establishing alternative mechanisms of assistance which are compliant with World Trade Organisation and other trade agreement conditions.

Recommendation 17

The Committee recommends that the Australian Department of Industry, Tourism and Resources conduct a formal review by 30 June 2007 of the effectiveness of the Commercial Ready Program, giving particular consideration to the following possible program amendments:

- extending eligibility to spin-off companies from publicly funded research institutions;
- extending eligibility to Australian-based subsidiaries of foreign owned companies; and
- reducing the co-contribution requirements and increasing the turnover thresholds.

Recommendation 18

The Committee recommends that the Australian Government:

- direct all Government agencies to report publicly on what proportion of the 10 per cent purchasing from small to medium enterprises, which is set out in Australian Government Procurement Guidelines, is directed toward technological innovation; and
- investigate mechanisms to encourage Government procurement of technological innovation from Australian small to medium enterprises where available.

1

Introduction

1.1 The end of the twentieth century has been characterised by a further opening up of the world economy and the growth of the knowledge-based economy.[1] In this environment, innovation is critical to enhanced productivity, economic growth and global competitiveness. There is increasing recognition of the importance of innovation to secure Australia's future economic growth, environmental sustainability and social well-being.[2]

1.2 In response to this, in 2001 the Australian Government introduced its five-year (2001–02 to 2005–06) innovation strategy, *Backing Australia's Ability—An Innovation Action Plan for the Future* (*BAA*), with a funding commitment of $3 billion.[3]

1.3 *BAA* is intended to stimulate innovation through the provision of a comprehensive range of integrated initiatives targeting research, commercialisation and skills development.[4]

1.4 Since the introduction of *BAA* a number of government reviews and a parliamentary committee inquiry have examined aspects of the Australian Government's innovation policy framework. This review

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1 Knowledge-based economy describes trends in advanced economies towards greater dependence on knowledge, information and high skill levels, and the increasing need for ready access to all of these by the business and public sectors.

2 Organisation for Economic Co-operation and Development (OECD) 2000*, A New Economy? The Changing Role of Innovation and Information Technology in Growth*, p. 7.

3 Commonwealth Government 2001, *Backing Australia's Ability – an Innovation Action Plan for the Future*, p. 14.

4 Commonwealth Government 2001, *Backing Australia's Ability – an Innovation Action Plan for the Future*, p. 14.

process is a vital mechanism for refining policy initiatives and assessing the effectiveness of programs in achieving their objectives.

1.5 In June 2003, a report by the House of Representatives Science and Innovation Committee (40th Parliament), *Riding the Innovation Wave: The Case for Increasing Business Investment in R&D*[5], was released. The report inquired into the commitment of Australian business to research and development (R&D) and considered ways to improve collaboration between publicly funded research institutions (PFRIs)[6] and the private sector. It also examined the drivers for major international business investment in Australian R&D, and suggested improvements to the Australian Government's R&D support initiatives and programs.

1.6 A significant element of the Australian Government's March 2004 response to the recommendations of the House of Representatives report was its reference to the 2003 science and innovation mapping exercise[7] and the impact of its findings on the evaluation and future development of *BAA*.

1.7 The 2003 *Mapping Australian Science and Innovation Report* identified strengths, weaknesses and gaps in Australia's science and innovation performance, complementarities and areas of possible greater cooperation between activities of the Australian Government and those of the states and territories.

1.8 The report indicated that Australia provides an exceptionally strong contribution to the development of scientific knowledge, but has had limited visibility and impact on the development of world technologies.[8] In addition, indicators suggested that relatively few Australian businesses are strong developers of innovative new technologies and have been successful in commercialising their innovations.[9]

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5 House of Representatives Standing Committee on Science and Innovation 2003, *Riding the Innovation Wave: The Case for Increasing Business Investment in R&D,* Canberra.

6 Publicly funded research institutions (PFRIs) include all Australian universities and publicly funded research agencies (PFRAs) including Australian Institute of Marine Science, Australian Nuclear Science and Technology Organisation, Commonwealth Scientific and Industrial Research Organisation, Defence Science and Technology Organisation.

7 Australian Government 2003, *Mapping Australian Science and Innovation: Main Report.*

8 Australian Government 2003, *Mapping Australian Science and Innovation: Main Report,* p. 72.

9 Australian Government 2003, *Mapping Australian Science and Innovation: Main Report*, p. 12.

1.9 Following the publication of the *Mapping Australian Science and Innovation Report*, an additional $5.3 billion was committed in the 2004 Budget to extending *BAA* until 2010–11. The program extension, titled *Backing Australia's Ability – Building Our Future through Science and Innovation* or *BAA-II*, commences in 2006–07.[10] It has been stated that many of the weaknesses and gaps identified in the *Mapping Australian Science and Innovation Report* will be addressed through *BAA-II*.

1.10 Despite this substantial Government investment and subsequent reviews, there remain concerns regarding the capacity of Australian business and research agencies to successfully innovate.

Inquiry into Pathways to Technological Innovation

1.11 On 16 March 2005 the then Minister for Science and Education, the Hon Dr Brendan Nelson MP, referred to the House of Representatives Standing Committee on Science and Innovation an inquiry into pathways to technological innovation.

1.12 Under the terms of reference for the inquiry, the Committee was asked to inquire and report on:

> … Australian technological innovation and pathways to commercialisation, with particular reference to examples of successful Australian technological innovations that demonstrate strategies to overcome potential impediments and factors determining success.

1.13 The Committee sought insights into approaches used by successful innovators to meet the challenges associated with technological innovation, and strategies applied to overcome impediments and barriers. To assist in its inquiry the Committee requested case studies illustrating the pathways leading to successful technological innovation, and additional information relating to:

- pathways to commercialisation;
- intellectual property and patents;
- skills and business knowledge;
- capital and risk investment;

10 Department of Education, Science and Training, *Submission No. 20*, p. 6.

- business and scientific regulatory issues;
- research and market linkages;
- factors determining success; and
- strategies in other countries that may be of instruction to Australia.

1.14 With only a short time remaining until funding for the initial five-year *BAA* commitment concludes and commencement of the extended *BAA-II*, the Committee considers that this is an appropriate time to review Australia's innovation performance and identify potential impediments to technological innovation.

1.15 The timing of the inquiry also enables an assessment of the effectiveness of the range of Australian Government initiatives implemented to improve Australia's innovation performance, including consideration of reviews of *BAA* programs which have been released since the publication of *Mapping Australian Science and Innovation*.

Conduct of the Inquiry

1.16 The Committee received 99 submissions and five supplementary submissions from a range of individuals and organisations. The submissions are listed at Appendix A. Additional material relevant to the inquiry which was received as exhibits is described in Appendix B.

1.17 The Committee held ten public hearings in Sydney, Canberra, Melbourne and Adelaide from May 2005 to December 2005, and two inspections in Melbourne and Sydney in April and May 2005 respectively. A list of the hearings and witnesses is at Appendix C.

Structure of the Report

1.18 A number of common themes or consensus issues emerged from the evidence. These consensus issues are identified in the introduction to each of the chapters and form the structural basis for consideration of pertinent issues. Committee comment on consensus issues and related matters are included in the text of each chapter.

1.19 Chapters two and three provide context and background for consideration of issues associated with innovation and commercialisation. Chapter two begins by examining various understandings of the concepts and definitions of innovation and commercialisation. The chapter reports on Australia's innovation and commercialisation performance, examining the metrics of innovation and commercialisation, and includes consideration of issues associated with data collection, analysis, comparison and interpretation.

1.20 Chapter three provides an overview of the Australian Government's major innovation and commercialisation policies. It includes consideration of evidence relating to the balance of support measures for key elements of the innovation system. The chapter also reviews the innovation program framework and issues related to its effectiveness, accessibility and coordination of support initiatives.

1.21 Chapters four and five consider factors that form the basis of Australia's innovation capability and competency. Chapter four examines issues raised with regard to human capital and the foundations of knowledge, personal attributes and skills that contribute to innovation. This chapter considers scientific, engineering and technology skills, as well as business and entrepreneurial skills.

1.22 Chapter five examines knowledge flows and includes consideration of issues relating to the appropriate management of knowledge. The chapter also considers the role of linkages and collaborations in supporting innovation via the facilitation of knowledge flows between sectors, industries and businesses.

1.23 Chapter six examines a range of Australian Government innovation support programs and fiscal initiatives that target specific stages or elements of innovation. The chapter reviews issues arising from the evidence with regard to various support measures directed to basic research, business R&D and commercialisation activities including marketing, sales, business expansion and export.

2

Innovation and Commercialisation—Concepts, Definitions and Metrics

2.1 This chapter examines:

- the concept, definition and meaning of innovation and commercialisation;
- the measurement (or metrics[1]) and assessment of Australia's innovation and commercialisation performance, including consideration of the limitations associated with indicators, data and metrics frameworks.

2.2 There were two consensus issues about the concept, definitions and metrics of innovation and commercialisation.

2.3 **Consensus Issue 1**—There are diverse understandings of innovation and commercialisation, resulting in a range of ambiguities. What has emerged is that:

- innovation is a complex non-linear process;
- innovation means different things to different people – this is reflective of the fact that the nature of innovation is different across sectors and industries. Various understandings result in divergences about the spectrum of activities that are considered innovative, the expected and preferred outcomes of innovation, and the range of factors that are seen to drive the innovation process; and

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1 Metrics are a system of parameters or ways of quantitative assessment of a process that is to be measured, along with the processes to carry out such measurement.

- the meaning of commercialisation varies across sectors as does its significance as an outcome of innovation.

2.4 **Consensus Issue 2**—Measurement and assessment of innovation performance is important to formulating, implementing and evaluating effective innovation policy. There are, however, limitations to innovation and commercialisation metrics frameworks and there is scope for different assessments of the metrics meaning.

What is Innovation?

2.5 The evidence to the inquiry is that innovation is a multi-faceted and complex process that encompasses a broad spectrum of diverse activities and outcomes.

2.6 In its call for submissions to the inquiry, the Committee defined innovation as:

> ... the path of conceiving, developing and implementing ideas through to the generation of products, process and services. It gives economic value to a nation's knowledge.[2]

2.7 In fact, there is no consensus on the meaning of innovation; innovation means different things to different people.[3] For example, Dr Richard Rowe noted:

> To some 'innovation' involves the generation of globally novel ideas, processes or products. To others 'innovation' means the exploitation in Australia of concepts or products well-known elsewhere. To yet others 'innovation' includes the application of methods or products which may have long been known but the impacts of which had been under-appreciated or perhaps unrecognised. Any investigation into 'innovation' must recognise these different concepts, and perhaps others, associated with the term.[4]

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2 Invitation to make submission, House of Representatives Standing Committee for Science and Innovation, *Pathways to Technological Innovation Inquiry.*

3 For example, see: Coordinating Committee on Science and Technology Working Group on the Metrics of Research Commercialisation, *Submission No. 7*, p. 1; Professors K Smith and J West, *Submission No. 18*, pp. 4-5. Department of Education, Science and Training, *Submission No. 20*, p. 32; Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 6; Group of Eight, *Submission No. 62*, p. 2; Mr S Fenton-Jones, *Supplementary Submission No. 78.1*, p. 1.

4 Dr R Rowe, *Submission No. 26*, p. 1.

2.8 In a similar vein, the Department of Education, Science and Training (DEST) has noted that concepts and definitions of innovation are 'evolving and can be somewhat ambiguous' [5], commenting:

> Innovation is a more recently introduced term about which there is, as yet, a less well developed consensus than for science. Various descriptions of innovation have been offered over the years … with a central idea being that innovation describes not merely the creation of new ideas, processes and technologies, but also their uptake, application and use to yield new value.[6]

2.9 As different understandings of innovation have implications for the measurement and assessment of innovation, initiatives have been undertaken to develop international standards. The Organisation of Economic Cooperation and Development (OECD) and Eurostat[7] have taken a lead in this regard through the development of the *Oslo Manual*, a publication that provides guidelines for collecting and interpreting innovation data.[8]

2.10 To date three editions of the *Oslo Manual* have been produced, with the third edition published late in 2005. Notably, the categories and definition of innovation have been modified between editions, reflecting 'changing policy needs'.[9]

2.11 Also of note with regard to the *Oslo Manual* is its intentional focus on the assessment of innovation occurring in the business enterprise sector. In relation to this, the manual states:

> Innovation can occur in any sector of the economy, including government services such as health or education. The Manual's guidelines, however, are essentially designed to deal with innovations in the business enterprise sector alone. This includes manufacturing, primary industries and the services sector.

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5 Department of Education, Science and Training, *Submission No. 20*, p. 22.

6 Australian Government 2003, *Mapping Australian Science and Innovation: Main Report*, p. 35.

7 Eurostat is the statistical arm of the European Commission, producing data for the European Union and promoting harmonisation of statistical methods across the member states.

8 Organisation of Economic Cooperation and Development (OECD) and Eurostat, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 3rd Edition, 2005, pp. 46-61.

9 Organisation of Economic Cooperation and Development (OECD) and Eurostat, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 3rd Edition, 2005, p. 3.

> Innovation is also important for the public sector. However, less is known about innovation processes in non-market-oriented sectors. Much work remains to be done to study innovation and develop a framework for the collection of innovation data in the public sector. Such work could form the basis for a separate manual.[10]

2.12 Innovation in the business enterprise sector is defined in the *Oslo Manual* as:

> ... the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.[11]

2.13 The *Oslo Manual* also identified and defined the following four categories of innovation:

- **Product innovation**—the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.
- **Process innovation**—the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.
- **Marketing innovation**—the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
- **Organisational innovation**—the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations.[12]

2.14 As noted previously, the categories and definitions of innovation have been modified between editions of the manual, with previous editions distinguishing between technological and non-technological innovation.

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10 Organisation of Economic Cooperation and Development (OECD) and Eurostat *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 3rd Edition, 2005, p. 16.

11 Organisation of Economic Cooperation and Development (OECD) and Eurostat, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 3rd Edition, 2005, p. 46.

12 Organisation of Economic Cooperation and Development (OECD) and Eurostat, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 3rd Edition, 2005, pp. 47-52.

2.15 The second edition of the *Oslo Manual* provided the following definition of **technological innovation**:

> Technological product and process (TPP) innovations comprise implemented technologically new products and processes and significant technological improvements in products and processes.[13]

2.16 **Non-technological innovation** was defined as covering:

> ... all innovation activities which are excluded from technological innovation. This means it includes all the innovation activities of firms which do not relate to the introduction of a technologically new or substantially changed good or service or to the use of a technologically new or substantially changed process. The major types of non-technological innovation are likely to be organisational and managerial innovations.[14]

2.17 The word 'technological' was removed from the 2005 definitions of innovation in the third edition of the manual on the basis that:

> ... the word raises a concern that many services sector firms would interpret 'technological' to mean 'using high technology plant and equipment', and thus not applicable to many of their product and process innovations.[15]

2.18 However, in modifying the definitions of innovation between editions of the manual the importance of maintaining continuity with the earlier definitions was acknowledged.[16]

2.19 Essentially, product and process innovation as defined in the third edition of the *Oslo Manual* is equivalent to the earlier definition of technological innovation. Marketing and organisational innovation as defined in the third edition of the *Oslo Manual* is equivalent to the earlier definition of non-technological innovation.[17]

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13 Organisation of Economic Cooperation and Development (OECD) and Eurostat, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 2nd Edition, 1997, p. 31.

14 Organisation of Economic Cooperation and Development (OECD) and Eurostat, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 2nd Edition, 1997, p. 88.

15 Organisation of Economic Cooperation and Development (OECD) and Eurostat, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 3rd Edition, 2005, p. 17.

16 Organisation of Economic Cooperation and Development (OECD) and Eurostat, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 3rd Edition, 2005, p. 47.

17 Organisation of Economic Cooperation and Development (OECD) and Eurostat, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 3rd Edition, 2005, p. 47.

2.20 While not specifically defined in the *Oslo Manual,* several other categories of innovation are commonly recognised. These categories include research and development (R&D)-based versus non-R&D-based innovation, and radical versus incremental innovation.

2.21 As these terms have been used frequently in submissions to the inquiry, the definitions used by DEST in its 2003 *Mapping Australian Science and Innovation Report* are provided:

- **R&D-based innovation** by a firm is most likely to involve applied research and experimental development of product concepts (prototype design, development and testing). Innovation that does not involve R&D may involve identifying new markets, products and technologies, piloting new production facilities, buying in technical information or skills, or investing in equipment or inputs that embody R&D undertaken by others (including from overseas), together with industrial design, which has been established as a highly important innovation activity.
- **Radical versus incremental innovation**—Incremental innovation typically involves relatively small changes in existing products or processes, building on existing technology or practices—fundamentally, it involves continuous improvement. Radical innovation, on the other hand, can involve significant and disruptive changes to products and processes based on new scientific or technological knowledge, or highly novel combinations of existing science and technology.[18]

2.22 While these categories and definitions provide a potentially useful framework for considering innovation, it is recognised that some innovations may have characteristics that span more than one category and that different categories of innovation may be inter-dependent.[19]

18 Australian Government 2003, *Mapping Australian Science and Innovation: Main Report*, pp. 36-37.

19 Organisation of Economic Cooperation and Development (OECD) and Eurostat, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 3rd Edition, 2005, p. 53.

What is Commercialisation?

2.23 Private sector submissions generally did not discuss the definition of commercialisation in the context of comments on innovation. This reflected an implicit consensus that it was about generating commercial returns.

2.24 The Australian Government described commercialisation in its 2003 *Mapping Australian Science and Innovation Report* as follows:

> **Commercialisation** is 'the process of transforming ideas, knowledge and inventions into greater wealth for individuals, businesses and/or society at large'. Commercialisation is a subset of the broader process of innovation. It is driven by market and profit motives, with firms and others seeking to gain a positive return on investment in research, licensing, product development, and marketing, including through the creation of competitive niche markets.[20]

2.25 Evidence to the inquiry has suggested that the definition of commercialisation and its application in the context of publicly funded research is problematic.[21]

2.26 For Australia's publicly funded research, DEST has provided a separate and specific definition of research commercialisation. Until late 2005, the definition of research commercialisation used by DEST for data collection and statistical purposes was:

> **Research commercialisation** refers to the processes that generate commercial returns through income and capital gains, income from licences and revenue from sales of new products and processes from research conducted.[22]

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20 Australian Government 2003, *Mapping Australian Science and Innovation: Main Report*, p. 37.

21 See for example Coordinating Committee on Science and Technology Working Group on the Metrics of Research Commercialisation, *Submission No. 7*, attached report *Metrics for Research Commercialisation: A Report to the Coordination Committee on Science and Technology*; Department of Education, Science and Training, *Submission No. 20*, p. 32; Knowledge Commercialisation Australasia (KCA), *Submission No. 27*, pp. 2-3; Group of Eight, *Submission No. 62*, p. 2.

22 Department of Education, Science and Training, *Definitions and Methodological Notes: Statistics on Science and Innovation 2004*, p. 28.

2.27 However, this definition of research commercialisation has been contested. The debate has covered the range of activities encompassed by the term and the impact of the definition on the measurement and assessment of research commercialisation activities in publicly funded research institutions (PFRIs).[23]

2.28 In 2005, a technology transfer and research commercialisation workshop from the Group of Eight, an advocacy group with representation from eight leading Australian universities[24], produced the following question for consideration:

> Does 'commercialisation' refer just to the exploitation for financial gain of Intellectual Property developed within the institution, or does it extend to include the myriad of other ways by which research organisations transfer knowledge for the benefit of the economy?[25]

2.29 This question, and the definition of research commercialisation, has been considered in detail in two recent reports produced for DEST, in the context of assessment of Australia's innovation performance.

2.30 The first of these reports, *The Emerging Business of Knowledge Transfer*[26], released in March 2005 and known as the Howard report, stated:

> Research commercialisation is a term that is used widely and diversely within research organisations, industry, and government. In application, it has slightly different interpretations and meanings.[27]

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23 See for example Coordinating Committee on Science and Technology Working Group on the Metrics of Research Commercialisation, *Submission No. 7*, attached report *Metrics for Research Commercialisation: A Report to the Coordination Committee on Science and Technology*; Department of Education, Science and Training, *Submission No. 20*, p. 32; Knowledge Commercialisation Australasia, *Submission No. 27*, pp. 2-3; Group of Eight, *Submission No. 62*, p. 2.

24 Group of Eight membership consists of the vice-chancellors (presidents) of: the University of Adelaide; the Australian National University; the University of Melbourne; Monash University; the University of New South Wales; the University of Queensland; the University of Sydney; and the University of Western Australia.

25 Group of Eight, accessed 12 October 2005, *Report on Outcomes of the Technology Transfer and Research Commercialisation Workshop held on 8 July 2005 in Canberra,* <go8.edu.au>.

26 Howard Partners 2005, *The Emerging Business of Knowledge Transfer: Creating Value from Intellectual Property and Services.*

27 Howard Partners 2005, *The Emerging Business of Knowledge Transfer: Creating Value from Intellectual Property and Services,* p. 11.

2.31 The Howard report identified four types of knowledge transfer that extend beyond the traditional understanding of commercialisation as the selling or licensing of research and intellectual property:

- **Knowledge production**—sees transfer as the sale of 'knowledge products' embedded in intellectual property (IP) and other explicit or codified formats, and manifested in sale and or licensing of intellectual property rights to new businesses (spin-outs) or existing businesses which may be in the public or private sector.
- **Knowledge diffusion**—approaches transfer from the perspective of encouraging broad industry adoption of the results of research; it emphasises communication and adoption of research results.
- **Knowledge relationship**—sees transfer as the provision of services to businesses based on a broadly defined intellectual property platform, including trade secrets, know-how and other forms of tacit knowledge; it emphasises collaboration, partnership and joint ventures.
- **Knowledge engagement**—sees transfer as a by-product of a convergence of interests between science and society and in particular, the interests of higher education, industry, and government.[28]

2.32 The Howard report suggested that these types of knowledge transfer might better encompass the range of different processes and interactions involved in commercialising research emerging from Australia's PFRIs.[29] DEST also noted that while the term research commercialisation was initially limited to the knowledge production model (i.e. idea—patent—licence—spin-off), it was evolving:

> ... to encompass the notion of commercial 'benefits' of publicly funded research, whether those benefits accrue to the research institution or not. This means that the term is now often applied to other modes and activities, such as 'diffusion' (e.g. through publications, conferences, information seminars etc), research contracts and consultancies, the training of research graduates for employment in industry, and various forms of joint venture and partnership.[30]

28 Department of Education, Science and Training, *Submission No. 20*, p. 7.

29 Howard Partners 2005, *The Emerging Business of Knowledge Transfer: Creating Value from Intellectual Property and Services*, p. 22.

30 Department of Education, Science and Training, *Submission No. 20*, p. 22.

2.33 The second report, *The Metrics for Research Commercialisation*[31], stated that 'there is considerable complexity in defining what research commercialisation means, and should mean, in Australia'.[32]

2.34 It concluded that the DEST definition for research commercialisation 'is somewhat narrow'.[33] This resulted in the Coordinating Committee on Science and Technology (CCST) Metrics Working Group's first recommendation:

> That for Australia's publicly funded research, 'research commercialisation' be defined as the means by which universities' and PFRAs [publicly funded research agencies]' research generates commercial benefit, thereby contributing to Australia's economic, social and environmental well-being. This is achieved through developing intellectual property, ideas, know-how and research-based skills resulting in new and improved products, services and business processes transferable to the private sector.[34]

2.35 In December 2005 DEST broadened its definition of research commercialisation, adopting the definition recommended by the CCST Metrics Working Group.[35]

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31 This report was produced by Department of Education, Science and Training's Coordinating Committee on Science and Technology Working Group on the Metrics of Research Commercialisation.

32 Coordinating Committee on Science and Technology Working Group on the Metrics of Research Commercialisation, *Submission No. 7*, attached report *Metrics for Research Commercialisation: A Report to the Coordination Committee on Science and Technology*, p. 12.

33 Coordinating Committee on Science and Technology Working Group on the Metrics of Research Commercialisation, *Submission No. 7*, attached report *Metrics for Research Commercialisation: A Report to the Coordination Committee on Science and Technology*, p. 11.

34 Coordinating Committee on Science and Technology Working Group on the Metrics of Research Commercialisation, *Submission No. 7*, Attached report *Metrics for Research Commercialisation: A Report to the Coordination Committee on Science and Technology*, p. 12.

35 Department of Education, Science and Training, *Definitions and Methodological Notes: Statistics on Science and Innovation 2005*, p. 44.

Outcomes of Innovation

2.36 Evidence to the inquiry has emphasised that commercialisation is not the only outcome of innovation. Specifically, a number of submissions have identified the implementation of innovation via technology transfer[36] and its broad uptake to achieve financial, social and/or environmental outcomes as critical components of the innovation process.[37]

2.37 Innovation can be made publicly available to promote industry-wide economic growth, or provide environmental and social benefits for the community rather than sold commercially to generate direct economic benefits. The non-commercial mechanisms by which new products or processes are disseminated and applied are referred to as **adoption** or **utilisation**. Evidence to the inquiry has indicated that those sectors with a strong 'public good'[38] focus (e.g. agriculture, health and environment) frequently consider adoption to be the most appropriate means of innovation implementation. [39]

2.38 In its submission to the inquiry, the Rural Research and Development Corporation (RDC) Chairs Committee noted that its focus on promoting the adoption of innovation stemmed from:

> ... the nature of rural product markets...and the consequent need to keep enabling producers to be strategically placed at the frontiers of technological innovation and global competitiveness. In many instances research is directed at problems unique to Australia and/or the size of the

36 Technology transfer is the sharing of knowledge and facilities among industries, universities, governments and other institutions to ensure that scientific and technological developments are accessible to a range of users who can then further develop the technology into new products, processes, materials or services.

37 Department of Education, Science and Training, *Submission No. 20*, p. 24; Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p.6; Dr J Yencken and Professor Emeritus M Gillin, *Submission No. 41*, Attached paper, p. 12.

38 'Public good' is characterised by outcomes or products that are not supply limited and are freely or readily available to benefit communities.

39 See for example Meat and Livestock Australia, *Submission No. 4*, p. 4; Dr R Rowe, *Submission No. 26*, p. 1; Rural Research and Development Corporation Chairs Committee, *Submission No. 54*, pp. 9-10; Australian Cotton Cooperative Research Centre, *Submission No. 57*, pp. 1-2; Department of Agriculture, Fisheries and Forestry, *Submission No. 90*, p. 2; Land and Water Australia, *Submission No. 96*, p. 2; Professor P Høj (Australian Research Council), *Transcript of Evidence*, 5 December 2005, p. 9.

> Australian market dictates a limit to commercialisation opportunities.[40]

2.39 The RDC Chairs Committee explained further:

> Additionally there is a view that [rural] producers, where they are the main target for adoption of a new technology, have in effect already contributed to the products from research and should not be required to make further payment. This is in recognition of the contribution [to the R&D that] they make through compulsory levies and the benefits they receive from government matching contributions, which in part, are perceived as an alternative to government incentives to businesses in other sectors, such as through 125per cent tax deductibility.[41]

2.40 While innovation adoption does not generally result in direct economic benefits for the originators and developers, it may result in economic benefits realised through positive social and environmental outcomes.

2.41 For example, Professor Alan Pettigrew of the National Health and Medical Research Council (NHMRC), the Australian Government's principal health and medical research funding body, emphasised the potential economic benefits arising from the translation (i.e. adoption) of improved health practice and policy as a result of health and medical research outcomes, stating:

> ...the translation of research discovery into improved health practice and health policy, which goes beyond just commercialisation, and it may not involve commercialisation at all...can have significant economic benefit to the community and Australia generally.[42]

2.42 In contrast to those sectors and organisations with a public good focus, profit related imperatives (i.e. increased revenues, reduced business costs or improved productivity) were the most frequently reported drivers of innovation for businesses.[43]

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40 Rural Research and Development Corporation Chairs Committee, *Submission No. 54*, p. 9.

41 Rural Research and Development Corporation Chairs Committee, *Submission No. 54*, p. 9.

42 Professor A Pettigrew (National Health and Medical Research Council), *Transcript of Evidence*, 12 September 2005, p. 1.

43 Australian Bureau of Statistics, *2003 Innovation in Australian Business (ABS 81580)*, p. 28.

Measurement and Assessment of Innovation Performance and Outcomes

2.43 Reliable data on the national innovation system[44] provides an essential foundation for policy formulation to support Australia's economic growth, social and environmental development. Innovation indicators that assess the system in terms of its inputs, outputs and outcomes can be used to identify national innovation strengths and weaknesses.

2.44 Evidence to the inquiry has underscored the importance of reliable data. It has also questioned the adequacy of existing measurement frameworks, highlighting some of the limitations associated with innovation indicators, data sets, analyses and interpretations.[45]

2.45 Due to the complexity of innovation systems, there is no single indicator that is capable of assessing all elements of innovation. Instead an array of measures is needed. The major role in developing international standardised guidelines for assessing innovation has fallen to the OECD.

2.46 These guidelines are disseminated through a series of methodological manuals which, in conjunction with other international and national standard classifications, define the indicators and data collection methodologies for use when assessing innovation systems.[46]

2.47 These international standard measurement frameworks enable comparisons of innovation to be made between countries, and analysis of national and international trends that could impact on the capacity of innovation systems to meet current and projected needs.

2.48 Nonetheless, assessment of innovation remains difficult, particularly as the associations between innovation inputs, outputs and outcomes are complex and multi-dimensional.

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44 The national innovation system is defined as the body of policies, regulations, institutional and infrastructural arrangements and activities concerned with the creation, acquisition, dissemination and use of scientific and technological knowledge.

45 For example see Science Industry Action Agenda, *Submission No. 61*, p. 11; Australian Geoscience Council, *Submission No. 71*, p. 12; Department of Industry, Tourism and Resources, *Submission No. 82*, p. 3; Mr D Scott-Kemmis, *Submission No. 99*, p. 2.

46 Organisation of Economic Cooperation and Development (OECD) methodological manuals include the *Frascati Manual* for research and development, the *Patent Manual*, the *Canberra Manual* for human resources in science and technology, the *Manual for Technology Balance of Payments*, the *Oslo Manual* for innovation and the *Productivity Manual*.

2.49 One significant limitation of current innovation measurement frameworks is that the majority of the key innovation indicators necessarily rely on empirical evidence that is indicative of correlations between resource inputs and innovation outputs and outcomes.

2.50 Urging caution with regard to the interpretation of innovation metrics, the *Australian Government's Innovation Report 2004–05* stated:

> ... it should be kept in mind that an increase in any one of the various indicators may not necessarily be a better outcome for the economy. This is true especially for input type indicators such as those in the knowledge creation and human resources categories, as it is difficult to prove a direct relationship between increased expenditure and subsequent increases in innovation output.[47]

2.51 In some cases, the limitations associated with the indirect nature of innovation indicators are exacerbated by deficiencies in data sets. These deficiencies can include gaps in the data where there has been no ongoing collection, and incompatibilities between data sets collected and compiled in different countries.[48]

2.52 Particularly challenging is the assessment of public sector innovation.[49] Evidence to the inquiry has also highlighted the absence of standard guidelines for data collection and analyses to assess the impact of innovation adoption. In addition, a 'triple bottom line' assessment requires measures of the social and environmental benefits of innovation, as well as economic outcomes.

2.53 Meat and Livestock Australia (MLA), one of the 14 RDCs, noted that its success can only be assessed through the measurement of outcomes that take account of 'key areas of adoption impact' including:

- Triple bottom line assessment, looking at economic, social and environment benefits.
- Direct cost-benefit analysis at both an industry and enterprise level.
- Identification of the adoption rate of technologies by industry stakeholders.

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47 *Australian Government's Innovation Report 2004-05: Real Results Real Jobs*, p. 5.

48 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 3.

49 Organisation of Economic Cooperation and Development (OECD) and Eurostat, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,* 3rd Edition, 2005, p. 16.

- Satisfaction of stakeholders, providing a qualitative measure of the outcomes of technology adoption where appropriate.
- Where possible, measurement of direct realised benefit at an enterprise level.[50]

Assessing National Innovation Performance

2.54 The existing metrics give an insight into:

- Australia's national comparative innovation overall in both the public and private sectors;
- innovation and commercialisation in the business sector; and
- research commercialisation in the public/not-for profit sector.

Australia's Innovation Performance Relative to OECD Countries

2.55 Table 2.1 shows Australia's comparative innovation under 15 indicators grouped in six categories.

2.56 Overall Australia performed at or above the OECD average on 10 of the 15 indicators. The Innovation Scorecard indicated that Australia is strong in the percentage of the labour force that has a tertiary education, the number of science and engineering graduates in the labour force and internet usage. These indicators imply that Australia's labour force is highly skilled and able to participate in the innovation process.

2.57 Table 2.1 shows that Australia is performing at 50 per cent or more above the OECD average in three of the 15 indicators. These indicators are:

- scientific and technical articles per capita;
- foreign affiliates in manufacturing R&D; and
- multi-factor productivity[51] growth for 1997 to 2001.

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50 Meat and Livestock Australia, *Submission No. 4*, p. 4.

51 A nation's productivity is the volume of goods and services it produces (its output) for a given volume of inputs (such as labour and capital). Much, but not all, of Australia's output growth can be accounted for by increases in the inputs to production. The amount by which output growth exceeds input growth is the productivity improvement. Multifactor productivity represents that part of the growth in output that cannot be explained by growth in labour and capital inputs.

Table 2.1 Australia's Innovation Scorecard 2004

Category	Indicator	2004 rank*	2002 rank	Relative to OECD average (per cent difference)	Available data
Knowledge creation (the ability to generate new ideas and technologies)	R&D expenditure in government and higher education sectors % GDP[52]	6	7	+ 18	2002
	Scientific and technical articles per million population	9	8	+ 66	2003
	Number US patents per million population	18	18	- 66	2003
	Business sector R&D Expenditure % GDP	19	19	- 48	2002
Human resources	Percentage of workforce with tertiary education	6	5	+ 30	2002
	Number of science graduates per 10 000 persons in labour force	6	6	+ 40	2001
	Researchers per 10 000 in labour force	8	7	+ 18	2002
Finance	Investment in venture capital % GDP	7	18	< 1	2001
Knowledge diffusion	Investment in ICT % of business sector gross fixed capital	6	3	- 5	2001
	Internet users per 1 000 population	6	10	+ 36	2003
	Investment in new equipment - investment in machinery & equipment % GDP	10	12	+ 11	2002
Collaboration	Share of foreign affiliates in manufacturing R&D	4	3	+ 135	2001
	Breadth of international science and engineering collaboration	12	8	+ 10	2001
Market outcomes	Average annual growth in multi-factor productivity between 1997 and 2001	4	4	+ 126	2001
	Expenditure on innovation as share of total sales in manufacturing %	N/A	16	- 42	1996-97

** Australia's current ranking is from a field of 27–30 OECD countries with the exception of: Investment in venture capital as a percentage of gross domestic product (GDP) (25), Investment in ICT as a percentage of business sector gross fixed capital formation (18), Share of foreign affiliates in manufacturing R&D (19), Growth in multi-factor productivity between 1997 and 2001 (17), and Expenditure on innovation as a share of total sales in manufacturing (19)—number in parentheses represents the number of OECD countries. A 'top ten' performance is considered to be within the top third of available OECD countries.*

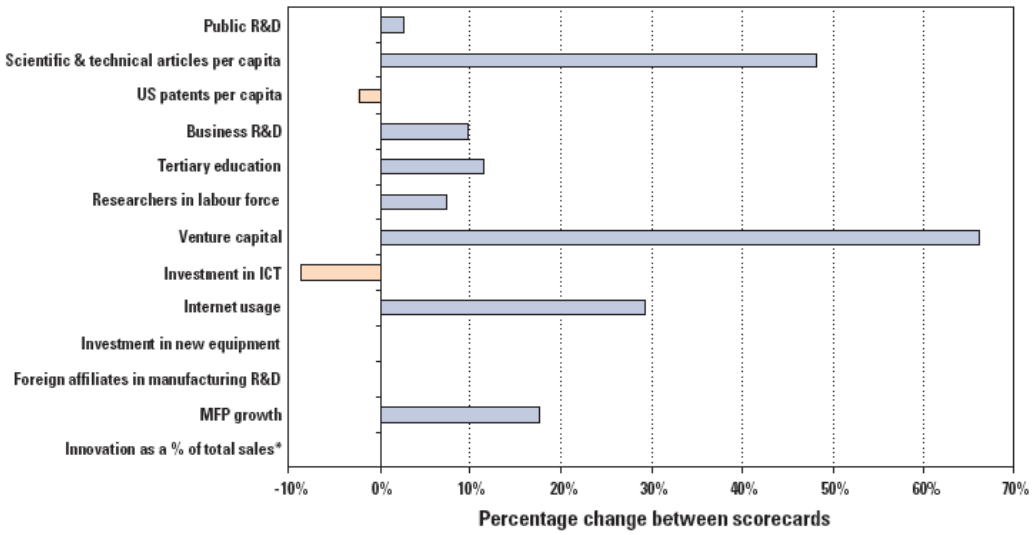
Source *Based on data from* The Australian Government's Innovation Report 2004–05: Real Results Real Jobs, *p. 6.*

52 R&D expenditure in the government and higher education sectors is defined as the expenditure of R&D performed by government research agencies (both federal and state governments) and universities. It includes all capital expenditure, labour expenditure and other current expenditure (such as materials, fuels, rent, hiring, repairs, maintenance and data processing, and the proportion of expenditure on general services and overheads) which are attributable to R&D activities.

2.58 Table 2.1 also indicates that Australia's business expenditure on R&D (BERD), levels of patenting in the United States (US) and innovations as a percentage of total sales were assessed as substantially below the OECD average. Australia also performed below the OECD average for investment in information and communication technology (ICT), although this indicator was less than 10 per cent below the OECD average.

2.59 The Innovation Scorecard also enables a review of innovation trends over time within Australia. The change in Australia's innovation performance between the 2002 and 2004 Innovation Scorecards is shown in Figure 2.1.

Figure 2.1 Percentage Change in Australian Indicator Values for the 2004 Innovation Scorecard Relative to the 2002 Scorecard



** Innovation as a percentage of total sales was not updated from the 2002 Scorecard due to a lack of new data*

Source ` The Australian Government's Innovation Report 2004–05: Real Results Real Jobs, *p. 7.*

2.60 Since 2002, Australia's Scorecard performance has improved on most innovation indicators, with investment in venture capital, scientific and technical articles, and internet usage all increasing significantly.

2.61 However, there has been a decline in patenting levels in the US and investment in ICT. These are both areas where Australia's performance is also below the OECD average.

2.62 In summary, Australia is above average with regard to science participation and workforce education, but is less successful in innovation and commercialisation of new ideas or patents.

2.63 This is consistent with concerns raised in some submissions regarding patent costs and ICT industry support.[53] Submissions also raised concerns regarding the projected supply of skilled science and engineering graduates which may impact on future Scorecard outcomes.[54] These issues are considered in more detail in subsequent chapters of the report.

Innovation in the Business Sector

2.64 In 2005, the Australian Bureau of Statistics (ABS) released the results of its third Australian business innovation survey. The survey was conducted in accordance with the OECD's *Oslo Manual* guidelines, and assessed both technological and non-technological innovation occurring in Australian businesses over the period 2001-03.[55]

2.65 Internationally comparative key findings of the ABS business innovation survey included:

- 34.8 per cent of Australian businesses innovate, with the most common type of innovation being process innovation, implemented by 22.9 per cent of businesses. Product or services innovation was implemented by 16.6 per cent of businesses.
- The proportion of firms innovating rises as the size of the firm increases, both in terms of employee numbers and business income.
- The main driver of business innovation is increased company revenue achieved through either increased productivity or meeting market demand.

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53 For example see Australian Computer Society, *Submission No. 38*, p. 1; Proteome Systems, *Submission No. 55*, p. 1; Australian Information Industry Association, *Submission No. 60*, p. 4; DSTC Pty Ltd, *Submission No. 69*, p. 2; Australian Geoscience Council, *Submission No. 71*, p. 9.

54 For example see Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 8; Science Industry Australia, *Submission No. 61*, Attachment 1, p. 53; GBC Scientific Equipment, *Submission No. 76*, pp. 4-5.

55 Australian Bureau of Statistics, *2003 Innovation in Australian Business (ABS 8158.0).*

- The major barriers to innovation include the cost and associated economic risks, and market related barriers (e.g. market domination by a competitor or lack of customer demand).
- Businesses with more than 50 per cent foreign ownership were more likely to innovate.
- 27 per cent of innovating businesses were involved in some form of active collaboration, with 25 per cent of businesses reporting collaboration with suppliers, clients, competitors and consultants. This compared to only 6.5 per cent collaborating with universities, government and research institutes.
- The majority of innovating businesses acquire innovation ideas, knowledge or abilities from within 100 kilometres of the business location.
- The majority of innovation reported by businesses comprised the introduction of goods, services or processes (33.9 per cent) that were 'new to Australia' rather than 'new to the world' (11.7 per cent).[56]

2.66 International comparisons revealed that the total proportion of businesses innovating in Australia is slightly higher than that of the European Union as a whole.[57]

Commercialisation in the Public Sector

2.67 The most recent *National Survey on Research Commercialisation* was released in 2004.[58] The *National Survey* provided information on a number of measures of commercialisation activities conducted by

56 Australian Bureau of Statistics, *2003 Innovation in Australian Business (ABS 8158.0).*

57 Australian Bureau of Statistics, *2003 Innovation in Australian Business (ABS 8158.0),* p. 11.

58 The National Survey was commissioned by Department of Education, Science and Training, and conducted by the Australian Institute of Commercialisation based on the methodology used in the annual licensing survey conducted in the US and Canada by the Association of University Technology Managers.

PFRAs[59], universities, medical research institutes (MRIs) and Cooperative Research Centres (CRCs) during 2001 and 2002.[60]

2.68 Specifically, the survey provided information on gross income derived from licences and start-up company formation and levels of patenting. The survey also enabled comparisons with similar data collected for the year 2000 and international comparisons.

2.69 In summary, Australian universities generated about 59 per cent of total licence income in 2002, compared with MRIs (22 per cent), Commonwealth Scientific and Industrial Research Organisation (CSIRO) (13 per cent), CRCs (five per cent) and the remaining PFRAs (one per cent).[61]

2.70 Other key changes from 2000 to 2004 included:

- increases in the stock of income-yielding licences, the active stock of start-up companies and the overall value of equity held by Australia's PFRAs;
- increases in employment of commercialisation and commercialisation support staff;
- a stable level of income earned from licences[62]; and
- a decline in the number of new patents applied for and issued.[63]

2.71 Taking into account differences in levels of research expenditure and countries' gross domestic product (GDP), international comparisons revealed that Australia's universities:

- have fewer US patents issued to them than universities in the US or Canada;

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59 Publicly funded research agencies included in the survey are the Australian Institute of Marine Sciences, the Australian Nuclear Science and Technology Organisation, Commonwealth Scientific and Industrial Research Organisation and the Defence Science and Technology Organisation.

60 Department of Education, Science and Training 2004, *National Survey of Research Commercialisation Years 2001 and 2002: Selected Measures of Commercialisation Activity in Universities and Publicly Funded Research Agencies*.

61 Department of Education, Science and Training 2004, *National Survey of Research Commercialisation Years 2001 and 2002: Selected Measures of Commercialisation Activity in Universities and Publicly Funded Research Agencies,* p. xvii.

62 Figures were adjusted to take in to account a single, very large transaction reported in the 2000 survey which inflated the figure reported for that year.

63 Department of Education, Science and Training 2004, *National Survey of Research Commercialisation Years 2001 and 2002: Selected Measures of Commercialisation Activity in Universities and Publicly Funded Research Agencies,* p. xvii.

- execute fewer licences than those in the US, Canada and the United Kingdom (UK);
- earn income from licences at a rate which is greater than those in the UK, roughly comparable to Canada but less than the US; and
- form more start-up companies than those in the US, but fewer than those in Canada or the UK.[64]

2.72 As noted previously in this report, the definition and metrics of research commercialisation in Australia has been reviewed recently by DEST.[65] While this has resulted in the adoption of a broader definition of research commercialisation and development of a revised metrics framework, the framework has yet to be implemented and evaluated.

2.73 While noting that further work is needed to develop commercialisation metrics, the *National Survey* acknowledged the work of DEST's CCST Metrics Working Group.[66] In summary, based on the analysis of research, commercialisation metrics used in Australia and overseas, the CCST Metrics Working Group has recommended the use of 14 core metrics grouped under three categories:

- intellectual property;
- research contracts and consultancies; and
- skills development and transfer.[67]

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64 Department of Education, Science and Training 2004, *National Survey of Research Commercialisation Years 2001 and 2002: Selected Measures of Commercialisation Activity in Universities and Publicly Funded Research Agencies*, p. xvii.

65 Howard Partners 2005, *The Emerging Business of Knowledge Transfer: Creating Value from Intellectual Property and Services*; Coordinating Committee on Science and Technology Working Group on the Metrics of Research Commercialisation, *Submission No. 7*, Attached report *Metrics for Research Commercialisation: A Report to the Coordination Committee on Science and Technology*.

66 Department of Education, Science and Training 2004, *National Survey of Research Commercialisation Years 2001 and 2002: Selected Measures of Commercialisation Activity in Universities and Publicly Funded Research Agencies*, Summary, p. xi.

67 Coordinating Committee on Science and Technology Working Group on the Metrics of Research Commercialisation, *Submission No. 7*, attached report *Metrics for Research Commercialisation: A Report to the Coordination Committee on Science and Technology*, 2005, p. 17.

2.74 In addition, the CCST Metrics Working Group also recommended the development of a comprehensive data collection strategy for research commercialisation which should:

- maintain the existing time series data for the core indicators developed through the National Survey of Research Commercialisation;
- address any deficiencies in data quality so as to improve data timeliness, availability and/or reliability; and
- whenever possible, draw upon existing and reliable third-party data to reduce the burden on respondents and to ensure consistency.[68]

Committee Comment

2.75 The Committee recognises that, despite the inquiry's terms of reference specifying technological innovation, it is not always possible to restrict innovation to the technological arena.

2.76 Additionally, commercialisation should not be regarded as the sole objective or outcome of innovation. The implications of innovation should encompass a range of diverse activities, mechanisms of implementation and outcomes.

2.77 The Committee notes that the debate regarding the definition of research commercialisation is indicative of the challenges faced by PFRIs as they undergo a process of adaptation and change.

2.78 Traditionally centres of teaching and research, there is a growing expectation from the government that PRFIs will also contribute to the global knowledge-based economy through the active transfer of knowledge, skills and innovation, specifically via increased commercialisation.

2.79 DEST's adoption of a broader definition to encompass the various ways in which PFRIs may contribute to Australia's economic, social and environmental wellbeing, significantly impacts on the range of commercialisation activities that PFRIs can report on and subsequently the level of commercialisation 'success' that PFRIs can demonstrate.

68 Coordinating Committee on Science and Technology Working Group on the Metrics of Research Commercialisation, *Submission No. 7*, attached report *Metrics for Research Commercialisation: A Report to the Coordination Committee on Science and Technology*, 2005, p. 9.

2.80 The Committee is encouraged to note national and international activities directed toward developing enhanced and standardised conceptual and metrics frameworks to facilitate objective and comparable assessments of innovation and commercialisation.

2.81 The Committee acknowledges the importance of monitoring innovation performance over time, and does not underestimate the challenges associated with developing and implementing robust metrics frameworks.

2.82 The innovation measurement frameworks reviewed in this chapter show their potential contribution to assessing the strengths and weaknesses of Australia's innovation system. Some of the challenges that can be encountered in implementing innovation measurement frameworks in a dynamic environment are also demonstrated.

2.83 For example, the capacity to make direct historical and cross-country comparisons of some innovation indicators included in the Innovation Scorecard and the ABS survey of business innovation is restricted due to gaps in data sets, changes in the data collected over time and differences in innovation data collected between countries.

2.84 Adding to the challenges associated with data collection is the scope for differential interpretation of innovation metrics. In this regard, the Committee notes the comment made by Science Industry Australia (SIA) in its submission:

> Data in publications from DEST are very useful, but it appears that for every conclusion that could be drawn from the data, it was also possible to find contradictory data from which an opposite view could be expressed.[69]

2.85 A key element to emerge with regard to the interpretation of innovation metrics was the need to take into account the unique context of a nation's economic structure, geographical opportunities and historical influences.

2.86 By way of example, the Committee notes evidence presented with regard to interpretation of the significance of Australia's comparatively low level of BERD. When taken at face value the low level of BERD might be interpreted to indicate a lack of innovative activity occurring in Australian businesses. However, it has also been argued that it may reflect the structure of Australian industry, with its high level of dependence on medium-to-low technology industries

69 Science Industry Australia, *Submission No. 61*, p. 11.

(e.g. agriculture, mining etc) and a predominance of SMEs, both of which tend to have a low reliance on in-house R&D to achieve innovation.[70]

2.87 Elaborating on the scope for different interpretations of innovation performance data with regard to Australia's low level of BERD and its high levels of GDP per capita, economic growth and dependence on primary product exports, Mr Scott-Kemmis submitted:

> Debate about the innovation policy implications of this situation has tended to centre around three positions concerning the facts above:
>
> - The low levels of BERD and international patenting signals weaknesses in the 'national innovation system' that will ultimately lead to diminishing competitiveness and living standards. Consequently, it is essential to stimulate industry to increase R&D investment.
> - The high and sustained rates of productivity growth signal the essential strength of the 'national innovation system' and the correctness of the policy settings of the past two decades. There is no persuasive or urgent case for major change in innovation policy, and there is perhaps even some over-investment in public sector research—as there is little evidence that this investment has been a major driver of productivity growth.
> - The low levels of BERD and patenting are simply reflections of our industrial structure. These low levels may nevertheless be quite consistent with high rates of innovation in sectors where R&D is not a dominant driver of innovation. However, Australia may well risk losing future degrees of freedom if its current level of specialisation narrows even further and major new firms and industries do not develop.[71]

2.88 Clearly, the alternate interpretations of the same innovation data would have significantly different implications and paths of action for innovation policy makers.

2.89 Generally, submissions made to the inquiry by those Australian Government departments with responsibility for innovation policy formulation and implementation have demonstrated a good

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70 Professors K Smith and J West, *Submission No. 18*, pp. 6-8; Mr D Scott-Kemmis, *Submission No. 99*, p. 2; Ms T Berman (Department of Industry, Tourism and Resources), *Transcript of Evidence,* 28 November 2005, p. 10; Ms P Kelly (Department of Industry, Tourism and Resources), *Transcript of Evidence*, 28 November 2005, p. 10.

71 Mr D Scott-Kemmis, *Submission No. 99*, p. 2.

awareness of innovation performance measurement frameworks, including their limitations and the potential for differential interpretation of innovation data. [72]

2.90 In addition, the Committee endorses the broader definition of innovation and commercialisation. However, evidence suggests that assessing the impact of innovation adoption, including its economic value and other benefits to the wider community, will be difficult and will require the development of a more robust measurement framework.

2.91 While there are challenges associated with the development of a quantitative framework to assess the broader impact of innovation, the Committee notes progress under DEST's **Research Quality Framework** (RQF) initiative. The RQF is intended to form the basis for an improved assessment of the quality and impact of publicly funded research, including assessment of the full economic, social and environmental impacts. Once implemented the RQF will provide the Australian Government with the basis for redistributing research funding to ensure that areas of the highest quality of research are rewarded.

2.92 In May 2006, following a consultation process with key stakeholders including universities, DEST released its advice on the preferred RQF model. During the consultation, a number of concerns were raised relating to the design and implementation of the RQF. These include concerns regarding the cost effectiveness of the RQF exercise, the potential for duplication of existing competitive peer-review processes and an underestimation of the impact of basic research due to the time lag between the initiation of the research and the realisation of research outcomes.[73]

2.93 In a private briefing to the Committee, DEST indicated that it was aware of these concerns and sought to address them through continuing consultation with key stakeholders with regard to the development of a detailed RQF implementation plan. In early 2006, an RQF Implementation Group was established to oversee further consultation. The Australian Government's 2006 budget also

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72 For example see Department of Education, Science and Training, *Submission No. 20*; Department of Industry, Tourism and Resources, *Submission No. 82*; Department of Communications, Information Technology and the Arts, *Submission No. 87*.

73 L Shewan and A Coats, 'The Research Quality Framework and its Implications for Health and Medical Research: Time to Take Stock?', *Medical Journal of Australia*, vol. 184 (9), 2006, pp. 463-66.

announced $3 million to finalise the development of the RQF.[74] The Committee anticipates that concerns expressed in relation to the RQF will be addressed during the next phase of consultations.

2.94 In addition, the Committee notes that the Treasurer and the Minister for Education, Science and Training have requested the Productivity Commission to undertake a research study into the economic, social and environmental returns of public support for science and innovation in Australia.[75]

2.95 The Committee expects that such an inquiry will consider appropriate metrics for measuring these broad impacts. The Productivity Commission will report by March 2007.

74 Australian Government, 2006, *Budget 2005-06, Budget Paper No. 2*, p. 164.

75 The Treasurer, accessed 31 March 2006, *Productivity Commission to Review Public Support for Science and Innovation* (Press Release), <treasurer.gov.au>.

3

Innovation and Commercialisation Policy and Program Framework

3.1 This chapter examines:

- Australia's innovation policy, its implementation and evaluation;
- models of innovation;
- the plurality of Australian Government and other innovation support programs and associated accessibility and navigation issues;
- the cost and administrative burden associated with innovation support application processes and reporting frameworks; and
- the coordination and complementarity of the Australian Government's innovation support framework.

3.2 In relation to the innovation and commercialisation policy and program framework, three consensus issues emerged from the evidence.

3.3 **Consensus Issue 1**—Effective innovation policy must balance a range of innovation needs, some of which may be viewed as complementary and others as competing. Evidence to the inquiry questioned whether such a balance was currently appropriate.

3.4 **Consensus Issue 2**—The large number of innovation support programs, and the complexity of the application and compliance processes associated with accessing innovation support, imposes cost

burdens on applicants and recipients. Evidence questioned the accessibility and value of innovation support given the administrative burden and costs associated with lodging applications for support, the relatively low chances of being successful, and the cost of compliance if successful.

3.5 **Consensus Issue 3**—Australia's innovation support is provided through a range of targeted programs and fiscal incentives. Some evidence suggested that innovation support programs lack coordination and complementarity across the framework.

3.6 With links between innovation, economic growth and productivity being documented, there is evidence that science and innovation are receiving greater policy attention across OECD countries.[1] As noted by Professors Smith and West in their submission to the inquiry:

> Innovation policy is central to innovation performance, and hence to wider economic performance. All major theories and all empirical analyses of economic development treat innovation as the key explanatory factor in growth.[2]

3.7 Therefore, it is critical that Australia achieves an innovation support framework that is appropriate for the varying needs of research agencies and businesses, is accessible and cost-effective for applicants and is well coordinated.

Innovation and Commercialisation Policy

3.8 In January 2001, the Australian Government commenced its largest coordinated package of measures to support science and innovation. The package, ***Backing Australia's Ability (BAA)—an Innovation Action Plan for the Future***, constituted a whole-of-government program to support and foster Australian innovation. It was founded upon earlier Australian Government innovation policy, including the 1997 *Investing for Growth* initiative.

1 Organisation of Economic Cooperation and Development (OECD), *Highlights—Science, Technology and Industry Outlook 2004,* p. 4.

2 Professors K Smith and J West, *Submission No. 18*, p. 3.

Backing Australia's Ability

3.9 The *BAA* initiative commenced with a five-year funding commitment from the Australian Government of $3.0 billion[3], and now totals $8.3 billion.[4] The initiative was the outcome of a February 2000 National Innovation Summit convened by the Australian Government and the Business Council of Australia (BCA), and of the Chief Scientist's report, *The Chance to Change*, presented to Government in November 2000.[5]

3.10 The National Innovation Summit assessed the strengths and weaknesses of Australia's innovation system and formulated ways to improve performance. The Chief Scientist's report reviewed the effectiveness of the nation's science, engineering and technology base in supporting innovation.

3.11 A Ministerial Taskforce[6] was established to oversee the development of the policy framework and to ensure an appropriate balance between competing priorities. The resulting *BAA* policy package targeted three key elements of Australia's innovation system:

- strengthening Australia's ability to generate ideas and undertake research;
- accelerating the commercialisation of ideas; and
- developing and retaining skills.[7]

3.12 The three key elements of the Australian Government's funding commitment to *BAA* are presented in Table 3.1.

3.13 Details regarding the range of *BAA* initiatives and program funding commitments are at Appendix D. Descriptions of selected Government innovation /commercialisation programs is at Appendix E. Specific issues relating to enhancing innovation and commercialisation through the development of collaborations and linkages, developing and retaining skills, and the provision of

3 Commonwealth Government 2001, *Backing Australia's Ability – An Innovation Action Plan for the Future,* p. 14.

4 Due to the 2004 announcement of an extension of funding to the 2001 *Backing Australia's Ability* initiative. The extension is referred to as *BAA–II*. Department of Education, Science and Training, *Submission No. 20*, p. 6.

5 Commonwealth Government 2001, *Backing Australia's Ability – An Innovation Action Plan for the Future*, pp. 8-9.

6 The taskforce comprised Senator the Hon Nick Minchin, then Minister for Industry, Science and Resources, the Hon David Kemp MP, then Minister for Education, Training and Youth Affairs, and Senator the Hon Richard Alston, then Minister for Communications, Information Technology and the Arts.

7 Department of Education, Science and Training, *Submission No. 20*, p. 24.

innovation and commercialisation programs support available under *BAA* are considered in subsequent chapters of the report.

Table 3.1 Overview of the Australian Government's 10 Year Total Funding Commitment to *Backing Australia's Ability*

***BAA* Key Elements**	**Funding ($ million)**	**Percentage of *BAA* Funding**
Research & Development	5 277.6	59.6
Commercialisation	2 355.6	26.6
Skills Development	1 227.8	13.8
Grand Total	8 861.0	100.0

Source *Adapted from* Australian Science and Innovation System: A Statistical Snapshot 2005, *Table 2.1.27* Overview of the Australian Government's Funding Commitment to *Backing Australia's Ability*, *p. 44.*

National Research Priorities

3.14 In late 2002, the Prime Minister announced the Government's **National Research Priorities** (NRPs)[8]:

- to identify and address areas of strength, opportunity or need where an increase in research effort – including collaboration, coordination or investment – would make a significant contribution to national wealth and/or well-being;
- to determine what shift in research effort is needed, what new or improved research activities are required, and how the targeting of research effort can best be achieved.[9]

3.15 The development and adoption of national priorities by a number of other countries (e.g. the United States of America [USA], Japan, France, the European Union [EU] and Netherlands) to focus their research efforts was also noted.[10]

3.16 Australia's NRPs were identified following extensive public consultation and liaison with the Prime Minister's Science, Engineering and Innovation Council (PMSEIC). They are areas of particular social, economic and environmental importance to

8 In 2003 the national research priorities were enhanced and refined to take greater account of the contributions of the humanities and social sciences research.

9 Department of Education, Science and Training, accessed 18 April 2006, *Developing National Research Priorities Issues Paper*, <dest.gov.au>.

10 Department of Education, Science and Training, accessed 18 April 2006, *Developing National Research Priorities Issues Paper*, <dest.gov.au>.

Australia where a whole-of-government focus has the potential to improve research and broader policy outcomes.

3.17 Four broadly thematic NRPs were identified:

- an environmentally sustainable Australia;
- promoting and maintaining good health;
- frontier technologies for building and transforming Australian industries; and
- safeguarding Australia.

3.18 All Australian Government funded research and research funding agencies have been required to develop and implement strategies to address the NRPs. The guidelines for developing NRP implementation plans state that research and research funding bodies should describe how they will link with related key Government or industry initiatives. In this way it is anticipated that the NRPs will strengthen collaboration.[11]

3.19 A NRP Standing Committee, chaired by the Australian Government's Chief Scientist, was established in February 2005 to assess agency progress in the implementation of the NRPs. The NRP Standing Committee is required to report back to the Government on NRP implementation progress.

How is Innovation Policy Evaluated?

3.20 To measure the effectiveness of innovation policy and inform future policy development, on-going evaluation of innovation policy is essential. As outlined earlier, the limitations associated with innovation metrics and their interpretation pose particular challenges to the objective evaluation of innovation policy.

3.21 Nevertheless, monitoring and evaluation of innovation policy are essential for accountability purposes and to inform the continued development and implementation of effective policy. Therefore, the Australian Government has instituted measures to regularly assess its innovation policy and initiatives.

11 Department of Education, Science and Training, accessed 10 April 2006, <dest.gov.au >.

The Australian Government's Innovation Reports

3.22 Since the introduction of *BAA* in 2001, assessment of innovation policy has taken the form of an annual whole-of-government report, *The Australian Government's Innovation Report*. The innovation report reviews Australia's science and innovation performance and outlines progress in implementing *BAA* policy initiatives. There have been four innovation reports published since the commencement of *BAA*:

- The 2001-02 *Innovation Report* focused on the Australian Government's aim to strengthen the foundation of innovation across the nation.
- The 2002-03 *Innovation Report* reviewed Australia's innovation structure, summarised the Government's programs and included the first Australian Innovation Scorecard.
- The 2003-04 *Innovation Report* provided details on progress and achievements of Government science and innovation initiatives and programs. The report also highlighted examples of collaborations between the public and private sectors, between universities and industry partners, and between national and international partners.
- The 2004-05 *Innovation Report* included the second Australian Innovation Scorecard, provided details of the progress of the range of Government innovation initiatives and programs, and reported on the implementation of the NRPs.

Mapping Australian Science and Innovation Report

3.23 In 2003 the Australian Government provided a detailed overview of Australia's science and innovation system in its *Mapping Australian Science and Innovation Report*.[12]

3.24 Among its other contributions, the report identified strengths, weaknesses and gaps in Australia's science and innovation performance, as well as complementarities and areas of possible greater cooperation between the Australian Government and the state and territory governments.

3.25 The innovation strengths identified in the report included:

- Australia's overall strong contribution to scientific knowledge;

12 Australian Government 2003, *Mapping Australian Science and Innovation: Main Report*.

- a high take-up of information and communications technology (ICT) by businesses;
- an intellectual property (IP) protection framework consistent with world's best practice;
- a high level, by international standards, of government expenditure on R&D; and
- a well qualified workforce to underpin science and innovation.[13]

3.26 Examples of weaknesses identified in the report included:

- the limited visibility and impact of Australian science and patented technology on the development of world technologies;
- weak innovation performance involving R&D and the development of new technologies (including ICT) of Australian businesses;
- a focus in government innovation policy on building R&D capacity rather than enhancing commercialisation;
- challenges in fostering collaboration and linkages between publicly funded research and industry; and
- a lack of entrepreneurial and innovation skills.[14]

3.27 In response to the weaknesses and gaps identified in the *Mapping Australian Science and Innovation Report*, in 2004 the Australian Government launched its $5.3 billion *BAA–II* extension to the existing *BAA–I* policy.

3.28 Together *BAA–I* and *BAA–II* constitute an $8.3 billion Australian Government funding commitment stretching from 2001–02 to 2010–11 to strengthen innovation and commercialisation (see Table 3.1).

3.29 While retaining the three key elements of *BAA–I* (i.e. strengthening Australia's ability to generate ideas and undertake research, accelerating the commercialisation of ideas, and developing and retaining skills), the *BAA–II* package has:

> … a strong focus on encouraging the growth of innovative Australian companies which produce internationally

13 Australian Government 2003, *Mapping Australian Science and Innovation: Summary Report,* pp. 6-20.

14 Australian Government 2003, *Mapping Australian Science and Innovation: Summary Report,* pp. 21-48.

> competitive goods and services, increase productivity and create jobs.[15]

3.30 In addition, *BAA–II* identified another key element of innovation policy, namely the continuing endeavour to strengthen collaboration across the science and innovation system on the basis that:

> Collaboration helps to create the necessary critical mass of expertise, infrastructure and resources and provides more pathways to the marketplace.[16]

3.31 By announcing *BAA–II* two years ahead of the conclusion of *BAA–I*, the Australian Government stated its intention to provide a more predictable science and innovation policy environment with greater certainty and continuity in funding for researchers, businesses and universities.[17] The majority of the *BAA–II* extension funding is due to commence in 2006–07.

Committee Comment

3.32 The Committee notes that efforts to evaluate performance through the *Innovation Reports* and the *Mapping Australia's Science and Innovation Report* are important to identify strengths and weaknesses, and to target further Government assistance. Several recent reviews and evaluations of Australia's science and innovation performance[18] have concluded that addressing issues such as collaboration and linkages, research infrastructure, research quality assessment and university research funding forms an essential basis for the development of sound innovation policy. The 2004–05 *Innovation Report* stated that many of these issues will be addressed through *BAA–II*.[19]

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15 Joint Ministerial Announcement, May 2004, *Backing Australia's Ability – Building Our Future through Science and Innovation*.

16 Joint Ministerial Announcement, May 2004, *Backing Australia's Ability – Building Our Future through Science and Innovation*.

17 Joint Ministerial Announcement, May 2004, *Backing Australia's Ability – Building Our Future through Science and Innovation.*

18 The reviews and evaluations include: *Mapping Australian Science and Innovation*; *Evaluation of Knowledge and Innovation Reforms*; *National Research Infrastructure Taskforce* and *Review of Closer Collaboration Between Universities and Major Publicly Funded Research Agencies*. All of these reviews can be accessed through the Department of Education, Science and Training website at <dest.gov.au>.

19 *The Australian Government's Innovation Report 2004-05: Real Results Real Jobs*, p. 110.

3.33 While the Committee recognises the substantial investment provided for innovation through *BAA*, it considers that it is important to review the debate on the balance of innovation policy, i.e. targeting support to meet differing needs of the public and private sectors and fostering strengths and skills in the national innovation system that are conducive to innovation.

Support for Public Sector and Private Sector Innovation

3.34 A number of submissions have emphasised the different innovation needs of the public and private sectors and have suggested that Australia should implement policy approaches which recognise the different but complementary roles and contributions of these sectors.[20]

3.35 For example, elaborating on the different policy needs of public sector-based knowledge infrastructure (i.e. PFRAs and universities) and private sectors businesses, Professors Smith and West stated:

> The problem is not to incentivise the knowledge infrastructure to provide commercialisable knowledge. Rather, it is necessary to separate out the [knowledge] infrastructure problems and the business development issues.[21]

3.36 With regard to support for commercialisation, Professors Smith and West noted further that:

> Commercialising innovations is the task of business, for which new financial mechanisms are needed to create incentives and control risk. This requires new approaches to tax policy (providing genuine incentives for innovation investment) and to risk management (including in the form of a system of income-contingent loans for investment).[22]

3.37 Evidence to the inquiry has emphasised the importance of accomplishing an appropriate policy balance between government

20 For examples see Mr T Roach, *Submission No. 3*, Attached Paper, p. 4; Professors K Smith and J West, *Submission No. 18*, pp. 2-4; Mr D Scott-Kemmis, *Submission No. 99*, p. 7; Mr R Grey (GBC Scientific Equipment), *Transcript of Evidence*, 4 August 2005, p. 50.

21 Professors K Smith and J West, *Submission No. 18,* p. 2.

22 Professors K Smith and J West, *Submission No. 18*, p. 2.

support for building and maintaining a strong public system of science and basic research[23], and the provision of support directed toward R&D and commercialisation activities occurring in businesses and industry.[24]

3.38 Some have questioned whether Australian Government innovation policy has achieved an appropriate balance. Specifically, it has been suggested that the Australian Government's innovation policy has been developed on the basis of a simplistic linear understanding of innovation founded on the assumption that basic research is the origin of the majority of innovation.[25]

3.39 Early models of innovation describe a linear process with research as the prime driver of innovation. In this model innovation is considered to be driven by '**technology push**'. An alternative early model of innovation attributed the major driver of the innovation process to '**market pull**', with research and development being tailored to meet market demand.

3.40 More sophisticated models of innovation have now superseded both the technology push and market pull linear models. The newer models of innovation have attempted to capture the non-linearity and complexity of the innovation process, placing a strong emphasis on supporting sectoral interactions and feedback loops, through developing human capital and promoting linkages or networks to enhance knowledge flows and transfer.

3.41 Despite the evolution of innovation models and contemporary advances in understandings of innovation, following a detailed analysis of Australian Government innovation policy Dr John Yencken and Professor Emeritus Murray Gillin concluded:

> We [Australia] are strong exponents of 'Technology Push'. The programs we have studied all operate on this premise. Something has been invented, whether through the

23 Basic research is defined as experimental and theoretical work undertaken primarily to acquire new knowledge without a specific application in view. In contrast, applied research is defined as original work undertaken to acquire new knowledge with a specific application in view.

24 Professors J Smith and K West, *Submission No. 18*, pp. 3-15; Australian Institute for Commercialisation, *Submission No. 29*, p. 4; Australian Business Foundation, *Submission No. 64*, p. 7; Mr D Scott-Kemmis, *Submission No. 99*, p. 2; pp. 5-8.

25 For examples see Dr M Sceats, *Submission No. 23*, p. 21; Australian Institute for Commercialisation, *Submission No. 29*, p. 29; Dr J Yencken and Professor Emeritus M Gillin, *Submission No. 41*, Attached paper, p. 5; Mr D Scott-Kemmis, *Submission No. 99*, p. 4.

> endeavours of a lone maverick or a multi-institution coordinated research project. Then money is found to move this to the development stage, and then finally capital is sought to commercialise the whole thing and take it to the market. Too often too little attention is paid to actually finding out if anybody is actually interested to purchase it.[26]

3.42 Similarly, while advocating a balance between technology push (i.e. supply of new ideas and concepts) and market pull (demand for innovative products, processes and services) the AIC also suggested that the current balance of Australian Government innovation policy is skewed in favour of technology push stating:

> There is a tendency in the commercialisation of research to focus on the supply side alone and to assume that the supply adjusts itself to meet demand. That adjustment process can be quite inefficient and wasteful. [27]

3.43 Other submissions to the inquiry have also highlighted features of the Australian Government innovation policy framework which may be indicative of a technology push bias. These features include:

- a policy focus on radical, R&D intensive innovation associated with the high technology sector[28], contrasting with insufficient recognition of incremental, non-R&D intensive innovations associated with the low-to-medium technology sector[29]; and

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26 Dr A Yencken and Professor Emeritus M Gillin, *Submission No. 41*, Attached paper, p. 18.

27 Australian Institute for Commercialisation, *Submission No. 29*, p. 29.

28 Under International Standard Industrial Classification (ISIC Rev. 3) **high technology industries** include aircraft and spacecraft; pharmaceuticals; office, accounting and computing machinery; radio, TV and communications equipment; and medical, precision and optical instruments while **medium-high technology** industries include electrical machinery and apparatus, not elsewhere classified; motor vehicle, trailers and semi-trailers; chemicals excluding pharmaceuticals; railroad equipment and transport equipment, not elsewhere classified; and machinery and equipment, not elsewhere classified.

29 ISIC Rev. 3 defines **Medium-low technology industries** as covering the building and repairing of ships and boats; rubber and plastics products; coke, refined petroleum products and nuclear fuel; other non-metallic mineral products; and basic metals and fabricated metal products. **Low technology industries** include manufacturing, not elsewhere classified; recycling; wood, pulp, paper, paper products, printing and publishing; food products, beverages and tobacco; and textiles, textile products, leather and footwear. Professors K Smith and J West, *Submission No. 18*, p. 7; Australian Business Foundation, *Submission No. 64*, p. 4; Mr D Scott-Kemmis, Submission No. 99, p. 2; Mr K Besgrove (Department of Communications, Information Technology and the Arts), *Transcript of Evidence*, 5 December 2005, p. 23.

- the high level of government expenditure directed toward supporting public sector R&D and a comparatively low level of expenditure for business R&D and commercialisation activities.[30]

Government Support for Radical High Technology Innovation versus Incremental Medium to Low Technology Innovation

3.44 Indicative of a technology push bias, some evidence has suggested that there is an innovation policy focus on support for radical, R&D intensive product innovation, especially associated with high technologies.[31]

3.45 Noting that such an innovation policy focus is not unique to Australia, Professors Smith and West stated:

> Much recent innovation policy, in Australia as elsewhere, has focused on 'high technology', 'knowledge intensive' industries, and the so-called 'frontier' technologies that support these industries. In Australia—as in virtually all other advanced countries—this leads to priority research policy areas placing a strong emphasis on ICT, biotechnology, and nanotechnology.[32]

3.46 Concern has been expressed that a ramification of a possible policy focus on radical 'high technology' innovations is that other types of innovation, particularly incremental, non-R&D-based and process innovation occurring in the low-to-medium technology sector, are not adequately recognised by innovation policy makers.[33] This is of particular concern given the predominance of medium and low technology businesses in Australia and the importance of incremental non-R&D-based forms of innovation to these businesses.[34]

3.47 With regard to incremental innovation, in its submission to the inquiry the Australian Business Foundation (ABF) stated:

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30 CEA Technologies, *Submission No. 8*, pp. 10-11; Professor T Cole, *Submission No. 40*, p. 5.

31 See for examples Clusters Asia Pacific, Submission No. 17, p. 5; Professors K Smith and J West, *Submission No. 18*, p. 5-6; Mr D Scott-Kemmis, *Submission No. 99*, p. 2.

32 Professors K Smith and J West, *Submission No. 18*, p. 5.

33 See for example Clusters Asia Pacific, *Submission No. 17*, p. 5; Professors K Smith and J West, *Submission No. 18,* pp. 5-6; Australian Film Commission, the Australia Council for the Arts and the Australian Film, Television and Radio School, *Submission No. 67*, p. 3; Mr D Scott-Kemmis, *Submission No. 99*, p. 4; Dr L Boldeman (Department of Communications, Information Technology and the Arts), *Transcript of Evidence*, 5 December 2005, p. 19.

34 Australian Bureau of Statistics, *2003 Innovation in Australian Business (ABS 8158.0)*, p. 8.

> ... that when examining successful technological innovation, the importance of incremental change and continual small improvements typically are under-estimated.[35]

3.48 Similarly, emphasising the relative importance of non-R&D contributions to innovation, Professors Smith and West stated:

> Non-R&D inputs to innovation include, for example, market research, design skills, trial production and testing, prototyping and engineering experimentation, and software development. These non-R&D inputs are essential to innovation across all industries, but they are often a larger component of low-tech activities. Non-R&D expenditures on innovation are usually significantly larger than R&D expenditures, so they should not be neglected by innovation policymakers. [36]

3.49 In addition, while Mr Keith Besgrove of the Australian Government Department of Communication, Information Technology and the Arts (DCITA) advised that innovation policy does in fact provide support for process innovation, he expressed concern that the importance of this form of innovation was generally not adequately acknowledged, stating:

> ... it is not the case that we [the Australian Government] do not fund them [process innovation]. I think DCITA's concern is that there is not really a lot of recognition about how important to the Australian economy process innovation really is. I believe it tends to get less focus within media commentary and within people's minds.[37]

3.50 Mr Besgrove suggested that it could make accessing early stage finance and markets more challenging, especially for smaller less established businesses attempting to gain credibility in the marketplace.[38]

3.51 While advocating a balance in the support provided for both incremental and radical innovation, Australia's then Chief Scientist, Dr Robin Batterham, suggested that radical innovation or step change

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35 Australian Business Foundation, *Submission No. 64*, p. 4.

36 Professors K Smith and J West, *Submission No. 18*, p. 7.

37 Mr K Besgrove (Department of Communications, Information Technology and the Arts), *Transcript of Evidence*, 5 December 2005, p. 23.

38 Mr K Besgrove (Department of Communications, Information Technology and the Arts), *Transcript of Evidence*, 5 December 2005, p. 22.

technologies warranted 'special attention' to offset the increased difficulties and higher risks involved:

> … I am particularly focusing on step change technologies here and asking, 'What can we do to make this easier?' Because, in the long run, the lesson of history is that incremental innovation is always welcome and always worth while. In fact, without innovation you are dead in any marketplace. But the big changes are equally worth while, yet the risks associated with big changes are much greater—to state the obvious—and they are fewer and further between.[39]

3.52 The importance of government policy makers taking a broad view of innovation has been emphasised. Specifically, effective innovation policy needs to acknowledge the different drivers of innovation and provide appropriate levels and mechanisms of support to facilitate all forms of innovation.[40]

Australian Government Science and Innovation Expenditure

3.53 Evidence to the inquiry has emphasised Australia's comparatively high levels of science and innovation expenditure directed to supporting its PFRI's. This contrasts with the comparatively low levels of expenditure directed toward supporting the R&D and non-R&D commercialisation activities of businesses.[41]

3.54 Table 3.2 shows the Australian Government's expenditure on science and innovation over recent years. For 2004–05 the Australian Government's science and innovation expenditure totalled $5 184.5 million, and expenditure is expected to reach $5 538.1 million in 2005-06.

39 Dr R Batterham (Chief Scientist to 31 May 2005), *Transcript of Evidence,* 30 May 2005, pp. 2-3.

40 Professors K Smith and J West, *Submission No. 18,* p. 6; Mr D Scott-Kemmis, *Submission No. 99*, p. 7.

41 See chapter 2, Table 2.1.

Table 3.2 Australian Government Support for Science and Innovation 2000–01 to 2005–06

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
	(In million dollars at current prices)					
Australian Government Research Agencies*						
DSTO	261.0	275.0	283.4	293.9	314.4	329.7
CSIRO	496.7	509.6	532.1	568.6	577.1	593.9
ANSTO	157.7	173.2	205.7	157.7	153.6	138.1
Other R&D Agencies	338.3	385.9	402.7	441.5	245.6	262.0
Total for Research Agencies	***1 096.0***	***1 170.5***	***1 218.1***	***1 304.1***	***1 290.7***	***1 323.7***
Percentage of total expenditure	*25.3%*	*25.6%*	*25.9%*	*25.2%*	*24.2%*	*23.9%*
Business Enterprise						
IR&D Tax Concession	510.0	370.0	416.0	406.0	456.0	491.0
R&D Start	176.8	237.9	158.6	230.8	62.6	87.4
Other Innovation Support	124.7	284.3	244.4	216.3	358.8	396.3
Total for Business Enterprise	***811.5***	***892.2***	***818.9***	***853.1***	***877.4***	***974.7***
Percentage of total expenditure	*18.7%*	*19.5%*	*17.4%*	*16.5%*	*16.5%*	*17.6%*
Higher Education						
Australian Research Council	247.8	265.8	298.3	394.4	481.4	556.5
Performance Based Block Funding	942.5	1012.5	1086.5	1 172.2	1 179.0	1 251.3
Other R&D Support	614.0	598.9	588.0	594.8	589.1	449.5
Total for Higher Education	***1 804.3***	***1 877.2***	***1 972.8***	***2 161.4***	***2 249.5***	***2 257.3***
Percentage of total expenditure	*41.7%*	*41.0%*	*41.9%*	*41.7%*	*42.3%*	*40.8%*
Other Science and Technology						
NH&MRC and Other Health	309.7	248.3	273.7	369.0	419.5	431.9
Cooperative Research Centres	139.7	145.3	148.6	201.1	194.0	208.2
Rural	141.3	197.5	204.3	210.7	193.7	207.2
Energy & Environment	20.9	33.6	29.1	35.8	43.4	63.7
Other Science Support	6.7	12.5	38.4	49.3	54.9	71.4
Total for other Science and Technology	***618.3***	***637.2***	***694.1***	***866.0***	***905.4***	***982.4***
Percentage of total expenditure	*14.3%*	*13.9%*	*14.8%*	*16.7%*	*17.0%*	*17.7%*
Total Australian Government Support	***4 330.1***	***4 577.1***	***4 704.0***	***5 184.5***	***5 323.0***	***5 538.1***

Source The Australian Government's 2005-06 Science and Innovation Budget Tables, *pp. 1–7.*

3.55 These data confirm that a significant proportion of Australian Government expenditure on science and innovation is directed toward support for Australia's PFRIs. Specifically, 40.8 per cent of the 2005–06 expenditure is directed to Australia's higher education sector, while support for the major Australian Government research agencies (including the Commonwealth Scientific and Industrial Research Organisation [CSIRO] the Australian Nuclear Science and Technology

Organisation [ANSTO] and the Defence Science and Technology Organisation [DSTO]) comprises 23.9 per cent.

3.56 In contrast, a relatively small proportion of Australian Government funding (approximately 17.6 per cent in 2005–06) is directed to provision of support for the R&D and non-R&D commercialisation activities of Australian businesses.

3.57 International comparisons show that the level of Australian Government support for publicly funded R&D is higher than the OECD and EU averages.[42] Also, while business expenditure on research and development (BERD) has increased steadily since the mid-1980s (albeit from a very low starting point), the percentage of BERD financed by the Australian Government remains below the OECD and European Union (EU) averages.[43]

3.58 While these expenditure patterns may suggest a bias toward a technology push policy approach, not all evidence to the inquiry has supported the view that the current policy balance is inappropriate.

3.59 For example, one submission expressed concern that an increasing focus of innovation policy on commercialisation and marketing may actually compromise Australia's R&D strength. Considering the innovation programs offered through the Industry Research and Development (IR&D) Board[44] and the appropriation of IR&D funds, Salmond and Associates R&D Services stated:

> There are indications that this altered focus [away from R&D support and towards commercialisation support]—against the intent of the [IR&D] Act [1986]—is harming Australia's R&D effort and is undermining our later efforts in the commercialisation of R&D. A weak R&D support basis leads to a weak commercialization effort—while conversely, a strong under-pinning of R&D leads to a strong commercialisation status.[45]

42 Department of Education, Science and Training, *Australian Science and Innovation System: A Statistical Snapshot 2005*, pp. 117-18; and pp. 128-29.

43 Department of Education, Science and Training, *Australian Science and Innovation System: A Statistical Snapshot 2005*, pp. 93-95.

44 The IR&D Board is an independent body responsible for assisting the Australian Government encourage research and development (R&D) and commercialisation in Australian businesses. The Board operates under the auspices of *the Industry Research and Development Act 1986* to assist the Government in its administration of a number of innovation programs including the R&D Tax Concessions, COMET (Commercialising Emerging Technologies program) and the Commercial Ready Program.

45 Salmond and Associates R&D Services, *Submission No. 44*, p. 2.

Committee Comment

3.60 The Committee acknowledges the concerns expressed by some that Australian Government innovation policy is based on a linear technology push view of innovation. However, submissions received from Australian Government departments and agencies with responsibility for the development and implementation of innovation policy have generally demonstrated a good conceptual understanding of the complexity and non-linearity of the innovation process.[46]

3.61 The Committee also notes that the bulk of the Australian Government's science and innovation funding continues to be directed to supporting public sector R&D. While this expenditure pattern may be suggestive of a technology push policy bias, the Committee cautions against an overly simplistic view that equates dollar for dollar expenditure with policy prioritisation.

3.62 Nevertheless, international comparisons indicating higher levels of government support for public sector R&D and lower levels of support for private sector innovation activities may be indicative of an innovation policy technology push bias.

3.63 The Committee recognises that the goal is to achieve an appropriate balance between R&D expenditure and support for the public and private sectors. To this end, the Committee supports the regular evaluations of innovation policy and innovation performance outcomes conducted by the Australian Government in the form of its annual *Innovation Reports* and in the monitoring of NRP implementation.

3.64 In addition, the Committee notes that the Australian Government introduced BAA–*II* to address innovation weaknesses and gaps identified in the Department of Education, Science and Training (DEST)'s *Mapping Australia's Science and Innovation Report* 2003. Notably, *BAA–II* includes a range of measures intended to enhance skills, strengthen linkages across the science and innovation system, as well as to provide greater support for R&D activities and commercialisation. The majority of *BAA–II* initiatives are due to commence in 2006–07.

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46 See for example Department of Education, Science and Technology, *Submission No. 20*, p. 6; Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, pp. 6-8; Department of Industry, Tourism and Resources, *Submission No. 82*, pp. 5-6; Department of Communications, Information Technology and the Arts, *Submission No. 87,* pp. 20-22.

3.65 The Committee does not underestimate the challenge associated with determining the appropriate balance of innovation policy, given the difficulties associated with the metrics of innovation as outlined in chapter two (including the potential for differential interpretation of data) and the issues raised above with regard to government support for R&D versus other key elements of the innovation system.

3.66 Further, with regard to determining the balance of the Australian Government's science and innovation policy, the Committee notes that the Productivity Commission is conducting an inquiry into the economic, social and environmental returns on public support for science and innovation in Australia.[47] Among other considerations, the inquiry terms of reference request that the Commission:

> Evaluate the decision-making principles and programme design elements that:
>
> - influence the effectiveness and efficiency of Australia's innovation system; and
> - guide the allocation of funding between and within the different components of Australia's innovation system;
>
> and identify any scope for improvements and, to the extent possible, comment on any implications from changing the level and balance of current support.[48]

3.67 In its evaluation, the Committee urges the Productivity Commission to examine the evidence received during this inquiry and to consider the findings of this report. The Committee also anticipates that the Commission will undertake a comprehensive evaluation of the balance of Australian Government support provided for:

- market pull versus technology push types of assistance;
- specific support to enhance business R&D and commercialisation activities versus equivalent support for the public sector; and
- specific support for incremental innovation in low-to-medium technology sectors versus radical innovation in the high technology sector.

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47 Productivity Commission, accessed 5 April 2006, <pc.gov.au>.

48 Productivity Commission, accessed 5 April 2006, <pc.gov.au>.

Government Innovation Program Framework

3.68 This section of the chapter examines the perception that Australia's innovation support framework is too complex and consequently difficult to access. It considers the plurality of programs and the measures that the Australian Government has introduced to assist users to navigate and access its innovation support. The section also considers evidence regarding the burden of application processes and reporting requirements.

Plurality of Innovation Programs

3.69 An increasing government focus on innovation as a driver of economic growth and productivity has resulted in the introduction of significant innovation policy initiatives over the last decade. This in turn has led to a proliferation of innovation assistance programs.

3.70 Evidence to the inquiry has indicated that the complexity of the innovation program framework continues to pose problems for many applicants.[49] For example, the CSIRO noted in its submission:

> Many SMEs struggle to understand the range of options available to them. CSIRO has spoken with several SMEs that are either unaware of their options or are confused by the myriad of programs available. Additional efforts to clarify, communicate and possibly coordinate the benefits of the many programs available would help encourage SMEs to utilise the programs that are the best fit with their needs.[50]

3.71 Table 3.3 provides data from 2003 on the number of Australian Government and state/territory governments programs available to support innovation in firms.[51] In total there were 169 different innovation programs available—54 programs available through the Australian Government, and 115 programs available through state/territory governments. The 54 Australian Government programs were administered across 11 different departments and agencies.

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49 For example see Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 3*2, p. 15; SIA, *Submission No. 61*, p. 12.

50 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 3*2, p. 15.

51 Department of Industry, Tourism and Resources, *Commonwealth and State Government Programs Supporting Innovation in Firms*: *January 2003.*

Table 3.3 Australian/State/Territory Government Programs Supporting Innovation in Firms

Australian (Commonwealth) Government	**Number of Programs**
Industry, Tourism and Resources	20
Aboriginal and Torres Strait Islander Commission	1
Austrade	5
Australian Greenhouse Office	4
Australian Research Council	2
Agriculture, Fisheries and Forestry	2
Communications, Information Technology and the Arts	7
Defence	6
Education, Science and Training	3
Employment and Workplace Relations	2
Health and Ageing (National Health and Medical Research Council)	2
Sub-total	**54**
State/Territory Government	
Australian Capital Territory	9
New South Wales	20
Northern Territory	2
Queensland	18
South Australia	12
Tasmania	15
Victoria	26
Western Australia	13
Sub-total	**115**
Total Number of Australian Government Programs	**169**

Source *Department of Industry, Tourism and Resources*, Commonwealth and State Government Programs Supporting Innovation in Firms*:* January 2003.

3.72 In addition, a range of innovation initiatives and programs are also supported at local government level.[52] While equivalent data on the number of innovation initiatives supported at local government level is not available, there are currently more that 700 local government bodies in Australia with responsibility for supporting local infrastructure and provision of a range of services.

3.73 Illustrating the difficulties associated with navigating the innovation program framework and identifying the most appropriate

52 University of the Sunshine Coast, *Submission No. 31*, pp. 1-3; Sutherland Shire Council, *Submission No. 92*, pp. 1-6; Mr R Taylor, *Transcript of Evidence*, 5 August 2005, p. 39.

government support scheme, Mr Bruce Johansson of Gazelle Monitoring System outlined his experiences:

> In May 2003, we [the Gazelle Monitoring System] applied for COMET [Commercialising Emerging Technologies program] funding. We were told we were too early [the development of the technology was not sufficiently advanced]...And it went on until September 2004 [sic] when we approached somebody who told us we were too advanced—this is six months after we were told we were too early: 'You are eligible for R&D Start but that finishes this week; you will be eligible for Commercial Ready, which starts in October.' ... In October, the email arrives. I apply for Com-ready. We were confirmed that we were too advanced for COMET, but we did not have enough software development for Com-ready...We basically thought this was just too hard, and we kept on going down the path of running our business without government funding. [53]

3.74 Commenting on the large number of government innovation programs Ms Patricia Kelly of the Department of Industry, Tourism and Resources (DITR) explained:

> ... within our portfolio we have a range of programs because we do not think there is any one answer. There is a range of market impediments out there and there is a range of ways to tackle them, so a number of programs have grown up in response to those particular issues.[54]

3.75 In addition, Ms Kelly informed the Committee that where possible the Department of Industry, Tourism and Resources (DITR) had introduced measures to streamline its innovation program framework, noting the recent amalgamation by DITR/AusIndustry of three previously separate innovation support programs 'under one umbrella'.[55]

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53 Mr B Johansson (Gazelle Monitoring System), *Transcript of Evidence*, 18 May 2005, p. 70.

54 Ms P Kelly (Department of Industry, Tourism and Resources), *Transcript of Evidence*, 28 November 2005, p. 3.

55 Ms P Kelly (Department of Industry, Tourism and Resources), *Transcript of Evidence*, 28 November 2005, p. 3. Ms Kelly was referring to Department of Industry, Tourism and Resources' Commercial Ready Program introduced in 2004, which combines the former R&D Start Program, Biotechnology Innovation Fund and elements of the Innovation Access Program.

Navigation and Accessibility of Innovation Support

3.76 As early as 2000 the complexity of the innovation support framework was acknowledged with the Innovation Summit Implementation Group stating in its interim report to PMSEIC:

> The Group considers that ease of access, time and complexity associated with obtaining assistance from innovation programs could be improved by implementing an Internet-based, single point of access for interested businesses. This could be complemented with an advisory service to provide customised advice on the availability and appropriateness of programs to the specific needs of each organisation.[56]

3.77 DITR, the Australian Government department with primary responsibility for the provision of innovation support to businesses, responded to these concerns through the introduction of a number of initiatives. Specifically, AusIndustry (the agency of DITR responsible for the implementation of DITR's innovation programs) provides a range of advisory and support services through its **Small Business Field Officers Program**. This service provides assistance to businesses that want to know where and how to access AusIndustry's innovation support. The advice is accessed through an AusIndustry 'hotline' telephone number as a first point of contact.[57] Small Business Field Officers assistance, which is delivered free of charge, is funded until 2008.[58]

3.78 More broadly, evidence also indicates that the various agencies with responsibility for innovation across Government portfolios and different tiers of government (e.g. Australian, state/territory and local) provide information on innovation assistance through designated websites which aim to publicise the range of innovation assistance programs available and improve accessibility.[59]

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56 Department of Education, Science and Training, accessed 13 February 2006, *Interim Report of the Innovation Summit Implementation Group to the Prime Minister's Science, Engineering and Innovation Council,* 2 June 2000, p. 4, <dest.gov.au>.

57 Mr B Peel (AusIndustry), *Transcript of Evidence*, 28 November 2005, p. 3; pp. 11-14.

58 Department of Industry, Tourism and Resources, accessed 12 December 2005, <industry.gov.au>.

59 For example see Queensland Government, *Submission No. 74*, Attachment 1, p. 1; NSW Government, *Submission No. 91*, p. 2; p. 4; Mr B Peel (AusIndustry), *Transcript of Evidence*, 28 November 2005, pp. 11-14; Mr E Arthur (Department of Education, Science and Training), *Transcript of Evidence*, 5 December 2005, p. 11.

3.79 One initiative undertaken by the **National Innovation Council** (NIC)[60] provides a centralised repository of information on its innovation website, which includes a series of links to key innovation assistance and programs available to SMEs through the various Australian Government portfolios and through state/territory governments.

3.80 To further promote the innovation assistance available to businesses, AusIndustry also has a marketing budget which it uses to support advertising and other publicity and promotional activities, including showcasing successful companies that have benefited from AusIndustry innovation assistance.[61]

3.81 Some evidence to the inquiry has revealed the widespread use of similar advisory services and promotional activities such as showcases by state and territory governments to publicise the range of innovation assistance available.[62]

3.82 Despite these initiatives, some evidence has indicated that there are continuing concerns with regard to the complexity of government innovation program frameworks as a consequence of the large number of different support programs available, their administration through a number of different Australian Government departments and across the three tiers of government.[63]

Committee Comment

3.83 The Committee notes concerns expressed, particularly by businesses, with regard to the large number of government innovation programs and associated difficulties in identifying the assistance available. The Committee recognises that the plurality of programs, while posing some difficulties, is a necessary feature of a comprehensive suite of

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60 The National Innovation Council was formed by the Minister for Industry, Tourism and Resources to provide advice to the Australian Government on building an innovative culture in Australia. The Council also provides strategic guidance on how best to communicate the benefits of innovation to small to medium enterprises, youth and the broader community.

61 Mr B Peel (AusIndustry), *Transcript of Evidence*, 28 November 2005, p. 12.

62 Queensland Government, *Submission No. 74*, p. 8; Tasmanian Government, *Submission No. 86*, pp. 8-9. NSW Government, *Submission No. 91*, p. 1.

63 For examples see Anssen Technologies, *Submission No. 13*, p. 1; Momentum Investment Group, *Submission No. 51*, attached report, p. 27; Australian Information Industry Association, *Submission No. 60*, p. 6; SIA, *Submission No. 61*, p. 12; Mr B Morris, *Transcript of Evidence*, 18 May 2005, p. 25.

innovation support to address different innovation needs at various stages of the process and sectoral specific requirements.

3.84 In addition, the Committee emphasises that a clear means of navigating through the range of innovation support is essential. Given the important role of the AusIndustry Small Business Field Officers and the NIC website in assisting businesses to find appropriate innovation support, the Committee suggests that all government agencies involved in supporting business innovation ensure that the assistance available through the AusIndustry hotline number and the AusIndustry/NIC web-based resources is publicised and made readily accessible.

3.85 In this regard, the Committee considers that agencies have demonstrated a generally sound approach to addressing difficulties associated with the complexity of the innovation program framework through the implementation of a range of publicity activities and navigational support initiatives. However, evidence to the inquiry indicates on-going difficulties experienced by some businesses in navigating and understanding the range of innovation assistance initiatives available.

3.86 Therefore, the Committee recommends that the Australian Government enhance promotional activities or consider additional mechanisms to further publicise the program navigational assistance already available through AusIndustry's Small Business Field Officers Program and the NIC website.

3.87 The Committee also considers that there is an onus on industry organisations and peak bodies to publicise and disseminate information to the businesses they represent on the range of government innovation assistance and support available.

Recommendation 1

The Committee recommends that the Australian Government better promote the assistance that is available for businesses to locate the most appropriate innovation support programs.

Increased promotion to be considered includes:

- **the provision of prominent links in all publicity materials and on Australian Government innovation websites to program assistance available through AusIndustry initiatives and the National Innovation Council website; and**
- **disseminating promotional information and liaising more closely with industry organisations and peak bodies.**

The Burden of Application Processes and Reporting Requirements

3.88 Evidence to the inquiry has emphasised the costs to businesses associated with applications for innovation assistance and, if successful, the compliance reporting requirements which are perceived by some to be 'onerous'.[64] Consequently, it has been suggested that accessibility to innovation support may be qualified by requirements that are especially burdensome for SMEs.

3.89 In its submission the Australian Information Industry Association (AIIA), the peak national body representing suppliers of information, communication and technology goods and services, noted:

> Management load in most SMEs is generally significant, without needing to complete excessively onerous processes to access government assistance. Some SMEs feel that government R&D programs are tailored more to larger businesses and are difficult for SMEs to access. Any steps that could be taken to reduce the complexity would encourage

64 For examples see Anssen Technologies, *Submission No. 13*, p. 1; Momentum Investment Group, *Submission No. 51*, attached report, p. 27; Australian Information Industry Association, *Submission No. 60*, p. 6; SIA, *Submission No. 61*, p. 12; Mr B Morris, *Transcript of Evidence*, 18 May 2005, p. 25.

> companies to take a closer look at the business benefits of becoming involved in R&D.[65]

3.90 Similarly, Mr Brett Morris of Neo Technology Ventures, a venture capital firm specialising in start-up and early stage investments in the information, media and telecommunications sectors, explained:

> The feedback we get from potential investee companies that we talk to … is that just trying to understand and access each of those programs individually is tough. It produces a lot of friction, takes a lot of time and is costly. We need to find a way to try to reduce the friction by a better over arching coordination.[66]

3.91 Mr Johansson suggested that the challenges faced by businesses in accessing innovation programs were exacerbated by the different communication styles and language of business and bureaucracy stating:

> ... [business people] go and see the people from COMET and the other government grant people whom you get to meet, and they cannot get the idea across. It just falls; there is a mismatch. So it dies or, more to the point, they try to do it unfunded, and it dies. That is a terrible tragedy. They [business people] find it too hard, and they do not use the right words. That is a big problem.[67]

3.92 Mr David Nelson of Divergent Capital suggested that better coordinated administration could assist in providing more cost effective support with less demands on business:

> If [businesses] had an account manager at AusIndustry who knew your business and knew where you were on the commercialisation pathway, and that you are now eligible for COMET, he could feed the existing information on file for you into that program and see whether it was successful or not. Then you could move forward to the next step, and the next step. It would be more seamless and less of a drain on AusIndustry resources in terms of time as well on the investee company.[68]

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65 Australian Information Industry Association, *Submission No. 60*, p. 6.

66 Mr B Morris (Neo Technology Ventures), *Transcript of Evidence*, 18 May 2005, p. 33.

67 Mr B Johansson (Gazelle Monitoring System), *Transcript of Evidence*, 18 May 2005, pp. 70-71.

68 Mr D Nelson (Divergent Capital), *Transcript of Evidence*, 18 May 2005, p. 34.

Committee Comment

3.93 The Committee acknowledges the cost to businesses associated with applying for government innovation support and strongly advocates simplification of application processes and streamlining of reporting requirements where possible.

3.94 The Committee recognises that any streamlining also needs to balance accountability requirements faced by government departments and agencies with regard to the appropriation and acquittal of public monies.

3.95 Again, the Committee notes initiatives introduced by AusIndustry to simplify innovation support application processes for businesses and streamline reporting requirements. Mr Peel of AusIndustry explained to the Committee:

> We have different [application] forms for each of our programs, because the programs are different. We try to make the front end of the forms as similar as possible for the information that we need to collect. One of our biggest challenges is to make them as simple as possible for the people to fill out. We are bureaucrats, and sometimes we fall into the trap of thinking that people know what we mean by certain terms, so we have hired plain English editors and those sorts of people to help us with the design of the forms.[69]

3.96 Mr Peel also advised the Committee that AusIndustry customer satisfaction surveys, which include questions regarding the complexity of application and reporting forms, have indicated generally high levels of customer satisfaction with the services provided. With regard to feedback from these surveys, Mr Peel stated:

> Some people say to us that the forms are too complex. We take that feedback on board and see what we can do. Others quite regularly say to us, though, 'In filling out the form for that program, you raised with me a range of questions that I would never have thought about and, as a result of considering those questions, I have now got a better understanding of my business and where I want to go... So, yes, on the one hand, we get criticised for the complexity of the forms but, on the other hand, we have equally been

69 Mr B Peel (AusIndustry), *Transcript of Evidence*, 28 November 2005, p. 13.

> complimented for the process that people need to go through.[70]

3.97 With regard to the transportability of company data from one program application to another (as suggested by Divergent Capital), the Committee acknowledges the difficulties this poses in relation to maintaining the currency of information. The Committee urges AusIndustry and other agencies with responsibility for the implementation of innovation programs to consider avenues where this might be possible. The need to ensure the privacy and currency of company information used in program applications would have to be considered.

Coordination and Complementarity of Innovation Support

3.98 The complexity of the innovation program framework raises issues for businesses trying to identify and access appropriate innovation support. It also raises issues with regard to the coordination and complementarity of innovation policy and programs across various tiers of government and between different portfolios.

3.99 As noted previously, innovation support is available from all three tiers of government and the Committee has already commented on the need to better promote the program framework navigational assistance. In considering the complementarities of innovation support available through the Australian Government and state/territory governments, DEST's *Mapping Australian Science and Innovation Report* concluded:

> There are some major areas of complementary interest between the Australian Government and the state and territory governments. Complementarities are particularly evident in research infrastructure and emerging sciences and technologies, where increased cooperation could yield benefits for the national interest.[71]

70 Mr B Peel (AusIndustry), *Transcript of Evidence*, 28 November 2005, p. 14.

71 Department of Education, Science and Training, *Mapping Australian Science and Innovation: Summary Report 2003*, p. 52.

3.100 One submission to the inquiry noted that innovation support from all three tiers of government had been valuable in developing a regional 'knowledge hub', stating:

> Each level of government [Australian Government, state and local] brings a unique perspective, expertise (including that of departmental officers) and funding opportunities that are essential for a project of this magnitude. All three tiers of government share a commitment to strong regions and the importance of developing knowledge based industries where a foundation already exists in which they can flourish. [72]

3.101 Representatives of DITR advised the Committee of regular dialogue and meetings to minimise duplication and ensure complementarity of innovation support available through the Australian Government and through state/territory governments.[73]

3.102 It was also noted that the innovation support available through state/territory governments is generally more directed to very early stage business planning and development, and provides smaller quanta of money than the majority of Australian Government innovation support initiatives.[74]

3.103 Consistent with its role and responsibilities, most innovation assistance at local government level comes in the form of supporting innovation infrastructure, business networks and providing business advisory services. This is well illustrated in the submission received from the Sutherland Shire Council which outlined a number of local initiatives it has implemented.[75]

3.104 In contrast to the apparent complementarities achieved across the three tiers of government, some evidence to the inquiry has suggested that there is scope for improvement with regard to the coordination of innovation initiatives between the different Australian Government portfolios, departments and agencies. For example, Mr Morris of Neo Technology Ventures stated:

> We think there is an opportunity to have better overarching coordination across departments and agencies in relation to

72 University of the Sunshine Coast, *Submission No. 31*, p. 1.

73 Various witnesses (Department of Industry, Tourism and Resources), *Transcript of Evidence*, 28 November 2005, pp. 3-4.

74 Various witnesses (Department of Industry, Tourism and Resources), *Transcript of Evidence*, 28 November 2005, pp. 3-4.

75 Sutherland Shire Council, *Submission No. 92*, pp. 1-6.

> those programs. This would lessen the friction experienced by potential commercialisation entities and allow for better replication of their processes. Potential investees that we are looking at almost have to reinvent themselves every time they go to a different agency seeking assistance, which is expensive, time consuming and complex. We think that coordination could be much more start-up and commercialisation centric, rather than program centric.[76]

3.105 In response to a question from the Committee regarding coordination of Australian Government support programs for innovation, Professor Pettigrew of the National Health and Medical Research Council (NHMRC) expressed the opinion that there needed to be greater dialogue between the agencies responsible for administering the various programs stating:

> We have to get a much better understanding of where our [NHMRC] funding fits into that overall set of schemes. I think there does need to be better coordination of that activity.[77]

Committee Comment

3.106 The Committee notes that evidence to the inquiry has been indicative of innovation support complementarity between the various tiers of government. However, some evidence suggests that there is room for improvement with regard to coordination between Australian Government portfolios with shared responsibility for innovation.

3.107 The Committee also notes the OECD's highlighting of some of the challenges faced by governments striving to achieve coordinated innovation policy that spans portfolio boundaries.[78] The OECD has identified a range of potential impediments to innovation policy integration, including:

> Fragmented governance structures often represent a loss of strategic capacity, and governments should pay more attention to improving mutual understanding of innovation-related issues across ministries.[79]

76 Mr B Morris (Neo Technology Ventures), *Transcript of Evidence*, 18 May 2005, p. 31.

77 Professor A Pettigrew (National Health and Medical Research Council), *Transcript of Evidence*, 12 September 2005, p. 7.

78 Organisation of Economic Cooperation and Development (OECD), *Governance of Innovation Systems: Volume 1, Synthesis Report*, 2005.

79 Organisation of Economic Cooperation and Development (OECD), *Governance of Innovation Systems: Volume 1, Synthesis Report*, 2005, p. 13.

3.108 Clearly Australia is not alone in facing these challenges. With regard to promoting and facilitating the development of coordinated innovation policy, the Committee acknowledges the value of establishing whole-of-government bodies such the Coordinating Committee on Science and Technology (CCST).[80]

3.109 In particular, the Committee notes that membership of the CCST brings together Deputy Secretaries and heads of Australian Government departments and agencies with an interest in science and technology.[81] The Committee also notes one of the CCST Working Group's functions is to:

> Promote consistency, coherence and effectiveness of Australian Government science and technology policy and programmes.[82]

3.110 The Committee considers that, on the basis of evidence presented, more needs be done to improve coordination and complementarity of innovation policies and programs, especially in light of rapidly evolving understandings of the scope of innovation activities.

3.111 Therefore the Committee recommends that the CCST establish a working group to investigate issues associated with the coordination and complementarity of Australia's innovation policy framework and make recommendations for improvements.

3.112 Specifically the working group should consider and make recommendations on strategies or approaches for:

- strengthening cross-portfolio dialogue to enhance whole-of-government understanding of innovation needs; and

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80 Department of Education, Science and Training, accessed 15 February 2006, <dest.gov.au>.

81 Coordinating Committee on Science and Technology membership includes the Chief Scientist of the Australian Government, representatives of Australian Government departments (e.g. Department of Education, Science and Training; Department of Industry, Tourism and Resources; Department of Communications, Information Technology and the Arts; Department of Foreign Affairs and Trade), government agencies (e.g. IP Australia and Geosciences Australia) and of research funding agencies (e.g. Australian Research Council and National Health and Medical Research Council) and publicly funded research agencies (e.g. Commonwealth Scientific and Industrial Research Organisation [CSIRO]); Australian Nuclear Science and Technology Organisation; Defence Science and Technology Organisation; and Australian Institute for Marine Science).

82 Department of Education, Science and Training, accessed 15 February 2006, <dest.gov.au>.

- improving innovation program coordination, particularly with regard to cross-portfolio program continuity and complementarity.

Recommendation 2

The Committee recommends that the Australian Government Department of Education, Science and Training establish a working group to improve the coordination of Australia's innovation policy framework.

Specifically the working group should consider initiatives to:

- **further strengthen cross-portfolio dialogue to enhance the whole-of-government understanding of innovation policy needs; and**
- **improve cross-portfolio program coordination, so as to ensure continuity of support throughout the innovation process.**

4

Human Capital—Knowledge and Skills

4.1 This chapter examines:

- issues associated with falling numbers of students electing to study scientific, engineering and technical (SET) subjects in schools, universities and vocational education and training;
- the shortage of teachers qualified in SET subjects; and
- the need to develop business skills and entrepreneurship among academics and public sector researchers and in the private sector.

4.2 From evidence to the inquiry three consensus issues related to SET skills and business/entrepreneurial skills have emerged.

4.3 **Consensus Issue 1**—Knowledge-based economies, including Australia, are increasingly reliant on access to a well-educated, scientifically literate and technically skilled workforce. Evidence suggests that Australia already has certain skills shortages and may not be able to meet projected skills needs. Specifically, concerns have been expressed regarding:

- numbers of students electing to study SET subjects in schools and the shortage teachers qualifies in SET subjects; and
- numbers of students electing to study SET subjects at tertiary level.

4.4 **Consensus Issue 2**—Business and entrepreneurial skills are critical to successful innovation. Evidence suggests that Australia's private sector does not adequately foster an entrepreneurial culture and has a shortage of high level business skills to support innovation.

4.5 **Consensus Issue 3**—The potential for innovation to emerge from public sector research and development (R&D) and to thrive will be enhanced if researchers have a better understanding of business and commercial imperatives. Evidence suggests that some of Australia's public sector researchers have a poor understanding of business and lack entrepreneurial skills. Addressing these issues will require:

- increased and improved business and entrepreneurial skills education and training; and
- a cultural shift and organisational reform in PFRIs to provide an environment which appropriately values entrepreneurship and rewards the commercialisation achievements of staff.

4.6 Human capital, defined as 'our stock of knowledge, skills and personal attributes embodied in people', has been identified as a critical factor underpinning innovation capability.[1]

4.7 The essential knowledge, skills and personal attributes required to support technological innovation fall within two broad categories:

- scientific, engineering and technical knowledge and skills, including information and communications technology (ICT); and
- business skills and entrepreneurial capacity.

4.8 Emphasising the important and complementary contribution of both skill sets to technological innovation, the Australian Business Foundation (ABF) stated:

> There is mounting evidence from innovation research and case studies that knowledge is becoming an increasingly important factor in business competitiveness and economic growth. This does not just include the knowledge from science and formal research and development, but market intelligence, tacit or technical know-how, knowledge embedded in capital goods, insights from customer and supplier relationships or strategic partners and learning gathered from past mistakes and failures.[2]

1 Department of Education, Science and Training, *Mapping Australian Science and Innovation Report 2003*, p. 188.

2 Australian Business Foundation, *Submission No. 64*, p. 3.

Scientific, Engineering and Technology Skills

4.9 International comparisons of statistical data have shown that Australia performs well against innovation indicators relating to a highly skilled workforce. Specifically, Australia ranks above the OECD average in terms of the percentage of the labour force that has a tertiary education, the proportion of researchers in the labour force and the number of science and engineering graduates in the labour force.[3]

4.10 The conclusion has been drawn from this data 'that Australia is well positioned to take advantage of graduates' ability to adapt and use emerging technologies in a knowledge driven economy.'[4]

4.11 However, several submissions to the inquiry have expressed concern regarding the possible erosion of this position. In particular, concerns were raised that the supply of SET skills may not be growing sufficiently to meet emerging demand, especially within industry.[5]

4.12 Two significant concerns regarding SET education in schools are:

- a reduction in the number of students electing to study SET-based subjects (particularly mathematics and the physical sciences[6]) in senior schooling years; and
- a shortage of adequately trained and skilled teaching staff for SET subjects.

Early Education

4.13 Mr Stan Jeffery of Integrated Company Growth Services (ICGS) and Director of the University of Ballarat Technology Park, suggested that education reform, starting at school level, is required to address deficiencies in business and entrepreneurial skills:

> We should educate our students 'to create a job and not just look for a job'. Even though Australia has a world-class

3 *Australian Government's Innovation Report 2004-05: Real Results Real Jobs*, pp. 14-15.

4 *Australian Government's Innovation Report 2004-05: Real Results Real Jobs*, p. 15.

5 For example see Citrix Systems Australasia R&D , *Submission No. 5*, p. 3; Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 8, Science Industry Australia, *Submission No. 61*, Attachment 1, p. 53; GBC Scientific Equipment, *Submission No. 76*, pp. 4-5.

6 Physical sciences include chemistry, electronics and physics, but exclude biology and psychology.

> education system, we focus on corporate employees following the large corporate model.
>
> To do this will require a change right back in the early education system to reward the trader attributes and create a nation of business people. An important lesson taken away by the author from his five years working with Toshiba in Sydney was that 'everyone is in sales' at least we have to sell ourselves and our unique talents and gifts.[7]

4.14 Similar views with regard to the need for educational reform within schools to enhance innovation and entrepreneurship were also expressed by others, including Dr Batterham,[8] and a representative of the ATSE who stated:

> It is in the education system as a whole where you just have to teach that culture … [W]e teach people to be employees rather than employers. If you do a project at school, you should be asked how you would set up a business to do A, B and C—that type of thing, something that makes people understand what risk is about and how the total thing fits together, rather than just the bits of it that seem to be there at the present time. It is a cultural thing that, unfortunately, we lack a bit in our education system … [9]

4.15 In its submission, the AIA also suggested that there is a need for significant reform of the school system to support the development of 'a culture of scientific and technological entrepreneurship'.[10]

Student Numbers

4.16 The *Australian Government's Innovation Report 2004–05* noted a steady decline over three decades in the numbers of senior year students electing to study mathematics and science subjects. The data show that year 12 enrolments in physics and chemistry have fallen from approximately 30 per cent in 1976 to below 20 per cent by the mid-to-late 1990s. [11]

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7 Mr S Jeffrey, *Submission No. 25*, p. 9.

8 Dr R Batterham (Chief Scientist to 31 May 2005), *Transcript of Evidence*, 30 May 2005, p. 5.

9 Mr P Laver (Australian Academy of Technological Sciences and Engineering), *Transcript of Evidence*, 4 August 2005, p. 35.

10 Australian Innovation Association, *Submission No. 72*, p. 4.

11 *Australian Government's Innovation Report 2004-05: Real Results Real Jobs*, pp. 78-79.

4.17 The consequences for Australia include a potential shortage of people with skills in the physical sciences, engineering and technologies, as well as a reduction in scientific literacy[12] in the population as a whole.

4.18 Both the Australian Academy of Technological Sciences and Engineering (ATSE) and the Australian Geoscience Council (AGC) expressed concern that falling numbers of school students electing to study SET-based subjects will compromise Australia's future capacity for technological innovation.[13]

4.19 The ATSE suggested that arresting the fall in student numbers electing to study SET-based subjects will require reform of the education system at all levels.[14]

4.20 Mr Neil O'Loghlen of GBC Scientific Equipment submitted that:

> There is a real problem in terms of people going into the hard disciplines through tertiary institutions. My personal belief is that in secondary school they are taught: you do not have to do subjects that you do not enjoy.[15]

4.21 Australia's then Chief Scientist, Dr Robin Batterham, submitted that a better understanding among school students of the relevance and potential applications of SET skills in the workplace is required. He suggested that this might be pursued by the introduction of a focused campaign, making use of current undergraduates or recent graduates as 'ambassadors'.[16]

4.22 One submission highlighted the importance of 'learning through doing' in stimulating interest in science and technology, and developing innovation skills in early childhood. The submission emphasised the contribution of science and technology centres outside the school system, such as Questacon.[17]

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12 Scientific literacy is defined by the Organisation of Economic Cooperation and Development (OECD) as the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity.

13 Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 8; Australian Geoscience Council, *Submission No. 71*, p. 10.

14 Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 8.

15 Mr N O'Loghlen (GBC Scientific Equipment), *Transcript of Evidence*, 4 August 2005, p. 60.

16 Dr R Batterham (Chief Scientist to 31 May 2005), *Transcript of Evidence*, 30 May 2005, p. 6.

17 Questacon is the National Science and Technology Centre, located in Canberra. Children's Discovery Museum, *Submission No. 97*, pp. 1-2.

Teacher Shortages

4.23 In evidence to the Committee, concern was expressed regarding 'an emerging shortage of scientifically trained teachers'.[18] The AGC referred to the findings of a 2005 report prepared for the Australian Council of Deans of Science (ACDS) which concluded:

> The shortage of suitably qualified science teachers is likely to be exacerbated in the coming years as the bulge of 'baby boomers' approach retirement age.[19]

4.24 Other key findings from the ACDS report included:

- Nearly 43 per cent of senior school physics teachers lacked a physics major, and one in four had not studied the subject beyond first-year university.
- One in four senior school chemistry teachers lacked a chemistry major.
- The heads of secondary school science departments have expressed concern regarding the difficulty in recruiting suitably qualified staff.[20]

4.25 Among its recommendations, the ACDS suggested that the federal and state governments, as well as secondary and tertiary education authorities 'cooperate across sectorial, state and territory boundaries to develop a national science teacher workforce plan'.[21]

4.26 Dr Batterham suggested that providing higher education contribution scheme (HECS) incentives for students studying SET-based courses at university could increase the pool of suitably trained individuals who may consider teaching SET subjects in schools as a career option.[22]

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18 For example see Australian and New Zealand Association for the Advancement of Science, *Submission No. 2*, p. 3; Royal Australian Chemical Institute, *Submission No. 22*, p. 1 (refers to RACI Report *Future of Chemistry: Supply and Demand of Chemists 2005*); Australian Geoscience Council, *Submission No. 71*, p. 10.

19 Australian Council of Deans of Science 2005, *Who's Teaching Science? Meeting the Demand for Qualified Science Teachers in Australian Secondary Schools*, Executive Summary, p. x.

20 Australian Council of Deans of Science 2005, *Who's Teaching Science? Meeting the Demand for Qualified Science Teachers in Australian Secondary Schools*, Executive Summary, pp. ix-x.

21 Australian Council of Deans of Science 2005, *Who's Teaching Science? Meeting the Demand for Qualified Science Teachers in Australian Secondary Schools*, Executive Summary, p. viii.

22 Dr R Batterham (Chief Scientist to 31 May 2005), *Transcript of Evidence*, 30 May 2005, pp. 9-10.

4.27 A range of measures have been introduced under the Australian Government's *Backing Australia's Ability* policy that are intended to encourage the development of skills in science, mathematics and technology in schools, and to promote high calibre teaching of those subjects.

4.28 These measures include:

- **Fostering Scientific, Mathematical and Technological Skills and Innovation in Government Schools**; and
- **Boosting Innovation, Science, Technology and Mathematics Teaching**.

4.29 The Fostering Scientific, Mathematical and Technological Skills and Innovation in Government Schools program will provide an estimated $373 million over the next four years to assist students at government schools to develop better science, mathematical and technical skills. The program was initiated in 2001 and will now run to 2010–11, subject to a review in 2007–08. [23]

4.30 The Boosting Innovation, Science, Technology and Mathematics Teaching program was introduced in 2004 and will provide $38.8 million in funding over seven years until 2010–11. The initiative comprises a series of measures intended to promote high calibre teaching of science, technology and mathematics subjects.

4.31 These programs are complemented by the **Australian Government Quality Teacher Program**[24], which was introduced in 2000 with an initial budget commitment of $76 million, and was extended in 2003 with an additional commitment of $82 million to 2005.

4.32 The Quality Teacher Program is intended to:

- update and improve teachers' skills and understanding in priority areas, including science and information technology; and

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23 Initiatives funded under this program include: targeted professional support and direct professional development in numeracy and technology (NSW); school-based centres of excellence and programs to expand teacher and student awareness of science, mathematics and technology, and a review of the science curriculum (Queensland); strategy for kindergarten to Year 7 curriculum to integrate learning approaches to technological activities, professional development support for teachers across the curriculum, particularly in mathematics, science and technology (WA); and a program to improve numeracy in Indigenous students in the middle years (Victoria). *Backing Australia's Ability* fact sheet, accessed 30 May 2006, <backingaus.innovation.gov.au>.

24 The *Quality Teacher Program* is available to both primary and secondary school teachers.

- enhance the status of teaching in both government and non-government schools.

4.33 The Quality Teacher Program also includes $10 million for the establishment of the **National Institute of Quality Teaching and Leadership** (NIQTL). The NIQTL initiative was commended by the Australian Innovation Association (AIA) in its submission to the inquiry.[25]

4.34 The NIQTL was established to support and advance the effectiveness and standing of the teaching profession in Australia. In December 2005, the NIQTL—renamed **Teaching Australia**—was launched as a permanent body with a further $30 million funding from the Australian Government over four years.[26]

Committee Comment

4.35 The Committee concludes that the Australian Government is cognisant of the need to encourage students to study SET-based subjects in schools and to enhance the quality of teaching in these subject areas.

4.36 While it will take some time for the Australian Government's current programs to have a demonstrable impact on innovation and commercialisation outcomes, the Committee notes the importance of such forward planning programs, and urges the Government to continue to make a long-term commitment to funding such programs and monitoring their outcomes.

4.37 In addition, there is a need to foster an entrepreneurial culture in Australia, starting in the early school years and continued through into public and private enterprises. The Committee addresses this need later in the chapter as a whole-of-government series of measures to target the development of entrepreneurial skills.

25 Australian Innovation Association, *Submission No. 72*, p. 9; Department of Education, Science and Training, accessed 18 November 2005, <backingaus.innovation.gov.au>.

26 Teaching Australia, accessed 9 December 2005, <teachingaustralia.edu.au>; Department of Education, Science and Training, accessed 9 March 2006, <dest.gov.au>.

Universities

4.38 Some submissions emphasised the importance to technological innovation of having sufficient tertiary educated graduates in SET-based subjects.[27] Concerns were expressed regarding declining numbers of students electing to study SET-based subjects at tertiary level.[28]

4.39 Australian tertiary graduate statistics indicate that the numbers of science and engineering graduates increased steadily during the 1990s. However, as a percentage of new graduates, the combined proportion of science and engineering graduates (21.6 per cent) in Australia is below the OECD average (23.1 per cent).[29] In particular, the percentage of engineering graduates (7.7 per cent) is low relative to the OECD average (11.8 per cent).[30] Foreign citizens comprise 45.7 per cent of total tertiary graduates.[31]

4.40 At the postgraduate level, between 1989 and 2002 the annual number of Australian PhD graduates in science and engineering has more than doubled (from 527 in 1988 to 1273 in 2003). However, as a percentage of Australian PhD graduates in all disciplines, science and engineering doctorates have decreased from 50.6 per cent in 1998 to 35.6 per cent in 2003.[32]

4.41 In addition to concerns regarding the supply of engineering graduates, the Australian Electrical and Electronic Manufacturers' Association (AEEMA) suggested that the quality of engineering degrees in Australia is declining in universities:

> ... engineering programs concentrate more on individual technologies and research rather than the issues involved in

27 For example see Australian Geoscience Council, *Submission No. 71*, p. 10; BHP Billiton, *Submission No. 88*, p. 2.

28 Mr S Jeffrey, *Submission No. 25*, pp. 10-11; GBC Scientific Equipment, *Submission No. 76*, pp. 4–5.

29 Department of Education, Science and Training, *Australian Science and Innovation System: A Statistical Snapshot 2005*, pp. 177; 182.

30 Department of Education, Science and Training, *Australian Science and Innovation System: A Statistical Snapshot 2005*, p. 177.

31 Department of Education, Science and Training, *Australian Science and Innovation System: A Statistical Snapshot 2005*, p. 177. Further breakdown of the percentage of foreign citizens graduating in science and engineering was not available to the Committee.

32 Department of Education, Science and Training, *Australian Science and Innovation System: A Statistical Snapshot 2005*, p. 178. Further breakdown of the percentage of foreign citizens awarded doctorates in science and engineering was not available to the Committee.

> product design and manufacture. The engineering schools in universities are increasingly constrained financially leading to less exposure of the graduates to world-class design tools and the experience of design implementation. As a consequence, the industry professional workforce is ageing and is falling behind in the professionalism applied to its core functions.[33]

Vocational Education and Training

4.42 The vocational education and training (VET) sector provides non-university post–school learning and educational opportunities across a wide range of subject areas. It aims to provide students with technical skills, trades and knowledge to enter the workforce.

4.43 There has been extensive growth and participation in the sector over the last decade. However, data from the National Centre for Vocational Education Research (NCVER) indicated that total student numbers decreased by 7.1 per cent from 2003 to 2004.[34]

4.44 In 2004, engineering and related technologies (16.2 per cent of students) was the second most popular field of education in VET, after management and commerce (20.6 per cent of students).[35]

4.45 In its submission to the inquiry, the NSW Department of Education and Training argued that the contribution of VET to innovation requires greater recognition.[36]

4.46 Using the outcomes of recent research, the submission argued that VET has a low profile in current government innovation policy:

> The VET sector is notably absent from Federal Government policies and programs on innovation and technology diffusion. The VET sector receives scant attention in the principal government statement on innovation policy, *Backing Australia's Ability—An Innovation Action Plan for the Future* (2001) and receives only a few incidental mentions in the comprehensive description of Australia's innovation system,

33 Australian Electrical and Electronic Manufacturers' Association, *Submission No. 30*, p. 9.

34 National Centre for Vocational Education Research, accessed 9 December 2005, 'Students and Courses 2004', *Australian Vocational Education and Training Statistics;* p. 3, <ncver.edu.au>.

35 National Centre for Vocational Education Research, accessed 9 December 2005, 'Students and Courses 2004', *Australian Vocational Education and Training Statistics;* p. 3, <ncver.edu.au>.

36 NSW Department of Education and Training, *Submission No. 58*, pp. 5-6.

Mapping Australian Science and Innovation – Main Report (2003). TAFE is specifically excluded from ABS measures of higher education R&D activity.[37]

4.47 The NSW Department of Education and Training has been involved in managing an Australian National Training Authority (ANTA)[38] national project focused on skills ecosystems.[39] Through this, the department has reached a number of conclusions regarding VET and the national innovation system. These are that:

- National policy should reflect an understanding of the role and potential contribution of VET to the national innovation system. Specifically, VET may have a significant role in supporting the diffusion of new technologies when innovation is viewed as a series of small, widely diffused, incremental changes, as distinct from one or a few major breakthroughs.
- The VET sector should engage with industry earlier in the product/service development cycle, moving beyond a reactive response to already articulated industry training needs (usually manifested through skill shortages or gaps), to involvement with industry in identifying the barriers to take-up of innovation and technology, and in formulating training and skills development strategies to overcome these barriers.
- The VET sector should engage more extensively and intensively with research funding bodies and programs (e.g. the Cooperative Research Centre (CRC) Program, AusIndustry's Registered Research Agency program and the Australian Research Council programs).[40]

4.48 In addition to fundamental SET skills, in certain industry sectors there are specific technology skills shortages that have the potential to adversely affect innovation.[41] The impact of the skills shortage on Australian businesses has been highlighted by a 2006 Australian Industry Group (AIG) survey which reports:

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37 NSW Department of Education and Training, *Submission No. 58*, p. 5.

38 In July 2005, under new administrative arrangements, the Department of Education, Science and Training assumed responsibility for all Australian National Training Authority initiatives and programs.

39 Skills ecosystems are networks of businesses, groups and organisations that interact to create clusters of skills and workforce capabilities in an industry or a region.

40 NSW Department of Education and Training, *Submission No. 58*, pp. 7-8.

41 KCS Pty Ltd, *Submission No. 24.1*, p. 2; Science Industry Australia, *Submission No. 61, Attachment 1,* p. 29.

- Firms think that skill shortages will be a significant threat to their competitiveness over the next three years. Results from the survey show that the inability to secure skilled staff is the potential barrier to success cited most often by employers – in 74 per cent of responses – ahead of competitive pressures at home and abroad.[42]

4.49 The AIG survey also reported:

> Most employers are having difficulty finding at least some of the skills they need, especially tradespeople, technicians and paraprofessionals, and engineering professionals...Many employers also report that they are having trouble accessing the right 'soft' skills, with large numbers of people, including potential apprentices, not having good, solid basic skills (numeracy and literacy), basic employability skills (punctuality, etc), higher level 'soft' skills (willingness to learn, good communication and teamwork skills, problem solving skills) or, often, the right 'attitude'.[43]

4.50 In a supplementary submission to the inquiry, plastics manufacturer KCS outlined the challenges faced as a consequence of the shortage of skilled toolmakers.[44] In response to the skills shortage, KCS made the decision to establish in-house training to develop the required level of tool making expertise.

4.51 While recognising the value of this training to the business, KCS noted that skills training can be costly and risky, particularly as the skills shortage in the plastics and tooling industry means that a company investing in training risks losing the employee once the training is complete. KCS concluded that 'our training investment can be used to improve the business of our competitors!' and that 'better-targeted support for skills development could alleviate some of these costs'.[45]

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42 Australian Industry Group 2006, *World Class Skills for World Class Industries: Summary Report*, p. 2.

43 Australian Industry Group 2006, *World Class Skills for World Class Industries: Full Report,* Executive Summary, p. ix.

44 KCS Pty Ltd, *Submission No. 24.1*, p. 2.

45 KCS Pty Ltd, *Submission No. 24.1*, p. 2.

Skills—Migration Policy and Practice

4.52 In addition to the Australian education system, another factor which has an impact on the supply of SET skills is the balance of skilled labour gains and losses experienced through immigration and emigration.

4.53 In its submission, BHP Billiton emphasised the importance of being able to 'move key personnel across borders' to support the continuity of innovation.[46]

4.54 Some evidence to the inquiry indicated that businesses had experienced difficulties with Australia's immigration policies.[47] For example, i3 Aerospace Technologies reported that it had encountered:

> Immigration policies [that] block the admission of educated, highly experienced technology professionals that seek to live in Australia...[48]

4.55 Specifically, i3 Aerospace Technologies claimed the following with regard to Australia's immigration policy:

> The Aussie immigration point scheme does not value the intellect or education required for innovation, people such as engineers, scientists, mathematicians, physicists and even science teachers. A PhD in electrical engineering or information technology from a top ranked technology university is valued less than an equivalent age hairdresser!! The system doesn't even award more points for more education, or the nature of that education. The age limitations and points attributed to applicants based on age make no sense either. A highly educated person takes longer to gain an education than a tradesman and will likely be productive much longer than a tradesman. The cut off age for immigration should reflect this fact.
>
> The bottom line is that to promote technology innovation and to 'seed' the innovation landscape with experienced technology innovators and entrepreneurs, Australia should welcome and encourage immigration of those with

46 BHP Billiton, *Submission No. 88*, p. 1.

47 i3 Aerospace Technologies, *Submission No. 1*, p. 1; pp. 5-6, Mr R Grey (GBC Scientific Equipment), *Transcript of Evidence*, 4 August 2005, p. 52.

48 i3 Aerospace Technologies, *Submission No. 1*, p. 1.

> exceptional technical training, experience, and know how. It does the opposite.[49]

4.56 Despite these reported difficulties, statistical data for the five years to 2003-04 indicated that, far from experiencing a skills shortage as a result of a 'brain drain', losses of scientists and engineers through emigration have been offset by net gains through immigration.[50]

4.57 Notably, by far the largest net gain through immigration was in the category of ICT professionals. A 2005 Monash University study claimed that Australia's general skilled migration policy, granting residency to overseas students graduating in ICT from Australian universities, has resulted in an oversupply of ICT professionals.[51]

Committee Comment

4.58 The Committee notes that the Australian Government is responding to the need to maintain a strong skills base in science, engineering and technology based subjects through several *BAA* policy initiatives.

4.59 In 2001 *BAA–I* provided $155 million to support an extra 5 470 higher education places in the target areas of ICT, mathematics and science. In 2003 *BAA–II* extended this support with an additional $199.5 million over five years from 2006–07 to provide an extra 2 000 higher education places in these target areas.

4.60 While it is too early to fully assess the impact of the *BAA* measures introduced to increase the number of graduates in mathematics, the sciences and ICT, the Committee commends the proactive initiatives introduced to date.

4.61 In addition, the **ARC Federation Fellowships** were introduced by the Australian Government to attract highly experienced and skilled scientists to Australia. [52] The ARC noted that 69 Federation Fellowships have been awarded to date, including 21 to returning expatriate Australians and seven to foreign nationals.[53]

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49 i3 Aerospace Technologies, *Submission No. 1*, pp. 5-6.

50 Department of Education, Science and Training, *Australian Science and Innovation System: A Statistical Snapshot 2005*, p. 185.

51 B Kinnaird, 'The Impact of the Skilled Migration Program on Domestic Opportunity in Information Technology', *People and Place*, vol. 12, no. 4, 2005, pp. 67-79.

52 Australian Research Council, *Submission No. 19*, pp. 8-9.

53 Australian Research Council, *Submission No. 19*, p. 8.

4.62 The Committee is also aware that the Australian Government, through the Department of Education, Science and Training (DEST), is conducting a comprehensive audit of SET skills in Australia. The skills audit is being conducted in response to concerns expressed by industry and the academic research community 'that the supply of skills from the education and training system may not be adequate to meet current or future demand for skills.'[54]

4.63 Specifically the skills audit will assess:

> The extent to which Australia's current and future industry and research body needs are being met by the higher education and VET sector in the supply of SET graduates. In particular, it will provide an understanding of where shortages lie and examine:
>
> - the supply of SET skills from all training and education sectors and report on supply trends;
> - public and private sector demand for SET skills from industry, the research community and education providers, both now and into the future;
> - how successful the education sectors are in meeting existing SET skill needs and responding to emerging needs; and
> - the long and short-term trends in the emigration and immigration of SET graduates and the impact this 'brain gain, brain drain' issue will have on Australia's skills base —particularly as we face an ageing workforce and countries with greater research expenditure. Global demand for skills in these fields will also be analysed.
>
> The audit will consider the supply of and demand for science skills across a broad range of SET disciplines and conduct case studies of specific industries.[55]

4.64 The Committee considers the conduct and scope of the skills audit to be both timely and pertinent. In particular the Committee notes that the information obtained regarding future supply of, and demand for, SET skills will enable the Australian Government to further refine existing policies to maximise their alignment with current and emerging needs.

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54 Department of Education, Science and Training, accessed 13 December 2005, *Audit of Science, Engineering and Technology Skills: Discussion Paper,* April 2005, pp. 4-5, <dest.gov.au>.

55 Department of Education, Science and Training, accessed 13 December 2005, *Audit of Science, Engineering and Technology Skills: Discussion Paper,* April 2005, p. 5, <dest.gov.au>.

4.65 With regard to industry specific skills shortages, the Committee notes the Australian Government's *National Skills Shortages Strategy*, which includes initiatives intended to identify skills shortages and implement measures to address workforce skills needs.[56]

4.66 The Committee also notes measures in the 2006–07 Budget intend to alleviate difficulties faced by employers in accessing a range of skills by implementing a national approach to apprenticeships, training and skills recognition. Under the national approach:

> The Australian Government will collaborate with the states and territories on a programme to fund the development of integrated strategies and solutions to labour market needs in selected regions and industries of strategic importance to the Australian economy. [57]

4.67 In particular, mutual recognition of trade skills and licences across states and territories result in greater portability of qualifications, and lead to a mobile workforce with the capacity to respond more effectively to regional skills shortages.[58]

4.68 In addition, the Committee notes the 2006–07 Budget commitment to improving data collection and sharing with regard to skills shortages between the governments. This will facilitate the identification of skills shortages and the development of appropriate responses to address them.[59]

4.69 With regard to concerns expressed in relation to the low profile of the VET sector in Australian Government innovation policy, the Committee notes the July 2005 transfer of responsibility for VET from ANTA to DEST as part of new administrative arrangements.

4.70 The Committee believes that, with the transfer of responsibility for VET to DEST, the profile and contribution of the VET sector will receive appropriate recognition in the Government policy framework.

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56 Department of Education, Science and Training, accessed 27 January 2006, <getatrade.gov.au>.

57 Australian Government 2006, *Budget 2006-07, Budget Paper No. 2*, p. 155.

58 Australian Government 2006, *Budget 2006-07, Budget Paper No. 2*, p. 155.

59 Australian Government 2006, *Budget 2006-07, Budget Paper No. 2*, p. 155.

4.71 The Committee also notes the introduction of *Shaping our Future: Australia's National Strategy for Vocational Education and Training (VET) 2004–2010.*[60] The National Strategy is Government and industry's collective strategy for VET, to ensure that industry will have a highly skilled workforce to support strong performance in the global economy, and that communities and regions will be strengthened economically and socially through learning and employment.

4.72 Implementation of the National Strategy will be reviewed periodically with a formal progress report produced in 2008 and a final evaluation in 2011.

Business and Entrepreneurial Skills

4.73 One of the most prevalent themes in submissions to the inquiry relates to the critical importance of business and entrepreneurial skills to innovation and commercialisation. [61] This applies to innovation in both the private and public sectors.

4.74 For example, the Queensland Government stated:

> The innovation process also requires skills and experience in bringing new products, processes and services to the market place. While scientific and technical skills are required, entrepreneurial, commercialisation, regulatory, patenting, manufacturing, marketing, financing, management and other business skills are also crucial for success.[62]

4.75 Evidence to the inquiry overwhelmingly suggested that Australia lacks people with adequate high level business skills[63] and an entrepreneurial culture[64] supported by skilled and experienced entrepreneurs.

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60 Department of Education, Science and Training, accessed 12 December 2005, *Shaping Our Future*: *Australia's National Strategy for Vocational Education and Training (VET) 2004-2010,* <dest.gov.au>.

61 For example see Australian Institute for Commercialisation, *Submission No. 29*, p. 21; Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 6; Queensland Government, *Submission No. 74*, p. 4.

62 Queensland Government, *Submission No. 74*, p. 4.

63 Business skills include financial management, marketing and sales, intellectual property management, and human resources and management.

64 Entrepreneurial skills are directed toward the identification and screening of opportunities with potential commercial value, as well as the alibility to liaise with the

4.76 In his submission, Mr Scott-Kemmis highlighted the findings of the 1995 Karpin report[65] which reviewed private sector management in Australia. The major findings of the Karpin report were that:

> ... the best of Australia's managers and enterprises are equivalent to the best in the world, but there are too few of them—there is a long tail of poor performers trailing out behind the front runners.
>
> ... in general, while Australian managers have acknowledged strengths, they also have distinct weaknesses, and...these tend to cluster in those areas which are most critical for the successful manager and business profile for the 21st century. These areas include leadership including teamwork and empowerment, people skills including management of a diverse workforce, strategic skills, a learning focus, and international orientation.[66]

4.77 Some submissions emphasised the lack of a strong marketing and sales culture in Australia.[67] As stated by GRP Technology in its submission:

> As Australians we don't have a good marketing CULTURE. Neither do the English / Europeans. The Americans do – it's a way of thinking— the best 'mousetrap' does not win. The best marketed one does win. We need to recognise this issue and do something about it.
>
> We need to educate our innovators that if they don't pay attention to marketing they may as well not bother! Get this silly idea out of their heads that the 'best' product will win.[68]

4.78 A *Westpac Global Entrepreneurship Monitor* (GEM) study reported that:

> ... Australia's national entrepreneurial performance is mediocre...[W]hen it comes to entrepreneurship, we are a nation of quiet under-achievers.[69]

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business community and secure venture capital. Entrepreneurship also encompasses personal attributes such as perseverance, courage, vision, enthusiasm and leadership.

65 D Karpin, 1995, *Enterprising Nation: Renewing Australia's Managers to Meet the Challenges of the Asia-Pacific Century*, Report of the Industry Task Force on Leadership and Management Skills (the Karpin Report), Australian Government Publishing Service, Canberra.

66 Mr D Scott-Kemmis, *Submission No. 99*, pp. 9-10.

67 For example see ACS, *Submission No. 38*, p. 3; GRP Technology, *Submission No. 45*, p. 7.

68 GRP Technology, *Submission No. 45*, p. 7.

4.79 Some submissions suggested that awareness and skills on both sides of the research–industry divide are required for innovative capacity to be maximised.[70] As stated by DEST in its submission:

> Awareness too, for both industry and researchers, to understand the other's environment and culture, to have the capacity to be able to work and understand the constraints of each other's field is an important skill. There is also a demand for commercialisation experts with experience in scientific fields.[71]

4.80 Similarly, while noting the importance of a technologically skilled workforce, Dr Batterham emphasised the necessary complementarity of business skills stating:

> We must also ensure that the [science and technology based] skills that our investment into R&D brings to the mix are married with business skills focussed on industry needs … [72]

4.81 Commenting on the inadequacy of entrepreneurship in Australia, i3 Aerospace Technologies noted that cultural change will be a slow process, stating:

> A major push over many years will be required to help entrepreneurs and SMEs to develop and demonstrate their ability to innovate and succeed. Once the culture is seeded with enough success stories of technology businesses that create substantial value, the process will become self-sustaining. Even with a major increase in well thought out government support, Australia is more than a decade away from this point.[73]

4.82 In his submission to the inquiry, Mr Bruce Williams of Park Bench Technology suggested that the links between education and innovation in Australia should be examined.[74] Specifically, Mr Williams submitted that there is a need to take business skills training

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69 K Hindle and A O'Connor, 'Westpac GEM Australia: A Study of Australian Entrepreneurship in 2004', *Australian Graduate School of Entrepreneurship Research Report Series*, vol. 2, no. 1, 2005, Swinburne University of Technology, Melbourne, p. 3.

70 For example see Department of Education, Science and Training, *Submission No. 20*, p. 15; Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 13.

71 Department of Education, Science and Training, *Submission No. 20*, p. 15.

72 Dr R Batterham, *Submission No. 9*, p. 2.

73 i3 Aerospace Technologies, *Submission No. 1*, p. 9.

74 Park Bench Technology, *Submission No. 15*, pp. 1-4.

beyond the traditional Masters of Business Administration (MBA) type degree courses currently available. Mr Williams proposed a 'bottom up' approach to training through the use of business simulation learning tools with the capacity to improve people's ability to identify and address the risks associated with innovation and to enhance communication skills.[75]

4.83 Similarly ATP Innovations stated:

> These [MBA] courses whilst valuable rarely fulfil the needs of those starting a technology based enterprise. It is our experience that MBA graduate[s] starting a business have little relevant knowledge required to sustain their business in the early stage start-up environment.[76]

4.84 Unlike SET skills, which rely heavily on formal education for development, high level business skills are to a greater extent acquired through experience, and aptitude and culture form the basis of entrepreneurship. The experiential and cultural elements of development of business skills and entrepreneurship create particular challenges for government in attempting to address shortages of these skills.

4.85 Nevertheless, evidence to the inquiry has identified key areas that might be targeted in an effort to enhance Australia's business skills and entrepreneurial capabilities. These key areas for skills development include:

- schools and early education;
- the public sector—publicly funded research agencies (PFRAs), universities and the VET sector; and
- the private sector—businesses and industry.

Business and Entrepreneurial Skills Development in the Public Sector—PRFAs and Universities

4.86 The evidence to the Committee identified a general lack of well-developed business and entrepreneurial skills among academics and researchers in publicly funded research settings.[77]

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75 Park Bench Technology, *Submission No. 15*, pp. 2-4.

76 ATP Innovations, *Submission No. 6*, p. 3.

77 For example see Australian and New Zealand Association for the Advancement of Science, *Submission No. 2*, p. 2; Department of Education, Science and Training,

4.87 Several factors have been identified as contributing to the general lack of business and entrepreneurial skills among academics and researchers working in the public sector. In the main these relate to the culture of academia and the lack of real incentives for researchers in the public sector to commercialise their research activities.

4.88 As summarised by DEST:

> ... most university researchers continue to lack the skills and/or the motivation to become entrepreneurs. Part of this issue has been a perceived lack of information regarding commercialisation practices and procedures, another is the culture of the researchers in particular the perception that by commercialising 'you're selling out'. Alternatively they see little real incentive or reward to undertake the commercialisation of their work. And there is no real peer or professional advancement currently associated with commercialisation involvement.[78]

4.89 In relation to the lack of incentives, several submissions suggested that business skills and entrepreneurship among researchers and academics could be enhanced if career paths and promotions were not focused only on academic achievements and publications, but also took into account commercialisation performance where appropriate.[79]

4.90 For example, one of the five most important factors in determining commercialisation success of publicly funded research as listed by Dr John Yencken and Professor Emeritus Murray Gillin was:

> Commitment of the *university governing body* or senior management to research commercialisation giving proper recognition of individual researcher commercialisation performance (alongside teaching research and administration) in award and promotion systems and

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Submission No. 20, pp. 15-16; Dr W Bridge, *Submission No. 39*, p. 3; Australian Geoscience Council, *Submission No. 71*, p. 10; GBC Scientific Equipment, *Submission No. 76*, p. 7.

78 Department of Education, Science and Training, *Submission No. 20*, pp. 15-16.

79 Australian and New Zealand Association for the Advancement of Science, *Submission No. 2*, p. 2; Department of Education, Science and Training, *Submission No. 20*, p. 16; Dr J Yencken and Professor Emeritus M Gillin, *Submission No. 41*, p. 3; Australian Innovation Association, *Submission No. 72*, p. 10; Council for Humanities, Arts and Social Sciences, *Submission No. 77, Attachment 1*, p. 33.

> providing adequate resources to its technology transfer and commercialisation group...[80]

4.91 The need to encourage a more fundamental cultural and attitudinal change was highlighted by evidence reporting a negative perception of commercialisation expressed by some public sector researchers.[81]

Skills Development Programs and Initiatives

4.92 Several different approaches have been proposed to support the development of business and entrepreneurial skills among public sector researchers, or to facilitate access to these skills. These include:

- formal business and entrepreneurial skills training;
- experience obtained through academic placements, secondments or sabbaticals in industry and business; and
- access to business and entrepreneurial skills through commercialisation offices or technology transfer offices.

Formal Business Skills and Entrepreneurship Training

4.93 Formal business and entrepreneurship training is currently offered to public sector researchers and academics through a range of courses, programs and workshops. These include:

- specialised business and entrepreneurial skills development courses, including those offered by universities and through state/territory government initiatives[82]; and
- the CRC program.

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80 Dr J Yencken and Professor Emeritus M Gillin, *Submission No. 41*, p. 3. The other four factors were: 'perceived fairness of arrangements for sharing of commercialisation earnings'; 'availability of business development support'; 'access to finance and other resources for intellectual property development'; and 'the level and quality of selectivity relating to opportunities identified, business planning and resources applied before the new venture is let go'. Dr J Yencken and Professor Emeritus M Gillin, *Submission No. 41*, p. 4

81 Department of Education, Science and Training, *Submission No. 20*, p. 16; National Health and Medical Research Council, *Submission No. 81*, p. 10; Council for Humanities, Arts and Social Sciences, *Submission No. 77*, *Attachment 1*, p. 10.

82 For example see Australian and New Zealand Association for the Advancement of Science, *Submission No. 2*, p. 3; ATP Innovations, *Submission No. 6*, pp. 3-4; Queensland Government, *Submission No. 74*, pp. 4-6; Tasmanian Government, *Submission No. 86*, pp. 5-7.

Specialised Business Skills and Entrepreneurship Courses

4.94 With regard to business and entrepreneurial skills training opportunities for researchers and academics, the Group of Eight noted that:

> Recent years have seen an increasing awareness within Australian universities of the importance of entrepreneurship to technological innovation. There has been particularly strong growth in subjects in entrepreneurship directed at students in science, technology and engineering as well as management. The great majority of university researchers are keenly interested in seeing the full potential of their research realised … Programs designed to enhance researchers' commercial skills and tax and other policies offering incentives that encourage researchers to pursue commercial outcomes do have positive results and should be encouraged.[83]

4.95 Evidence to the inquiry has suggested that there are several issues to be addressed with regard to formal business and entrepreneurial skills training, particularly its delivery to students who have elected to study science or technology-based subjects, rather than subjects that are more closely aligned with business and commerce.

4.96 Concern was expressed that embedding business and entrepreneurial skills training within undergraduate science and technology degree courses might compromise the quality of the degree if core elements of the science/technology were removed to make way for the additional components.

4.97 Dr Wallace Bridge stated in his submission on commercialisation training in tertiary education:

> At an undergraduate level, an obvious solution to the education problem would be to include appropriate business focused subjects in the course work and some universities are taking this approach. However, this strategy can potentially result in the technical coursework being diluted to an extent that the students do not receive sufficient training in the actual science.[84]

83 Group of Eight, *Submission No. 62*, p. 5.

84 Dr W Bridge, *Submission No. 39*, p. 4.

4.98 Also of concern was the fact that much of the current entrepreneurship training is offered as non-award short courses or workshops.[85] It was suggested that, as a consequence, 'for a lot of people they [the courses and workshops] do not have the impact'.[86]

4.99 Professor Frank Larkins of the University of Melbourne questioned the value of placing too much emphasis on formal business and entrepreneurial skills education at undergraduate level. Providing further clarification, Professor Larkins explained that his experience was that at undergraduate level the concepts were abstract and not so well absorbed, while at postgraduate level students had a better understanding of the relevance of these skills to innovation, and consequently were more receptive:

> It is a question of relative impact … Certainly our educational experience is that people learn particular skills best when they feel they need them.[87]

4.100 The cost to the university and the resources required for entrepreneurial training in science and technology degrees were also raised as major impediments that need to be considered and addressed.[88]

4.101 As an alternative to embedding business and entrepreneurial skills training into existing undergraduate degrees, there was some support for encouraging more students to undertake double degree courses or additional study for separate awards combining science and technology with business and entrepreneurship education.[89]

4.102 Dr Bridge concluded that:

> DEST must update the current education of PhD science students to include formal training in the essential business skills required to recognise and drive commercial opportunities arising from scientific discovery. Without this training, Australia's scientists will continue to be inadequate in recognising and managing financial, technical and market

85 Dr W Bridge, *Submission No. 39*, pp. 4–5.

86 Ms S Bell (La Trobe University), *Transcript of Evidence*, 4 August 2005, p. 6.

87 Professor F Larkins (University of Melbourne), *Transcript of Evidence*, 4 August 2005, p. 12.

88 Ms S Bell (La Trobe University), *Transcript of Evidence*, 4 August 2005, pp. 6-7; Dr C Day (Melbourne Ventures), *Transcript of Evidence*, 4 August 2005, p. 9.

89 Dr W Bridge, *Submission No. 39*, p. 4; Professor P Pigram (La Trobe University), *Transcript of Evidence*, 4 August 2005, pp. 10-11.

> risk, which will continue to inhibit Australia's ability to become a significant player in the emerging global high technology industry sectors. The preferred model would be a revised APA (Australian Postgraduate Award) scholarship for PhD students that would fund a four year combined PhD/MBA (or similar, specifically designed for scientists).[90]

4.103 One business and entrepreneurial skills training initiative that received support in a number of submissions to the inquiry is the Australian Institute for Commercialisation (AIC)'s Commercialisation Bootcamp.[91] This initiative specifically targets public sector researchers and scientists.

4.104 Dr Rowan Gilmore of the AIC outlined the objectives and structure of the Commercialisation Bootcamp stating:

> It is a program predominantly to try and change the culture of an organisation and to win the hearts and minds of researchers so that they understand that their research may have market outcomes. It is a two-day program in which we start out by talking a little bit about commercialisation and then talk about the value of IP [intellectual property], the potential need to protect IP, and some of the dilemmas that researchers face in terms of publishing versus disclosing research. We bring in successful entrepreneurs who have founded start-up companies themselves. They give their stories. We talk about what venture capitalists are after and we basically describe the potential paths to market, the importance of considering markets if you do want to take IP downstream, the importance of partnerships, the importance of building a team and so on.[92]

4.105 In response to a question regarding the extent to which a short training course, such as the Commercialisation Bootcamp, could influence attitudinal change in the research sector, Mr Alex Blauensteiner of the AIC stated:

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90 Dr W Bridge, *Submission No. 39*, p. 1.

91 ATP Innovations, *Submission No. 6*, p. 3; Cooperative Research Centres Committee, *Submission No. 11*, p. 4; Queensland Government, *Submission No. 74*, p. 3; Tasmanian Government, *Submission No. 86*, p. 7; Ms S Bell (La Trobe University), *Transcript of Evidence*, 4 August 2005, p. 6.

92 Dr R Gilmore (Australian Institute for Commercialisation), *Transcript of Evidence*, 5 September 2005, p. 4.

> I think a two-day boot camp is a starting point. I would not see it as the be all and end all to solving an issue like that. Realistically, you are talking about a massive cultural change within academia, and that is something that is being thrust upon them in one way or another. I think it is going to take a little bit of time.[93]

4.106 Some evidence to the inquiry argued that, as entrepreneurship is essentially innate, it cannot be taught or learned effectively. However it was suggested that entrepreneurship could be better supported by the provision of an environment conducive to the development of entrepreneurial skills in those individuals that demonstrate a natural aptitude.

4.107 Representing the ATSE, Mr Laver argued that:

> Entrepreneurship is a bit like football: you cannot teach it, even if you have some basic skills, but you can actually refine it by doing some things. So I am not exactly sure the academy [ATSE] believes this rush to teach entrepreneurship in universities is quite as productive as it might be.[94]

4.108 Rather than focussing too heavily on formal business and entrepreneurial skills training, the ATSE suggested the introduction of a range of strategies to enhance support for entrepreneurs, including to:

- send young technology graduates overseas for experience, and have policies in place to get them back.
- provide incentives for established overseas companies to provide training opportunities for technological management.
- establish an expatriate register, sponsored by the Government.
- provide assistance to companies to repatriate Australians back to Australia.
- have policies to boost training and mentoring of technological entrepreneurs.[95]

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93 Mr A Blauensteiner (Australian Institute for Commercialisation), *Transcript of Evidence*, 5 September 2005, p. 7.

94 Mr P Laver (Australian Academy of Technological Sciences and Engineering), *Transcript of Evidence*, 4 August 2005, p. 33.

95 Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 6.

Cooperative Research Centres

4.109 As part of its role in building linkages between research and industry, the CRC program has 'a strong education component with a focus on producing graduates with skills relevant to industry needs.'[96]

4.110 Representatives of the CRC Association and of the CRC Committee asserted that postgraduates trained in the CRC operating environment were not only technically trained, but also had well-developed business skills, effectively making them 'workplace ready'.[97]

Experience in Industry and Business

4.111 Another mechanism by which researchers and academics working in the public sector can acquire an improved understanding of business skills and entrepreneurship is through direct experience working in business or industry.

4.112 Support for measures that facilitate the mobility of researchers between PFRIs and industry was expressed in several submissions to the inquiry.[98]

4.113 The Commonwealth Scientific and Industrial Research Organisation (CSIRO) noted that:

> People who have experiences both from industry and from within a research organisation can be especially effective at bridging the divide. Encouraging even more interactions between researchers and people from industry through secondments, joint appointments and other mechanisms could greatly improve technology transfer across the board.[99]

4.114 The AIA identified a number of measures that might facilitate researcher mobility between the public and private sector. These included the introduction of flexible employment contracts for

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96 Department of Education, Science and Training, accessed 16 December 2005, <crc.gov.au>.

97 Cooperative Research Centres Association, *Submission No. 48*, pp. 1-2; Cooperative Research Centres Committee, *Submission No. 11*, p. 4.

98 Australian Research Council, *Submission No. 19*, p. 6; Department of Education, Science and Training, *Submission No. 20*, p. 15; Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 15; Robert Taylor and Associates, *Submission No. 34*, p. 6; Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, pp. 5-6; Australian Innovation Association, *Submission No. 72*, p. 10.

99 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, pp. 7-8.

university researchers allowing them to spend periods away from their institutions to work with R&D companies, and providing science and engineering students with the opportunity to spend time in their final year of study working in the business R&D setting.[100]

4.115 The AIC also supported the introduction of initiatives to 'promote mobility and enable exchanges of staff between government labs, universities and industry', suggesting that government might:

> Develop appropriate incentive schemes, protect tenure (where applicable) and ensure pension rights are unaffected in order to enable such exchanges.[101]

4.116 To address the issue of relatively low levels of mobility of researchers between the public and private sectors in Australia, the National Health and Medical Research Council (NHMRC) introduced **Industry Fellowships** for researchers working within the clinical and biomedical sciences. The NHMRC explained that:

> Industry Fellowships were established to develop the commercialisation skills available to researchers. The objectives of the scheme are to:
>
> - Provide a vehicle for Australian researchers to gain experience in industrial research including project planning, business planning, and knowledge of business and industry dynamics; and
> - Increase knowledge of the commercial aspects of R&D within research institutions.[102]

4.117 The NHMRC reported that the numbers and quality of applications have fluctuated since the scheme was introduced in 2002. Consequently, the NHMRC is considering a range of recommendations to revise the scheme and make it more attractive to both researchers and industry.[103]

4.118 Further, the ARC outlined the role of its **Linkage Projects** scheme as a mechanism to encourage commercial skills development via enhanced mobility:

> Lack of mobility is a significant barrier to collaboration, due in most instances, to inflexible and widely different conditions of employment and remuneration across different

100 Australian Innovation Association, *Submission No. 72*, p. 10.

101 Australian Institute for Commercialisation, *Submission No. 29*, p. 31.

102 National Health and Medical Research Council, *Submission No. 81*, p. 3.

103 National Health and Medical Research Council, *Submission No. 81*, p. 4.

> sectors. One of the best ways to transfer knowledge or technology from the performers to the users of research is to transfer people. Without this capability it becomes very inefficient to transfer knowledge from one organisation to another. The ARC's Linkage Projects scheme is aimed, in part, at trying to 'break-down' this barrier and it has been successful particularly at the postgraduate level. In the last funding round under the scheme, 426 Australian Postgraduate Awards (Industry) were awarded. [104]

4.119 While the NHMRC Industry Fellowships and the ARC Linkage Projects provide opportunities for researchers and academics to obtain experience working in industry, one submission received from a business argued for the introduction of a mandatory period spent working in industry for all public scientists.[105]

Commercialisation and Technology Transfer Offices

4.120 An alternative to developing the business and entrepreneurial capabilities of academics and researchers is to ensure that these skills are accessibly located within PFRA and university commercialisation offices or technology transfer offices (TTOs). Several submissions emphasised the importance of easy access to skilled technology transfer and commercialisation office staff 'to help steer technologies through the commercialisation process'.[106]

4.121 In support of this approach, Dr Yencken and Professor Emeritus Gillin submitted that:

> The Committee may wish to support the initiative of the Australian Institute of Commercialisation in running *boot camps* for academic researchers to increase their ability to find commercial opportunities arising from their research. The literature however draws attention to the danger of turning good researchers into poor entrepreneurs. A recent consultancy for the Department of Education, Science and Training (Yencken and Ralston, 2005) has concluded that the most effective incentive to academic researchers to commercialise their research outcomes and to make available

104 Australian Research Council, *Submission No. 19*, p. 6.

105 Environment Research and Information Consortium Pty Ltd, *Submission No. 28*, p. 10.

106 Melbourne Ventures, *Submission No. 21*, p. 1; Also see Department of Education, Science and Training, *Submission No. 20*, p. 15; Knowledge Commercialisation Australasia, *Submission No. 27*, p. 7; La Trobe University, *Submission No. 35*, pp. 3-4.

> the required opportunity assessment, intellectual property assessment and deal making skills has been the deployment of the right type of business development people close by the researchers, that is in the faculties and research centres.[107]

4.122 Melbourne Ventures, established in 2004 by the University of Melbourne, is an example of a technology transfer company.[108] Specifically Melbourne Ventures provides access to a team which:

> ... assists in the commercialisation of research-based intellectual property by facilitating access to business development expertise, development funds, and management skills to run technology-based start-ups, and secure licences for University Intellectual Property. Our seasoned team has experience in a wide range of commercial environments, and access to all the necessary elements to enable the successful coordination of the commercialisation process.[109]

4.123 In its submission, Melbourne Ventures outlined the assistance provided by its commercialisation team to the establishment of the start-up biomedical company Cryptopharma. Specifically, the commercialisation team provided Crytopharma with support in patent management and strategic business development.[110]

4.124 Some submissions expressed concern that the requisite level of business knowledge was not currently available through many TTOs.[111] The need for adequate funding to enable TTOs to attract and retain appropriately skilled personnel was highlighted by the Group of Eight:

> Skilled commercial managers are highly sought after internationally and are expensive to both attract and keep. Unless adequately resourced, university commercial offices will struggle to employ the calibre of staff required to deliver on the commercial potential of their patent portfolios.[112]

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107 Dr J Yencken and Professor Emeritus M Gillin, *Submission No. 41*, p. 3.

108 Melbourne Ventures, *Submission No. 21*, pp. 1-3.

109 Melbourne Ventures, accessed 24 January 2006, <research.unimelb.edu.au>.

110 Melbourne Ventures, *Submission No. 21*, pp. 2-3.

111 Biomedical Consulting Services, *Submission No. 16*, p. 2; Dr M Sceats, *Submission No. 23*, p. 20, QPSX, *Submission No. 47*, p. 9.

112 Group of Eight, *Submission No. 62*, p. 5.

4.125 Knowledge Commercialisation Australasia (KCA), a body representing the organisational units that provide outreach services for the majority of Australia's universities and for some PFRAs, suggested consideration be given to:

> ... direct support or rebate to the establishment and/or running of a commercialisation technology transfer office.
>
> - Minimum requirements for qualification might be that the university has committed to at least a dedicated resource of 2 full time equivalent (FTE) for three (3) years.
> - For an established office, a separate formula could be developed.[113]

Committee Comment

4.126 The lack of business skills and entrepreneurship apparent among some researchers, scientists and academics in the public sector poses significant challenges for the commercialisation of technological innovation emerging from PFRAs and universities.

4.127 The Committee considers that no single approach will address these issues. Therefore the Committee supports a multi-faceted approach combining all the elements of business and entrepreneurial skills education and training, enhanced mobility between the public and private sectors, and access to business skills through TTOs.

4.128 With regard to formal business and entrepreneurial skills education and access to skills through TTOs, the Committee notes the submissions that consider additional dedicated funding and resources are needed. This forms part of the case made in a number of submissions to the inquiry for government to provide 'third stream funding'.[114] The case for third stream funding is considered by the Committee later in the report (see discussion in chapter five).

4.129 In relation to staff mobility between the public and private sectors, the Committee is concerned that opportunities are limited by institutional and organisational barriers (e.g. limits on the transferability of accrued entitlements, such as leave, and on the ability to continue contributions to some superannuation schemes). In addition, business

113 Knowledge Commercialisation Australasia, *Submission No. 27*, p. 8.

114 'Third stream funding' describes additional funding for universities to support business and community engagement activities. These outreach activities complement universities' two traditional activity sets of teaching and research.

acumen, entrepreneurship and commercial achievements are not always taken into account in promotions within PFRIs.

4.130 The diversity of PFRI structures across Australia means that a 'one-size-fits-all' approach is not appropriate to address the issues of governance, staff priorities, promotion structures and mobility opportunities. However, there are common barriers to an improved culture of innovation, commercialisation and entrepreneurship, and there will be some common responses that can address these impediments.

4.131 Accordingly, the Committee recommends that a study be conducted into appropriate entrepreneurial incentives and new models for rewarding entrepreneurship within PFRIs. The study should consider mechanisms for overcoming jurisdictional issues that hinder the mobility of researchers between the public and private sectors.

4.132 The Committee strongly recommends that PFRIs implement options identified by this study and adapt their governance and incentive structures in line with the outcomes of the study. The Committee considers that, as a prerequisite for building a case for third stream funding, universities must be able to demonstrate that they have maximised their capacity for innovation and opportunities for entrepreneurship within existing resources (see discussion in chapter five).

Recommendation 3

The Committee recommends that the Department of Education, Science and Training, in conjunction with the Australian Vice-Chancellors' Committee and publicly funded research agencies:

- **conduct a study into jurisdictional, promotion, mobility and cultural issues in publicly funded research agencies and universities which may impede an entrepreneurial culture and innovation; and**
- **develop options for universities and publicly funded research agencies to provide governance structures and incentives which encourage business and entrepreneurial skills and commercial outcomes within these organisations.**

4.133 The Committee notes that its comments and recommendations under the heading 'Fostering a Culture of Entrepreneurship in Australia' later in this chapter apply to the public sector as well as the private sector.

Business and Entrepreneurial Skills Development in the Private Sector

4.134 Examining the skills and capabilities sought by innovating businesses in Australia, the ABS *Innovation in Australian Business Survey 2003* revealed that general business and marketing skills were the skills most frequently sought by businesses developing new products, goods or services.[115]

4.135 With regard to developing business skills and entrepreneurial ability in the business setting, experience, complemented by on the job training, and mentorship from experienced entrepreneurs, emerged as important elements.[116]

4.136 The ABS *Innovation in Australian Business Survey* found that most innovative businesses looked to source sought-after skills from people already working in the business, emphasising the importance of experience to the development of skills competency.[117]

4.137 While formal training can provide a basis for the development of business skills, it has been asserted that higher level competency is usually only developed through experience. Reporting on the outcome of the 2003 Symposium in its submission, the ATSE noted that the majority of the speakers had emphasised the importance of 'learning on the job'.[118]

4.138 Of note with regard to supporting the development of business skills in the private sector is the Department of Industry, Tourism and Resources (DITR)'s **Commercialising Emerging Technologies** (COMET) program. The COMET program, introduced in 1999–2000 was described as:

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115 Australian Bureau of Statistics, *2003 Innovation in Australian Business Survey* (ABS 8158.0), p. 50.

116 For example see Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 6; Mr M Cochran, *Submission No. 73*, p. 9.

117 Australian Bureau of Statistics, *2003 Innovation in Australian Business Survey* (ABS 8158.0), p. 50.

118 Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 6.

> ... a competitive grants program that supports early-growth stage and spin off companies to successfully commercialise their innovations by providing access to business services and advice.[119]

4.139 Specifically, COMET business advisers are private sector consultants engaged to assist in the delivery of the COMET program. Business advice is available in the following areas:

- management development including participation in approved management skills development courses;
- engagement of mentors;
- strategic and business planning, including an export strategy if appropriate;
- market research;
- market validity;
- *Intellectual Property* strategy; and
- *Proven Technology* (including finalising *Working Prototypes*).[120]

4.140 Evidence was generally supportive of the COMET program. An independent assessment of the Australian Government innovation programs provided in an attachment to one submission concluded:

> The program that clearly shines here is COMET … It has been directed at very early stage ventures and is the only program to evaluate the potential of the applicant with regard to their perceived entrepreneurial abilities.[121]

4.141 However, the restriction of the scheme to new, start-up companies has been criticised, with some evidence suggesting that the kind of business advice and venture capital raising assistance available through COMET could also be useful to companies that are more established.[122]

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119 IR&D Board, *Submission No. 53*, p. 1.

120 AusIndustry, *Commercialising Emerging Technologies – COMET, Customer Information Guide,* p. 2.

121 Dr J Yencken and Professor Emeritus M Gillin, *Submission No. 41*, *Attachment 1*, p. 14.

122 Environment Research and Information Consortium Pty Ltd, *Submission No. 28*, p. 7; S Hudson and Associates, *Submission No. 80*, p. 11.

Committee Comment

Business Skills in the Private sector

4.142 Despite the critical importance of business skills to successful innovation the Committee notes that data on the number of business/commerce graduates and their contribution to the workforce is not included in DEST's annual *Australian Science and Innovation System: A Statistical Snapshot*.

4.143 The Committee acknowledges that there may be several reasons why data on business skills has not been included in this publication. For example, it may simply reflect the historical absence of business skills data in science and innovation statistics.

4.144 Alternatively, the exclusion of business skills data may be a consequence of the ongoing international debate regarding the range of appropriate innovation indicators and statistics, and concurrent efforts to standardise innovation metrics frameworks. Furthermore, as the development of high level business skills relies more on experience than formal training, objective statistic measures such as graduate numbers are likely to be less informative with regard to Australia's business skills competency.

4.145 In any event, evidence to the inquiry suggested that business skills may be in short supply. DEST's 2003 *Mapping Science and Innovation Report* indicated that Australia does not compare well internationally with regard to formal business and management training, relative to other major industrialised countries.[123]

4.146 Given the importance of business skills to innovation and commercialisation, the Committee considers it essential to have adequate trend data tracking this connection. Accordingly, the Committee recommends DEST include data on business skills in the human resources section of its annual *Australian Science and Innovation System: A Statistical Snapshot.* At a minimum, this data should include information on the number of new business/commerce graduates and their workforce participation rates.

123 Department of Education, Science and Training, *Mapping Australian Science and Innovation Report 2003*, p. 241.

Recommendation 4

The Committee recommends that the Department of Education, Science and Training expand its annual *Australian Science and Innovation System: A Statistical Snapshot* to include the following data:

- **the number of students with combined science, engineering, technology/business/commerce degree qualifications;**
- **state and territory breakdowns of science, engineering, technology graduates;**
- **breakdown by subject and qualification of the number of foreign citizens with science, engineering, technology qualifications graduating from Australian universities; and**
- **science, engineering, technology graduate workforce participation rates.**

4.147 The Committee recognises the challenges faced by businesses in supporting the ongoing development of business and entrepreneurial skills. The Committee notes that DITR's COMET program is targeting business skills development in new start-up companies to enhance competency in these areas. The Committee was impressed by the strong support for the COMET program, which evidently addresses a business need for mentoring and market advice.

4.148 While the need for business skills mentoring may be most pronounced in start-up companies, it is certainly not restricted to start-up companies. During inspections conducted in the course of its inquiry, members of the Committee had informal discussions with representatives of a number of companies who referred to the difficulties experienced, and mistakes made, due to a lack of business knowledge and skills.

4.149 In considering whether the mentoring and marketing advice available through COMET should be extended to more established companies, the Committee notes the recent introduction of another DITR initiative—the **Small Business Entrepreneurship Program** (SBEP).

4.150 SBEP is intended to provide skills development, incubation and advisory services to small business owners and managers throughout Australia. Applications for funding under the SBEP were called for in November 2005 and the successful applicants will be announced in 2006.[124]

4.151 The Committee considers that the SBEP should serve a similar purpose for established businesses as COMET provides for start-ups. The Committee anticipates that the effectiveness of the program will be assessed as part of routine monitoring activities.

Fostering a Culture of Entrepreneurship in Australia

4.152 The Committee acknowledges the importance of entrepreneurial skills to innovation, technology transfer and the commercialisation process. Evidence has suggested that, in addition to fundamental reform at all levels of the education system, a cultural shift is required.

4.153 The Committee notes that the Australian Government, through DEST and DITR, currently supports a range of initiatives under the **National Innovation Awareness Strategy** (NIAS). The NIAS aims to raise awareness among young Australians, SMEs, and the broader community of the economic benefits of innovation and entrepreneurship.[125]

4.154 Given the clear association between entrepreneurship and innovation, and the need for Australia to match global efforts in this area in order to improve, or at least maintain, productivity and economic wealth, promoting cultural shift to develop a culture of entrepreneurship must be considered.

124 Still to be announced at time of writing. AusIndustry, accessed 30 May 2006, <ausindustry.gov.au>.

125 Department of Industry, Tourism and Resources, accessed 21 December 2005, <innovation.gov.au>.

4.155 While the *BAA* framework of programs is commendable for the support it provides for R&D, the Committee concludes that Australia must now foster the culture of innovation and generation of innovators that can maximise the considerable investment of *BAA*.

4.156 Fostering a culture of entrepreneurship is a critical early step in improving Australia's pathways to innovation. It is also a challenging task for government. Formulating a program by which a government might foster such a cultural shift and engender a more entrepreneurial culture, requires the expertise of educators, researchers, industry specialists and social theorists at a minimum.

4.157 Accordingly, the Committee recommends that a whole-of-government taskforce be established to investigate a suite of appropriate policy and program measures to foster national culture of entrepreneurship.

Recommendation 5

The Committee recommends that the Australian Government establish a dedicated whole-of-government taskforce to develop a series of measures targeting the early development of entrepreneurial skills in the education system (including the early school years) and the broader community. To inform the development of these measures, the Committee recommends that the taskforce draw upon the expertise of educators, researchers and industry specialists.

5

Connecting Knowledge, People and Markets

5.1 This chapter examines:

- options for the management of knowledge and intellectual property (IP);
- knowledge transfer through engagement between publicly funded research institutions (PFRIs) and businesses; and
- knowledge transfer through business to business collaborations and linkages.

5.2 Three consensus issues have emerged from evidence relating to knowledge management and transfer.

5.3 **Consensus Issue 1**—Appropriate management of knowledge and IP (i.e. knowing when to share knowledge, and when to use appropriate informal or formal mechanisms for the protection of IP) is required to support innovation. Despite a robust IP legislative framework, evidence suggests that:

- PFRIs need to adopt a more strategic and consistent approach to IP management; and
- some public and private sector organisations experience difficulties with the process, cost and enforcement of formal IP protection.

5.4 **Consensus Issue 2**—Public sector engagement with industry is a key element to innovation, facilitating knowledge transfer through linkages and collaborations. Evidence suggests that public sector engagement with the private sector could be enhanced by:

- addressing structural and cultural incompatibilities between public and private sector organisations which act as impediments to establishing linkages; and
- the provision of designated or third stream funding to public sector organisations to support outreach activities.

5.5 **Consensus Issue 3**—Linkages and collaboration between businesses is important in supporting and facilitating innovation. Evidence suggests that proximity matters, and that business collaborations can be encouraged through appropriate support for the development of industry clusters.

Intellectual Property Management

5.6 The importance of appropriate and effective management of IP has been emphasised in evidence. Protecting and increasing the value of IP is complex and can be achieved either through informal non-legislative means (i.e. trade secrets or confidentiality agreements) or formal legislative means (i.e. patents, trade marks, designs and plant breeders' rights).

5.7 The choice between formal or informal means of IP protection is influenced by a range of factors including sector specific factors, time to market, the availability of resources and the nature of the IP itself.[1]

5.8 As noted by Mr Scott-Kemmis with regard to intellectual property and patents:

> In most cases the capacity to capture the returns to innovation has more to do with a firm's overall competitive capacity and perhaps their speed to market than with their control of IP. In some sectors, such as pharmaceuticals and instruments, patenting plays a key role in appropriation but this is not the general rule.[2]

1 GRP Technology, *Submission No. 45*, p. 8; Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 5; Department of Industry, Tourism and Resources, *Submission No. 82,* pp. 19-20; Flavourtech, *Submission No. 84*, p. 2; AWS Clinical Waste, *Submission No. 63*, p. 3.; Mr D Scott-Kemmis, *Submission No. 98*, p. 8.

2 Mr D Scott-Kemmis, *Submission No. 98*, p. 8.

5.9 The Australian Bureau of Statistics (ABS) *Innovation in Australian Business* survey found that informal methods of IP protection were used by 36.6 per cent of innovating businesses, while formal methods were used by 21.5 per cent.[3]

Informal Intellectual Property Protection

5.10 A number of submissions highlighted a range of informal non-legislative strategies for protecting IP, including confidentiality agreements.[4] AWS Clinical Waste advised that patents were not an effective form of protection for its technology due to the resources, time and money required and also because the 'technology has developed too fast for the patent process to be relevant'.[5] Instead, AWS found that:

> Confidentiality is vitally important to AWS and protection of our intellectual property has been through copyright of documents, drawings, software, illustrations and other IP, more along the lines of corporations such as Microsoft and Coca Cola rather than through patents.[6]

5.11 While emphasising that IP is its greatest asset, Flavourtech explained its preference for an informal approach to IP protection. With regard to patents Flavourtech stated:

> Their principal value seems to be as a deterrent. If it ever came to having to defend a patent in court the strategy will have, in a sense, already failed. The main function of patents is to reassure customers and to deter competitors. The size of our company relative to that of any adversary could be a significant disadvantage if wanting to pursue any patent infringements. The danger is that we could find ourselves spending all management time in court instead of running the business.[7]

3 Australian Bureau of Statistics, *2003 Innovation in Australian Business* (ABS 8158.0), p. 57.

4 GRP Technology, *Submission No. 45*, p. 8; Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 5; Flavourtech, *Submission No. 84*, p. 2; AWS Clinical Waste, *Submission No. 63*, p. 3.

5 AWS Clinical Waste, *Submission No. 63*, p. 3.

6 AWS Clinical Waste, *Submission No. 63*, p. 3.

7 Flavourtech, *Submission No. 84*, p. 2.

5.12 Instead, Flavourtech explained that it employs confidentiality agreements with all customers, and advised that no substantive interaction occurs until a confidentiality agreement is in place.[8]

5.13 Evidence also noted that the strategies of continued research and development (R&D) were often commercially more relevant and successful than the legislative approach.[9]

Formal Intellectual Property Protection

5.14 Formal IP protection in Australia (including patents, trade marks, designs and plant breeders' rights) is granted through IP Australia, an Australian Government agency in the Industry, Resources and Tourism portfolio. Describing the incentives to innovation provided by formal IP protection, the Department of Industry, Tourism and Resources (DITR) explained:

> The main purpose of a patent system is to stimulate industrial invention and innovation by granting limited monopoly rights to inventors in return for full disclosure to the public of the invention, thereby increasing public availability of information on new technology.[10]

5.15 Applications for patents must be filed with the Patent Office, which forms part of IP Australia. Applications must fully describe the invention and state the scope of the desired patent rights. To be patentable, the claims must satisfy threshold tests relating to novelty and usefulness as prescribed under the *Patents Act 1990*.[11]

5.16 Processing an application involves a number of stages including:

- receiving the application;
- processing formalities;
- examination;
- acceptance;
- opposition hearing if requested;
- patent grant; and
- fees for renewal. [12]

8 Flavourtech, *Submission No. 84*, p. 2.

9 KCS Pty Ltd, *Submission No. 24*, p. 7; Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 5; Flavourtech, *Submission No. 84*, p. 2; AWS Clinical Waste, *Submission No. 63*, p. 3.

10 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 17.

11 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 17.

12 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 18.

5.17 In Australia, a **standard patent** lasts for up to 20 years, with a possible five year extension for pharmaceuticals. Annual fees are payable from the fifth year and increase from the fifth anniversary to the twentieth anniversary.[13]

5.18 IP rights are granted by each country independently and have effect only in that country.[14] However, Australia is a signatory to a number of international treaty agreements which can reduce the complexity of the international application process. Two such treaties/agreements are the Patent Cooperation Treaty (PCT) and the Trade Related Aspects of Intellectual Property Agreement (TRIPS).

5.19 PCT provides a means of commencing patent applications in all 126 signatory countries. IP Australia acts as the receiving office, the international search authority and international preliminary examining authority under the PCT.[15]

5.20 The multilateral TRIPS agreement requires:

> … minimum standards for IP protection for countries to become members of the World Trade Organisation and the World Intellectual Property Organisation (WIPO).[16]

5.21 In addition, IP Australia cooperates with a number of international bodies to ensure that the Australian IP system is closely aligned to international IP systems, thereby streamlining processes.

Issues Relating to the Australian Intellectual Property System

5.22 Submissions highlighted a range of issues relating to the current IP system in Australia. These issues include:

- a perceived lack of strategic and consistent IP management in Publicly Funded Research Institutions (PFRIs); and

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13 Department of Industry, Tourism and Resources, *Submission No. 82*, pp. 17, 18; IP Australia, accessed 15 December 2005, *The Patents Guide: The Basics of the Patent System in Australia Explained*, p. 9, <ipaustralia.gov.au>.

14 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 16; Dr I Heath (IP Australia), *Transcript of Evidence*, 28 November 2005, p. 25.

15 IP Australia, accessed 22 December 2005, <ipaustralia.gov.au>.

16 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 16.

- specific problems with patent application and registration processes including:
  - ⇒ timeframes associated with patent application and registration;
  - ⇒ cost burden of patent application, registration and maintenance;
- concerns with Australia's IP schemes and the underlying legislative/regulatory framework, including:
  - ⇒ the cost and effectiveness of IP protection and enforcement;
  - ⇒ the effect of the current IP legislative framework on competition; and
- the lack of an adequate IP skills base.

Intellectual Property Management in Publicly Funded Research Institutions

5.23 Australia's approach to protecting IP originating from its PFRIs allows ownership of IP emerging from Government funded research to be retained by the institution in receipt of the research funds.[17]

5.24 The NHMRC also noted the 2001 *National Principles of Intellectual Property Management for Publicly Funded Research*, explaining that:

> The main focus of the National Principles is to assist researchers, research managers and their research institutions, in ensuring that they have access to best practices for the identification, protection and management of IP, and therefore, to maximise the national benefits and returns from public investment in research.[18]

5.25 However, beyond this framework, the specifics of IP management within individual PFRIs are determined on the basis of internal institutional/organisational policies.[19]

5.26 While it is recognised that PFRIs need the flexibility to 'develop their own IP policy to reflect the agency's IP and management processes'[20],

17 National Health and Medical Research Council, *Submission No. 81*, p. 6.

18 National Health and Medical Research Council, *Submission No. 81*, p. 6.

19 La Trobe University, *Submission No. 35*, p. 5; University of Melbourne, *Submission No. 52*, p. 6; Rural Research and Development Corporation Chairs Committee, *Submission No. 54*, p. 11; National Health and Medical Research Council, *Submission No. 81*, p. 6; Defence Science and Technology Organisation, *Submission No. 83*, p. 8.

20 Queensland Government, *Submission No. 74*, p. 4.

it has been argued that overall management of IP could be improved with greater consistency of IP management policies across PFRIs.[21]

5.27 Specifically, it has been suggested that improvements in PFRI IP management can be achieved with regard to the following:

- assessment and maintenance of existing IP;
- the strategic screening and identification of IP commercial opportunities; and
- the clarity of IP ownership, especially when commercialisation of IP follows on from collaborative undertakings.[22]

5.28 Evidence has suggested that PFRIs need to adopt a more strategic and analytical approach with identification of IP commercial opportunities. As one company specialising in the commercialisation of IP assets from research institutes observed:

> After reviewing the patent portfolios of major research organisation[s] we found many patents that have little commercial potential continue to be advanced through the costly patenting process. Often patents are maintained for the wrong reasons, such as maintaining inventor vanity, boosting commercialisation statistics or purely through lack of commercial assessment.[23]

5.29 Evidence has highlighted the dilemma facing researchers in PFRIs as a result of tension between the desire to publish research results in academic literature and the risk associated with premature disclosure of new IP that might compromise its commercial value.[24] The Department of Education, Science and Training (DEST) concluded that:

> The critical issue, however, is that researchers, their institutions and their commercial partners need to take a

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21 Australian and New Zealand Association for the Advancement of Science, *Submission No. 2*, p. 2; Department of Education, Science and Training, *Submission No. 20*, p. 16; KCA, *Submission No. 27*, p. 6; Group of Eight, *Submission No. 62*, p. 6; Australian Innovation Association, *Submission No. 72*, p. 8; Council for Humanities, Arts and Social Sciences, *Submission No. 77*, Attachment 1, p. 32.

22 Memtec, *Submission No. 42*, pp. 5-6; GBC Scientific Equipment, *Submission No. 76*, p. 7; National Health and Medical Research Council, *Submission No. 81*, p. 7.

23 QPSX, *Submission No. 47*, p. 4.

24 Australian and New Zealand Association for the Advancement of Science, *Submission No. 2*, p. 2; Department of Education, Science and Training, *Submission No. 20*, p. 15; Mr S Jeffrey, *Submission No. 23*, p. 3.

> strategic approach to patenting and licensing, to ensure that they do not close off the opportunity to patent through premature publication, nor impede the innovation process by creating excessive secrecy around an idea, discovery or invention.[25]

5.30 The Australian and New Zealand Association for the Advancement of Science (ANZAAS), noted that promotion pathways in universities remain heavily influenced by publications, but acknowledged that commercial outcomes were increasingly recognised. ANZAAS suggested that incentives for academics to pursue IP commercialisation could be enhanced by a more consistent assessment regime for 'non-published achievement'.[26]

5.31 Recent amendments to Australia's IP system have included the provision of a 12-month grace period to protect a patent application against invalidation by self-publication or prior public use of the invention.[27]

5.32 With regard to ownership of IP a number of submissions stated that PFRIs need to give early consideration to appropriate co-ownership provisions. Some submissions emphasised the importance of rewarding individual researchers or research teams.[28] It was suggested that full or partial transfer of IP rights from the research institution to individual researchers or research teams might be a means to promote innovation.[29]

5.33 Evidence also indicated that when IP has been developed in collaboration with private industry, IP co-ownership agreements need to be established at the outset.[30] Submissions from a number of PFRIs and research funding agencies indicated that they have already adopted this approach, emphasising the need to negotiate IP

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25 Department of Education, Science and Training, *Submission No. 20*, p. 15.

26 Australian and New Zealand Association for the Advancement of Science, *Submission No. 2*, p. 2.

27 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 19.

28 Australian Geoscience Council, *Submission No. 71*, p. 9; Australian Innovation Association, *Submission No. 72*, p. 8.

29 Biomedical Consulting Services Pty Ltd, *Submission No.* 16, p. 4; Professor T Cole, *Submission No. 40*, p. 3.

30 Australian Research Council, *Submission No. 19*, p. 6; Australian Geoscience Council, *Submission No. 71*, p. 9; Department of Industry, Tourism and Resources, *Submission No. 82*, p. 19.

ownership rights on a case by case basis in advance of embarking on a collaborative project.[31]

5.34 To ensure that individual researchers and private industry partners' interests are addressed, some submissions called for consistent IP guidelines for all PFRIs.[32]

5.35 Evidence has suggested that an effective system of identifying IP assets held within PFRIs might enhance opportunities for the development of IP with commercial potential.[33]

5.36 In this regard the Queensland Government noted that:

> A whole-of-government IP register is currently in development to record significant IP assets within agencies. Industry will be able to access this register to assess opportunities and value-add to Queensland Government-developed IP.[34]

5.37 Submissions from two companies suggested that the opportunities for commercialisation of IP generated from PFRIs could be enhanced if access to IP emerging from PFRAs was made more readily available to domestically based private enterprise.[35]

Committee Comment

5.38 On the basis of evidence, the Committee considers that there is scope for PFRIs to adopt a more strategic approach to IP management based upon clear and consistent IP management guidelines.

5.39 As noted earlier, guidance on IP management best practice for PFRIs is provided by the *National Principles of Intellectual Property Management for Publicly Funded Research.* Specific arrangements for managing IP within individual PFRIs are determined by internal institutional policies.

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31 For example see Meat and Livestock Australia, *Submission No. 4*, p. 5; National Health and Medical Research Council, *Submission No. 81*, p. 7.

32 Knowledge Commercialisation Australia, *Submission No. 27*, p. 6; Group of Eight, *Submission No. 62*, p. 6; Australian Innovation Association, *Submission No. 72*, p. 8; Council for Humanities, Arts and Social Sciences, *Submission No. 77*, Attachment 1, p. 32.

33 Australian Innovation Association, *Submission No. 72*, p. 8; Queensland Government, *Submission No. 74*, p. 4.

34 Queensland Government, *Submission No. 74*, p. 4.

35 Environment Research and Information Consortium Pty Ltd, *Submission No. 28*, p. 10; DSTC Pty Ltd, *Submission No. 69*, p. 5.

5.40 The Committee recognises that IP management is complex. Difficulties can arise in determining the appropriate timing and means of IP disclosure, and also in determining equitable IP ownership arrangements and IP management and protection.

5.41 With regard to universities, the Committee notes that the issue of IP management was considered in the 2004 BCA and Australian Vice-Chancellors' Committee (AVCC) commissioned report, *Building Effective Systems of the Commercialisation of University Research*. This advocates the need for a clear policy or framework on the ownership and management of IP policies.[36]

5.42 While generally supportive of the calls for more consistent IP guidelines for PFRIs, the Committee recognises that flexibility across PFRIs is also important. Therefore, the Committee maintains that PFRIs must take the initiative in developing IP guidelines suited to their endeavours.

5.43 While appreciating the critical importance of IP protection, the Committee does not consider that Government intervention to establish guidelines is an appropriate response. Instead, the Committee strongly urges PFRIs to work together to develop internal policies and appropriate guidelines.

Patent Application Processes

5.44 A number of submissions advocated the use of formal IP protection through the patent process, identifying this as an important factor in successful commercialisation of technological innovation.[37]

5.45 In addition to confirming the uniqueness of a new product, process or service and indicating to the market that an enterprise has a monopoly position, Memtec listed some of the benefits of patenting for businesses. These included:

- [providing a] basis for capital raising and other financial dealings;

36 Business Council of Australia/Australian Vice-Chancellors' Committee, The Allen Group Consulting, 2004, *Building Effective Systems of the Commercialisation of University Research*, pp. 70-71.

37 Ampcontrol, *Submission No. 37*, p. 1; Care-Free Water Conditioners Australia, *Submission No. 50*, p. 1; Proteome Systems, *Submission No. 55*, p. 1; Memtec, *Submission No. 42*, p. 3; Australian Geoscience Council, *Submission No. 71*, p. 9; Cooperative Research Centre CAST, *Submission No. 75*, p. 3; Department of Industry, Tourism and Resources, *Submission No. 82*, p. 16; Defence Science and Technology Organisation, *Submission No. 83*, p. 8.

- licensing (especially cross-licensing) to other companies or overseas associates;
- various commercial agreements including the establishment of joint ventures;
- employee incentives and rewards;
- publicity and marketing;
- product promotion; and
- applications for government grants and other funding. [38]

5.46 Some submissions, however, were critical of the patent application process administered by IP Australia, raising concerns with regard to the timeframes and costs associated with patent application, registration and maintenance.[39]

5.47 Acknowledging the significant timeframes and costs sometimes associated with the IP application and registration process, DITR noted:

> Processing an application for an IPR [intellectual property right] involves a significant number of stages over a significant period of time. Each of these processing stages involves a number of sub-stages many of which attract separate fees. The process until grant of a standard patent can take up to 5 years.[40]

5.48 With regard to anticipated timeframes, IP Australia provides information on timeframes in its Customer Service Charter and provides regularly updated data on current response times.[41]

5.49 Other submissions have argued that the costs of registering and maintaining patents are too high, especially for PFRIs and organisations attempting to build an IP portfolio.[42]

5.50 For example, Proteome Systems highlighted:

> To establish value and be able to use [it] to springboard into profitable businesses, there needs to be a means for

38 Memtec, *Submission No. 42*, p. 4.

39 ATP Innovations, *Submission No. 6*, p. 2; Biomedical Consulting Services Pty Ltd, *Submission No. 16*, pp. 2-3; AmpControl, *Submission No. 37*, p. 1-2; Proteome Systems, *Submission No. 55*, p. 1; Australian Information Industry Association, *Submission No. 60*, p. 4; Australian Geoscience Council, *Submission No. 71*, p. 9.

40 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 18.

41 IP Australia, accessed 24 February 2006, <ipaustralia.gov.au>.

42 Australian Information Industry Association, *Submission No. 60*, p. 4; Proteome Systems, *Submission No. 55*, p. 1; Australian Geoscience Council, *Submission No. 71*, p. 9.

affordably building strong patent portfolios. Currently this does not exist in Australia.[43]

5.51 The schedule of fees for lodging and maintaining a standard patent is shown in Table 5.1.

Table 5.1 Schedule of Standard Patent Fees

Application Process	Maintenance	Cost ($)
Filing – in paper form		320
Filing – online		290
Request for an examination		340
Request where there is an Australian IPER*		240
Acceptance of an application		140
... and if more than 20 claims, $20 for each claim in excess of 20		20 each
Annual maintenance fees (from the 5th anniversary of filing date)	5th anniversary	180
	6th anniversary	200
	7th anniversary	250
	8th anniversary	300
	9th anniversary	350
	10th anniversary	400
	11th anniversary	450
	12th anniversary	500
	13th anniversary	550
	14th anniversary	600
	15th anniversary	650
	16th anniversary	700
	17th anniversary	800
	18th anniversary	900
	19th anniversary	1000
	If term extended $1200 for each anniversary during the period of extension	1200

** IPER—International Preliminary Examination Report*

Source IP Australia, accessed 3 May 2006, <ipaustralia.gov.au>.

43 Proteome Systems, *Submission No. 55*, p. 1.

5.52 Based on these application and maintenance fees, IP Australia indicated that:

> The estimated cost of an Australian standard patent including attorney fees is about $5 000 to $8 000. Maintenance fees over a 20 year term would be a further $8 000.[44]

5.53 Several submissions suggested that PFRIs in particular lack the resources to pursue and maintain appropriate patent protection, especially given the high risk nature of the IP and potentially lengthy timeframes associated with commercialisation process and eventual returns on investment.[45]

5.54 To alleviate this cost burden, Biomedical Consulting Services (BCS) suggested that Government assistance with patenting costs might be useful, stating:

> Such programs would be extremely useful if implemented on a competitive basis here in Australia, where proposals could be submitted to an expert review panel who would assess the commercial potential of the invention and recommend funding of patenting costs in the nominated countries.[46]

5.55 An alternative approach was advocated by ATP Innovations, which suggested that the Australian Government should consider:

> ... establishing an IP maintenance line of credit. This would allow universities to call on this line of credit to pay for IP maintenance and protection costs until such time as the IP is assigned to commercial partners. At this time once the commercial transaction has been completed the line of credit loans would be paid back.[47]

5.56 With regard to the costs associated with the innovation process, DITR stated in its submission:

> As in many other countries, Australia encourages easier entry into the IP system, particularly by SMEs, by minimising the official fees charged early on in the process when the commercial value of the innovation is uncertain and so funding may be difficult. Higher official fees are then charged

44 IP Australia, accessed 3 May 2006, <ipaustralia.gov.au>.

45 ATP Innovations, *Submission No. 6*, p. 2; Biomedical Consulting Services, *Submission No. 16*, pp. 1-2.

46 Biomedical Consulting Services Pty Ltd, *Submission No. 16*, pp. 2-3.

47 ATP Innovations, *Submission No. 6*, p. 2.

> later in the IPR's life if the innovation is sufficiently successful commercially. The patent maintenance fee structure set out in the Patents legislation is designed to encourage patent holders in all technologies to relinquish patents for which a commercial advantage is no longer gained.[48]

5.57 In addition, DITR further noted that:

> The patent attorney charges make up the major component of the costs associated with obtaining and maintaining a patent in Australia.[49]

Innovation Patent

5.58 DITR also noted that the Australian Government has implemented a number of cost-reducing initiatives, including the introduction of the innovation patent particularly to assist SMEs to access the patent process.[50]

5.59 The innovation patent is a second tier system, directed to lower level and incremental inventions which may not meet the higher inventive threshold requirements of the standard patent system. In addition, an innovation patent can be obtained more quickly and is less costly than a standard patent.[51]

5.60 The schedule of fees for lodging and maintaining an innovation patent is shown in Table 5.2.

5.61 Dr Ian Heath, Director General of IP Australia, informed the Committee of the progress of innovation patents:

> We have done some small reviews of the innovation patent. It has not been around for very long. It was introduced in 2001. Our early assessment is that it has been relatively successful, given its purpose—that is, the users of it have largely been small enterprises and it has largely been used for incremental improvements.[52]

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48 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 18.

49 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 18.

50 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 18.

51 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 18; IP Australia, accessed 21 December 2005, <ipaustralia.gov.au>.

52 Dr I Heath (IP Australia), *Transcript of Evidence*, 28 November 2005, pp. 19-20.

Table 5.2 Schedule of Innovation Patent Fees

Application Process	Maintenance	Cost ($)
Filing – in paper form		180
Filing – online		150
Request for an examination by 3rd Party (if required) – fee payable by 3rd party or patentee		145
Annual maintenance fees (from the 2nd anniversary of filing date)	2nd anniversary	100
	3rd anniversary	100
	4th anniversary	100
	5th anniversary	165
	6th anniversary	200
	7th anniversary	235

Source *IP Australia, accessed 3 May 2006, <ipaustralia.gov.au >.*

5.62 IP Australia informed the Committee that although the innovation patent has been successful in assisting the target market (i.e. SMEs), the uptake of the innovation patent to date has not been encouraging. At this early stage, it has been difficult for IP Australia to identify the reason for the modest uptake of the innovation patent.[53]

Committee Comment

5.63 The Committee notes that a number of submissions highlighted difficulties with regard to the timeframes and costs associated with obtaining IP protection through formal mechanisms.[54] The Committee also recognises recent positive steps taken by the Australian Government to assist in reducing the cost of IP protection, including minimising fees in the early stage of the process and the introduction of the innovation patent.

5.64 The relatively small volume of evidence which focused on innovation patents[55] suggests that perhaps the use of the innovation patent has

53 Dr I Heath (IP Australia), *Transcript of Evidence*, 28 November 2005, p. 20.

54 ATP Innovations, *Submission No. 6*, p. 2; Biomedical Consulting Services, *Submission No. 16*, pp. 1-2; Proteome Systems, *Submission No. 55*, p. 1; Australian Information Industry Association, *Submission No. 60*, p. 4; Australian Geoscience Council, *Submission No. 71*, p. 9.

55 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 18; Drs C Lawson and C Pickering, *Submission No. 93*, p. 14; Barokes Wines, *Submission No. 94*, pp. 2-4; Dr I Heath (IP Australia), *Transcript of Evidence*, 28 November 2005, pp. 19-20.

not been considered by many businesses or PFRIs as a means of protecting IP.

5.65 The Committee recognises that it is incumbent on businesses and PFRIs (specifically TTOs or similar) to identify which IP needs to be protected and the most appropriate IP protection strategies. The Committee strongly urges universities and industry to consider the use of innovation patents to reduce the costs of IP protection.

5.66 The Committee recommends that IP Australia review the use of the innovation patent at the end of 2006 to determine the level of uptake, its effectiveness in reducing costs for SMEs and possible strategies to improve and/or promote the system.

Recommendation 6

The Committee recommends that IP Australia implement strategies to promote the uptake of the innovation patent, and report to the Australian Government Minister for Industry by 30 June 2007 on the following:

- **the increased level of uptake for the innovation patent; and**
- **the effectiveness of the innovation patent in reducing costs for small to medium sized enterprises.**

Intellectual Property—Protection and Enforcement

5.67 A number of submissions highlighted difficulties relating to existing IP schemes and IP protection and enforcement. Specifically two issues have emerged:

- the high costs of protecting and enforcing IP against infringements, particularly in some overseas countries; and
- the potentially anti-competitive nature of Australia's current IP legislative and regulatory framework.

5.68 The validity of a patent can be challenged in court anytime after it has been granted. In addition, an opposition to grant procedure can occur

in the period between IP Australia accepting the application as appropriate, and when a patent is sealed or granted.[56]

5.69 The opposition to grant procedure entails the Commissioner of Patents re-examining the patent on the grounds that the invention is not new or obvious. If either party disagrees with the decision, they can file an appeal with the Federal Court of the Administrative Appeals Tribunal depending on the nature of the decision.[57]

5.70 A number of submissions noted the high costs involved when a third party opposes the granting of a patent. Costs result from lost commercial opportunities and revenue due to legal costs and uncertainty regarding validity and ownership.[58] For example, CHAMP Ventures noted:

> IP and patents are important as a baffler to competitors—they are often a necessity unless companies have the largest marketing budgets and distribution channels, but they are not the be all and end all. A legal fight with a multi-national corporate would sink most small, entrepreneurial companies.[59]

5.71 One submission claimed that under certain circumstances larger organisations with significant resources and established product lines will legally challenge the validity of a patent specifically with the intention of exhausting the more limited resources of smaller competitors, thereby preventing others from competing with an existing product line or lines.[60]

5.72 Barokes Wines expressed its concern regarding the potential for 'delaying tactics' to be employed in opposition proceedings lodged through IP Australia's patent office, stating:

> The procedures set down in the legislation enable a third party to challenge or oppose the grant of the patent at any time during its eight year term. This means that a third party could oppose a patent and drag out the proceedings, making

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56 *Patent Oppositions*, IP Australia information sheet, p. 1, accessed 15 December 2005, <ipaustralia.gov.au>.

57 *The Patents Guide: The Basics of the Patent System in Australia Explained*, IP Australia, p. 8, accessed 15 December 2005, <ipaustralia.gov.au>.

58 CHAMP Ventures, *Submission No. 59*, p. 5; Barokes Wines, *Submission No. 94*, p. 3; Mr K Schnepf (KCS Pty Ltd) , *Transcript of Evidence*, 4 August 2005, p. 66.

59 CHAMP Ventures, *Submission No. 59*, p. 5.

60 Barokes Wines, *Submission No. 94*, p. 3.

> the proceedings more expensive and the ownership of the patent less valuable. If the Patent Office or the patentee tried to stop this delaying strategy, the third party could simply file a new challenge or opposition at the Patent Office. This would recommence the proceedings.[61]

5.73 To address this issue, Barokes Wines suggested:

> … that there be a window of six months from the certification of the innovation patent for a party to oppose or challenge the patent at the Patent Office.[62]

5.74 Other submissions identified another way in which IP can inhibit innovation. This tactic involves obtaining control over a new patent with no intention of developing it further, but specifically to prevent competition with existing and established product lines. [63]

5.75 When questioned by the Committee regarding the validity of these claims, IP Australia explained that it was aware that IP positions can be used defensively or offensively stating:

> ... companies work very hard on developing what they would term a patent position, and they use that both offensively and defensively, as I would describe it—offensively to push their own particular commercial venture and defensively to tie up space where they think competitors might move somewhere near them and they will take up patents to do it. The deeper your pockets, the more you can do that. I am describing it neither as a good thing nor as a bad thing, but I think it is true that if you have a lot of money you can do more things in society in this world than if you have little money. There is certainly a behaviour there.[64]

5.76 Evidence also highlighted the significant costs and challenges associated with enforcing IP where there have been infringements, particularly overseas.[65] One company stated: 'Lord help you if you

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61 Barokes Wines, *Submission No. 94*, p. 4.

62 Barokes Wines, *Submission No. 94*, p. 4.

63 Dr R Rowe, *Submission No. 26*, p. 2; Australian Cotton Cooperative Research Centre, *Submission No. 57*, p. 8; GBC Scientific Equipment, *Submission No. 76*, p. 6.

64 Dr I Heath (IP Australia), *Transcript of Evidence*, 28 November 2005, pp. 14-15.

65 For examples see Haddon Perceptions, *Submission No. 12*, p. 4; AmpControl, *Submission No. 37*, p. 1; Memtec, *Submission No. 42*, p. 4; GRP Technology, *Submission No. 45*, p. 6; Mr B Williams and Dr R Vaughan, *Submission No. 46*, p. 1; Mr K Schnepf (KCS Pty Ltd), *Transcript of Evidence*, 4 August 2005, p. 66.

actually have to defend any of these things. It is simply like throwing money into a shredder'.[66]

5.77 In particular, problems with IP protection for Australian innovation in China were emphasised. Some submissions suggested that there is a need for Chinese authorities to more rigorously enforce IP legislation.[67]

5.78 GRP Technology suggested that Austrade needs 'to put on retainer the best Chinese legal firm who understands how to get results in the IP area'.[68]

5.79 In its submission, GRP Technology also listed a range of alternative strategies to protect Australian IP overseas. These included:

- confidentiality agreements;
- licensing manufacturers to sell rebranded product in countries that are not marketed to;
- manufacturing parts of the product in different countries (e.g. producing the labour intensive part of a product in countries where labour is relatively inexpensive); and
- using complex and costly tooling to limit counterfeiting. [69]

5.80 Another issue that was raised with regard to Australia's IP framework relates to the importance of achieving a balance between the anti-competitive nature of IP legislation and the assumed benefits derived through the promotion of economic benefits. Drs Charles Lawson and Catherine Pickering suggested that Australia's IP schemes have not been subjected to 'a rigorous assessment according to the requirements of the *Competition Principles Agreement*'. They further explained:

> This requires those seeking to justify the restriction remain in place or be imposed [to] *demonstrate* that the benefits of restricting competition to the community as a whole outweigh the costs, and that the objectives of the statutory intellectual property privileges can only be achieved by restricting competition.[70]

66 GRP Technology, *Submission No. 45*, p. 4.
67 Haddon Perceptions, *Submission No. 12*, p. 4; GRP Technology, *Submission No. 45*, p. 13.
68 GRP Technology, *Submission No. 45*, p. 6.
69 GRP Technology, *Submission No. 45*, p. 8.
70 Drs C Lawson and C Pickering, *Submission No. 93*, p. 1.

5.81 In addition, the submission also argued that Australia's adoption of more stringent patent standards than the minimum standards required by the World Trade Organisation's trade related aspects of intellectual property agreements (TRIPs) had not been subject to adequate analysis, and may not represent an optimal IP framework for Australia.[71]

Committee Comment

5.82 The Committee notes concerns expressed regarding the costs and other difficulties associated with defending IP and enforcing IP rights against infringement. Specifically, the Committee is concerned with reports suggesting that larger organisations can misuse the patent process. This has the effect of limiting the ability of smaller businesses to compete in the market and potentially impeding innovation.

5.83 Enforcement of IP is a complex issue set in a framework which includes IP legislation itself, the legal system and its processes, court procedures and international obligations such as TRIPS. While IP Australia indicated that addressing these issues is beyond the scope of its activities as the regulatory authority[72], the Committee believes that some action is required.

5.84 With regard to IP protection and the enforcement of IP rights in Australia, the Committee notes the consideration given to these issues by the Advisory Council on Intellectual Property (ACIP) in 1999.[73] This led ACIP to make a series of recommendations regarding the IP enforcement system in Australia which resulted in some new awareness raising initiatives and amendments to the *Patents Act 1990*.[74]

5.85 Despite these changes, the Committee notes that concerns regarding the defence of IP and the enforcement of IP rights have persisted, particularly with regard to the potential abuse and misuse of the IP system by organisations with more resources. Therefore the Committee recommends that as a priority ACIP again review

71 TRIPs: agreement on Trade Related Aspects of Intellectual Property Rights, Drs C Lawson and C Pickering, *Submission No. 93*, p. 9.

72 Dr I Heath (IP Australia), *Transcript of Evidence*, 28 November 2005, p. 15.

73 The Advisory Council on Intellectual Property is an independent body appointed by the government, and advises the Federal Minister for Industry, Tourism and Resources on intellectual property matters and the strategic administration of IP Australia.

74 Advisory Council on Intellectual Property, *Review of Enforcement of Industrial Property Rights*, March 1999.

Australia's IP system as it relates to the protection and enforcement of IP in Australia. This review should determine whether additional amendments or actions can be implemented that will reduce the capacity for abuse and misuse of the IP system.

Recommendation 7

The Committee recommends that the Attorney-General request the Advisory Council on Intellectual Property to review Australia's intellectual property system to determine the capacity for reduction in the misuse of the system.

5.86 The Committee also notes the concern expressed in submissions that IP protection legislation is not enforced in many countries, notably China.[75] While IP legislation in China is compatible with that of other nations, enforcement is not rigorous. The Committee recognises that this issue needs to be addressed by the Chinese Government both at a national and local level.

5.87 The Committee recommends that the Australian Government, in its trade negotiations with China, pursue the issue of IP enforcement.

Recommendation 8

The Committee recommends that the Australian Government, through the Department of Foreign Affairs and Trade, pursue the enforcement of intellectual property legislation during trade and diplomatic negotiations with China.

5.88 In addition, the Committee urges Australian businesses to use non-legislative strategies such as those suggested by GRP Technology[76] to overcome poor IP legislation enforcement in overseas jurisdictions.

5.89 With regard to consideration of the anti-competitive nature of Australia's IP system, the Committee notes suggestions that IP

75 Haddon Perceptions, *Submission No. 12*, p. 4; GRP Technology, *Submission No. 45*, p. 13.

76 GRP Technology, *Submission No. 45*, p. 8.

legislation needs to be reviewed again according to the requirements of the *Competition Principles Agreement*.[77] This issue was also raised in a recent Productivity Commission report.[78] In response to this issue the Productivity Commission advocated:

> In the Commission's view, it is important that intellectual property laws continue to be scrutinised to ensure that they are not unduly restrictive. Retention of a legislation review mechanism, including provision for periodic re-review ... would give effect to this requirement.[79]

5.90 The legislative review mechanism referred to by the Productivity Commission is a commitment given by the Australian Government and all state/territory governments under the National Competition Policy (NCP)[80] to review and change legislation that restricts competition.

5.91 Under the legislative review mechanism:

> Governments agreed that legislation should not restrict competition unless it could be shown that:
>
> - the benefits of the restriction to the community as a whole outweigh the costs; and

77 Drs C Lawson and C Pickering, *Submission No. 93*, p. 2; 7.

78 Productivity Commission Inquiry Report 2005, *Review of National Competition Policy Reforms*, No. 33, p. 285. The Productivity Commission report also discusses the work of the Intellectual Property and Competition Review Committee which, in September 2000, made recommendations to limit anti-competitive behaviour. In March 2006, the Intellectual Property Laws Amendment Bill 2006 was introduced to the Parliament to give effect to some of the recommendations from that review. However the Bill, if passed, does not address the Productivity Commission' concerns that there should be ongoing reviews of Intellectual Property legislation.

79 Productivity Commission Inquiry Report 2005, *Review of National Competition Policy Reforms*, No. 33, p. 285.

80 National Competition Council, accessed 4 May 2006, <ncc.gov.au>. Governments initiated a national approach to competition policy reform in October 1992 when they established an Independent Committee of Inquiry into a National Competition Policy for Australia. This led to the development of a NCP and the implementation of a number of reforms including: the extension of the provisions of the *Trade Practices Act 1974* prohibiting anti-competitive activities of businesses; the introduction of competitive neutrality so privately owned businesses can compete with those owned by Government on an equal footing; the review and reform of all laws that restrict competition unless it can be demonstrated that the restrictions are in the public interest; the development of a national access regime to enable competing businesses to use nationally significant infrastructure (such as airports, electricity cables, gas pipelines and railway lines); and specific reforms to the gas, electricity, water and road transport industries.

- the objectives of the legislation can be achieved only by restricting competition.[81]

5.92 The Committee supports the Productivity Commission findings and considers that the IP system and its justification in relation to the *Competition Principles Agreement* should be specifically considered under the legislative review mechanism.

Recommendation 9

The Committee recommends that the Australian Government review Intellectual Property legislation according to National Competition Policy Agreements and establish an Intellectual Property legislation system of periodic re-review.

Intellectual Property Management Skill Base

5.93 Numerous submissions noted a general lack of knowledge and understanding of the IP legislation, processes and systems. For example, the Council for Humanities, Arts and Social Sciences (CHASS) noted these views regarding universities:

> Many focus group participants saw intellectual property (IP) as a minefield. Ownership, protection and student IP were reported as causing many commercial ventures to falter. Respondents said they did not know the best way to protect their ideas, whether by taking a patent, or being first to market, or applying it for public good.[82]

5.94 This lack of knowledge is most evident during the patent application process where specific skills are required to prepare patent applications. To address this issue, DITR noted that many applicants choose to use the services of a patent attorney to pursue application.[83]

81 National Competition Council, accessed 4 May 2006, <ncc.gov.au>.

82 Council for Humanities, Arts and Social Sciences, *Submission No. 77*, Attachment 1, p. 32.

83 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 18.

5.95 Similarly, Park Bench Technology argued that the laws on IP, copyright, breach of confidence and patents are 'not easy to use or enforce' and suggested that Licensing Executives be approached to assist.[84]

5.96 In addition, Memtec advocated the appointment of a:

> … qualified and knowledgeable person within the company whose sole responsibility is to manage the IP assets of the company, in particular, to interface with the company's patent attorney and be able to provide precise instructions to the firm as required.[85]

5.97 The Queensland Government outlined an initiative to increase general awareness about IP, particularly during the early stages. It is currently:

> … developing an online IP training program that will be available to all Qld Govt employees and will include relevant case studies to highlight IP issues.[86]

5.98 Some submissions also suggested that advice on IP management be provided by the Australian Government. BCS suggested:

> It would be significantly more cost effective for the various PFRIs (and the government) to have access to a centralised resource, funded by the government, staffed with experience lawyers and people with the necessary legal/technology transfer skills to provide assistance in the preparation and review of such documents, at no cost to the PFRIs. The savings would be substantial.[87]

5.99 A number of strategies have recently been implemented by IP Australia to improve awareness and skills. These include:

- establishing an internet IP portal to provide information and access to all areas of IP and coordinate IP inquiries falling under different portfolio responsibilities;
- boosting tertiary and research sector awareness programs, including seminars, a supporting web-site 'IP Professor' which provides a lecture data base, lecture materials and case studies;

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84 Park Bench Technology, *Submission No. 15*, p. 2.

85 Memtec, *Submission No. 42*, pp. 3-4.

86 Queensland Government, *Submission No. 74*, p. 4.

87 Biomedical Consulting Services, *Submission No. 16*, p. 3.

- incorporating IP into education curricula through 'InnovatED', a program which includes a teachers web-site with lesson plans, a students web-site which allows users to 'meet' real people working with IP, an educational CD-ROM game;
- establishing an IP research centre at Melbourne University to provide independent multi-disciplinary input into IP policy formulation on matters such as IP management, enforcement, and valuation and protection costs; and
- introducing an IP Toolbox, a practical self-help workbook format manual (with accompanying CD ROM software) designed to provide business advisers and SMEs with a working understanding of IP issues and business related concepts. [88]

5.100 Many of the issues raised in the inquiry are being addressed by the awareness and skills initiatives being offered by IP Australia.

Knowledge Transfer—Linkages and Collaborations

5.101 A large number of submissions have recognised that knowledge transfer is a critical component of innovation, and that developing linkages and collaborations[89] between organisations and industry sectors is therefore crucial.[90]

5.102 Describing the importance of linkages to innovation, the Australian Business Foundation (ABF) noted:

> … world economic growth is being increasingly dominated by knowledge-intensive goods and services and a key element for competing in knowledge-based economies is the

88 IP Australia, accessed 21 December 2005, <ipaustralia.gov.au>.

89 Department of Education, Science and Training, *Submission No. 20*, p. 22. **Linkages**: the myriad ways in which industry interacts with the research sector, often involving multifaceted communications and relationship. **Collaborations**: partnership, affiance or network involving public sector researchers and the private sector, aimed at a mutually beneficial, clearly defined outcome. The components essential for successful collaboration are trust, cooperation and mutual benefit. Australian Bureau of Statistics, *2003 Innovation in Australian Businesses (ABS 8158.0),* p. 84. **Collaboration**: active joint participation with other organisations that involves sharing of technical or commercial risk.

90 For example see Biomedical Consulting Services, *Submission No. 16*, p. 3; Australian Research Council, *Submission No. 19*, p. 4; Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, pp. 7-11; R. Taylor and Associates, *Submission No. 34*, p. 2; Australian Institute for Marine Science, *Submission No. 65*, p. 7. Mr S Fenton–Jones, *Submission No. 78,* p. 1.

> 'interconnectedness' or linkages between individual firms, research, education and financial institutions and government that serve to diffuse and capitalise on this distinctive knowledge.[91]

5.103 Several submissions outlined the benefits of establishing research and market linkages. These include:

- facilitating critical mass of expertise infrastructure and resources;
- transfer of knowledge between disciplines;
- enabling a variety of pathways to market;
- sharing objectives, costs and risks; and
- speed to capitalise on emerging opportunities. [92]

5.104 Linkages and collaborations range from informal interactions and partnerships between individuals, 'often developed through consultancy or contract work'[93], to more formal strategic collaborations between organisations. These may be formed between private industry and research institutions, including PFRIs or between private enterprises.

Publicly Funded Research Agencies—Linkages and Collaborations

5.105 A majority of the evidence relating to publicly funded research agencies (PFRA) outreach activities noted that a key issue for collaboration is ensuring that small to medium enterprises (SMEs) can access PFRAs' research and IP.

5.106 All of the PFRAs who provided evidence expressed a desire to collaborate with SMEs and outlined products and services that they have put in place to facilitate linkages.[94]

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91 Australian Business Foundation, *Submission No. 64*, p. 7.

92 Queensland Government, *Submission No. 74*, p. 7 and p. 8; GBC Scientific Equipment, *Submission No. 76*, p. 13; Department of Industry, Tourism and Resources, *Submission No. 82*, p. 31; Mr A Newton (Rural Research and Development Chairs Committee), *Transcript of Evidence*, 23 May 2005, p. 19.

93 Department of Education, Science and Training, *Submission No. 20*, p. 17.

94 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*; Australian Institute for Marine Science, *Submission No. 65*; Australian Nuclear Science and Technology Organisation, *Submission No. 70;* Defence Science and Technology Organisation, *Submission No. 83*.

5.107 Emphasising the importance of PFRA linkages with SMEs, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) noted:

> SMEs are the growth engine of the Australian economy. They make a disproportionately large contribution to economic growth, exports and to industrial development in Australia. They have accounted for 70 per cent of jobs growth over the past decade and contribute approximately 30 per cent to Australia's GDP. Not only are SMEs intrinsically important to Australia, but they are also a natural vehicle to translate R&D into market impact. SMEs are an important distribution channel, or pathway for Australian science to have impact.[95]

5.108 CSIRO also suggested that technology transfer and innovation could be enhanced if PFRAs engaged with SMEs more deeply and strategically on larger scale projects.[96] CSIRO advocated that such projects should be:

> … driven by the needs of SMEs—market pull as opposed to science push … PFRAs have valuable intellectual property and know-how that could help certain tech-based export-oriented SMEs become more successful. PFRAs and universities have a desire to work deeply with SMEs in this fashion … Many SMEs have expressed a desire for this level of interaction as well … Furthermore, CSIRO carries out longer term, higher risk industrial research, which Australian SMEs cannot perform because of their small size, offering a very complementary partner to the SMEs.[97]

5.109 A number of businesses (including SMEs and larger companies) indicated that they had benefited from collaborations with PFRAs, with some indicating that IP for innovative technologies had originated in PFRAs.[98] Flavourtech provided a positive view of its collaborations with PFRAs and universities stating:

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95 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 8.

96 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 9.

97 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 10.

98 Care Free Water Conditioners, *Submission No. 50*, p. 1; SIA, *Submission No. 61*, p. 13; BAE Systems, *Submission No. 66*, p. 1; Flavourtech, *Submission No. 84*, p. 3.

> Collaboration with institutions such as CSIRO, University of Sydney and Charles Sturt University has been an important part of Flavourtech's R&D effort. This aspect of our R&D culture has many benefits and is to be maintained.[99]

5.110 In contrast, a small number of submissions expressed concerns regarding the shift into commercialisation as part of PFRAs' activities.[100] The Environmental Research and Information Consortium (ERIC) argued that PFRAs are competing with private industry in providing R&D and commercial services, to the detriment of private industry.[101]

Barriers to Collaboration—Publicly Funded Research Agencies

5.111 From evidence provided to the inquiry the main barriers to PFRAs engaging with private industry are due to incompatibilities with organisational objectives, structures and operating environments.[102]

5.112 With regard to incompatibilities in organisational objectives, Professor Cole argued that there is a mismatch between research in Australia and market relevance, stating:

> Market relevance of the knowledge being produced in Australia is abysmally low—enhanced by other weaknesses in research focus relative to market opportunity.[103]

5.113 Professor Cole also noted difficulties that SMEs have experienced when engaging with PFRAs, due to a lack of financial flexibility in PFRAs:

> Of importance is the flexibility with which the commercialising companies can interact with the research sector and, especially, its publicly funded infrastructure. In the pre-competitive phase, the technical and commercial risks are still very high for companies. Encouraging effective innovation, especially within the SME-dominated industry of Australia, cannot take place if access is at full-cost recovery

99 Flavourtech, *Submission No. 84*, p. 3.

100 Roach Industries, *Submission No. 3*, p. 3; Environment Research and Information Consortium, *Submission No. 28*, p. 1.

101 Environment Research and Information Consortium, *Submission No. 28*, p. 1.

102 CCST Metrics for Research Commercialisation Working Group, *Submission No. 7*, p. 2; Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No.* 32, pp. 10-11; Professor T Cole, *Submission No. 40*, pp. 4-5.

103 Professor T Cole, *Submission No. 40*, p. 4.

> compared with the more generous academic access regimes that have existed in, for example, MNRF [Major National Research Facilities Program] and university-based facilities.[104]

5.114 In its submission CSIRO identified three structural impediments to larger scale PFRA/SME collaborations. These were summarised in the following way:

> Firstly, successful SMEs cannot afford to invest (or choose not to invest) in larger scale continuing R&D … Partnering with a PFRA or university may help enhance the SME's innovation and commercialisation prospects, but the opportunity costs are often too high. Such large-scale collaborative projects are beyond the financial capacity of SMEs to fund out of their cash reserves, and are not the types of investment that private equity or venture capital firms typically make. Venture capital funds and the private sector have a risk/reward profile that prevents them from investing in collaborations between SMEs and PFRAs or universities.
>
> Secondly, PFRAs and universities have a desire to work deeply with SMEs, but do not have the financial flexibility to subsidise the work … PFRAs and universities have high fixed costs and a business model that requires a certain level of external earnings in order to maintain operations … Tight financial budgets make it nearly impossible for PFRAs to forego contract research revenue and instead share in the risk/reward with SMEs.
>
> Thirdly, existing mechanisms of funding collaboration do not go far enough … Because Commercial Ready requires an SME to fund 50 percent of a funded project, however, Commercial ready does not provide strong enough incentives for SMEs to collaborate with PFRAs/universities on new large scale collaborations that will meaningfully impact the growth of the SME.[105]

104 Professor T Cole, *Submission No. 40*, p. 5.

105 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, pp. 10-11.

5.115 The CSIRO indicated that it has developed a proposal to bridge the gap that 'currently prevents high potential technology based export oriented SMEs from participating in large scale demand-driven collaborations with PFRAs and universities.'[106]

5.116 The proposal advocates the introduction of a new Government funded program called Australian Growth Partnerships (AGP). CSIRO explained that the scheme would provide:

> … funds directly to selected SMEs to engage in large scale collaborations with Australia's leading providers of R&D services. In order for th[ese] type of co-development projects to occur, a fund would be created that selects and funds high potential proposals on a competitive basis.[107]

5.117 CSIRO stressed that the AGP model is not a grant explaining that:

> Financial models suggest that AGP could be a self-sufficient program in five to seven years. Similar to the HECS model [Higher Education Contribution Scheme], star SMEs that benefit from participating in the program would repay the funds back to the program. SMEs that do not benefit from the program are not required to contribute back to the program. … The likelihood of success and the potential recuperation of funds would be one of the factors used in selecting proposals for funding.
>
> In addition to AGP's recuperation through licence fees and royalties, governments would also achieve increased payroll taxes and income taxes from the successful SMEs.[108]

Publicly Funded Research Agency Outreach Activities

5.118 Evidence to the inquiry from PFRAs have indicated a range of different approaches to promote linkages with private enterprise, including SMEs. While not an exhaustive list, approaches that have been adopted include:

- the implementation of programs and initiatives specifically designed to support PFRA and business partnerships (e.g. CSIRO's

106 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 11.

107 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 11.

108 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 12.

National Flagships Initiative[109] and the Defence Science and Technology Organisation's (DSTO's) **Industry Alliances**[110]);

- the establishment of commercialisation offices and TTOs to promote IP commercialisation opportunities and facilitate engagement with businesses (e.g. DSTO's **Technology Transfer Advisory Group**[111] and **Access ANSTO**[112]); and
- the simplification of contract systems to make it easier for SMEs to engage with PFRAs by reducing the complexity of routine, low risk contracts and streamlining approval processes (e.g. CSIRO's **FastTrack**[113]).

5.119 Other than descriptive information provided by the PFRAs on their own outreach initiatives, the inquiry received little evidence from third parties regarding the operation and effectiveness of specific outreach initiatives.[114]

Intermediaries

5.120 The role of intermediaries (i.e. organisations or initiatives that act as an independent third party to broker partnerships and collaborations) are viewed as very effective means of connecting researchers with investors and industry partners. [115]

5.121 In its submission, the Australian Institute for Commercialisation (AIC) outlined a number of products and services which it believes

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109 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 8.

110 Defence Science and Technology Organisation, *Submission No.83*, p. 2.

111 Defence Science and Technology Organisation, *Submission No. 83*, p. 6.

112 Australian Nuclear Science and Technology Organisation, *Submission No. 70*, p. 7.

113 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 10.

114 Comments received in relation to PFRA outreach activities were supportive of most initiatives. For example QPSX, *Submission No. 47*. p. 4; Care-Free Water Conditioners Australia, *Submission No. 50*, p.1; Mr R Taylor (Robert Taylor and Associates), *Transcript of Evidence*, 5 August 2005, p. 50. However, i3 Aerospace Technologies, *Submission No. 1*, p. 8 was critical of Defence Science and Technology Organisation's Capability Demonstrator Program and Unsolicited Proposal Gateway.

115 Australian Institute for Commercialisation, *Submission No. 29*, p. 5; Australian Electrical and Electronic Manufacturers' Association, *Submission No. 30*, p. 4; Robert Taylor and Associates, *Submission No. 34*, p. 1; Australian Academy of Technological Sciences and Engineering Ltd., *Submission No. 49*, p. 5; Australian Institute for Marine Science, *Submission No 65*, p. 7. 5.1 Examples of intermediaries provided in the evidence included organisations such as the Australian Institute for Commercialisation and KCA, and schemes such as the Australian Industry Group's InnovationXChange.

fill 'gaps in the spectra of commercialisation support'.[116] These included the AIC's **TechFast program** which, with support from DITR, is currently undergoing a national pilot and gives assistance to companies by providing:

- linkages to appropriate expertise from research organisations;
- services and support downstream to commercialise these opportunities; and
- identification of potentially useful IP residing within PFRIs. [117]

5.122 In its submission, the AIC provided examples of two SMEs (i.e. Vortex Insect Control Holdings and Merino Pty Ltd) that had benefited from its TechFast program.

5.123 Describing the role of KCA, Robert Taylor and Associates explained:

> On the supply side members of Knowledge Commercialisation Australasia (KCA) are central to the achievement of effective knowledge commercialisation outcomes from the university and public research sector in Australia.
>
> Members operate as deal makers and facilitators between the knowledge supply side and multiple groups of potential customers and service providers locally, nationally and internationally.[118]

5.124 **InnovationXChange** is 'a not-for-profit, commercially neutral organisation that has been created to help potential business partners come together for mutual benefit'.[119] DITR described InnovationXchange as providing:

> ... a secure, managed environment for the connection of insights and opportunities between firms, universities and governments...[120]

5.125 Both CSIRO and ATSE have advocated that greater industry and government support to fund increased activities of intermediaries would be beneficial.[121]

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116 Australian Institute for Commercialisation, *Submission No. 29*, p. 11.

117 Australian Institute for Commercialisation, *Submission No. 29*, p. 15.

118 Robert Taylor and Associates, *Submission No. 34*, p. [1].

119 InnovationXchange Network, accessed 28 February 2006, <ixc.com.au>.

120 InnovationXchange Network, accessed 28 February 2006, <ixc.com.au>.

Committee Comment

5.126 The Committee considers that the outreach activities undertaken by the CSIRO, DSTO and the Australian Nuclear Science and Technology Organisation (ANSTO) are positive and productive initiatives to facilitate innovation and commercial outcomes. While the Committee recognises that some of these outreach initiatives have only recently been established, it strongly urges PFRAs to undertake regular reviews and when necessary to refine theses activities to ensure that outcomes are maximised.

5.127 The Committee notes little evidence was received from SMEs and private industry on PFRA outreach activities. Anecdotal evidence from inspections and informal discussions suggests there may be a reluctance to speak publicly due to commercial in confidence issues or, for fear of jeopardising future relationships and business opportunities in a specialised market area.

5.128 Some evidence to the inquiry suggested that PFRAs should not pursue commercialisation outcomes as this potentially represents unfair competition to private industry.[122] The Committee does not endorse this view. While commercialisation may not be the core function of PFRAs, there remains a role for research agencies to engage in commercialisation where appropriate.

5.129 In addition, the Committee considers that CSIRO's implementation of the contract simplification system, FastTrack, may provide a practical means of strengthening opportunities for SMEs to engage with PFRAs by reducing the administrative burden and prohibitive financial barriers. Therefore the Committee strongly urges other PFRAs to adopt similar practices.

5.130 Intermediaries, such as the TechFast program and the InnovationXchange, also appear promising and the Committee looks forward to the results of the formal reviews at the completion of the pilot programs.

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121 Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 15; Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 5.

122 Roach Industries, *Submission No. 3*, p. 3; Environment Research and Information Consortium, *Submission No. 28*, p. 1.

5.131 A further promising development is CSIRO's proposal for an Australian Growth Partnerships program. The Committee is strongly supportive of this proposals objective of increasing collaborations between PFRAs and high potential technology based export-oriented SMEs.

5.132 The proposal has been submitted to DITR for consideration and the Committee recommends it receives urgent attention given the importance of establishing dynamic linkages and partnerships as a pathway to commercialisation.

Recommendation 10

The Committee recommends that the Australian Government give priority consideration to the Commonwealth Scientific and Industrial Research Organisation's proposal for an Australian Growth Partnerships program to engage small to medium enterprises in demand driven collaborations with publicly funded research agencies.

Universities—Linkages and Collaborations

5.133 Some of the issues identified in submissions relating to university linkages and collaborations are similar to those raised in relation to PFRAs. However, due to an increased emphasis on university outreach activities in recent times, there are also a number of specific issues which warrant further attention.

The Changing Role of Australian Universities

5.134 Universities are traditionally centres of both teaching and research. More recently, universities are playing an increasingly active 'third stream' role—transferring knowledge, skills and innovation for public and private benefit (also called 'third arm' activities).

5.135 The two main drivers for universities taking on this third role have been identified as:

- a shift in government policy placing emphasis on university income derived from private funding; and

- an increase in market opportunities as a result of the growth of the knowledge-based economy.[123]

5.136 The majority of universities have embraced the role of technology transfer, with many of Australia's larger universities establishing TTOs or similar structures to facilitate the transfer of knowledge via linkages with private industry or other research institutions and to provide a focus for the commercialisation of IP.[124]

5.137 However, some evidence to the inquiry has identified challenges faced by universities in this new environment. Concern was expressed by a number of submissions regarding the limited ability (even in the best case scenario) for universities to derive a substantial proportion of income from the commercialisation of IP.[125]

5.138 As noted by ATP Innovations, a technology commercialisation centre jointly owned by four of Australia's leading universities[126]:

> The reality is that for most universities (even those with large research outputs), commercialisation of institutional IP provides relatively modest financial returns to the institutions in the short term and this is mainly derived through licensing opportunities. It is worth noting that international comparisons … also indicate that most universities only derive modest returns on these activities and this is not isolated to Australia.[127]

5.139 Similarly, the Group of Eight also stated in its submission:

> The high-risk nature of investing in commercial activities means that there is often conflict between the expectations governments have about the commercialisation of university R&D and the prudential environment in which universities operate. This conflict would be removed if governments

123 M Gallagher, *The Emergence of Entrepreneurial Public Universities in Australia*, Department of Education, Training and Youth Affairs, 2000, p. 5.

124 For example see ATP Innovations, *Submission No. 6*, p. 2; Melbourne Ventures, *Submission No. 21*, p. 1; La Trobe University, *Submission No. 35*, p. 3.

125 For example see ATP Innovations, *Submission No. 6*, pp. 1-2; Professors K Smith and J West, *Submission No. 18,* p. 10; SIA, *Submission No. 61*, p. 14; Group of Eight, *Submission No. 62*, p. 2.

126 ATP Innovations is jointly owned by the Australian National University, the University of New South Wales, the University of Sydney and the University of Technology Sydney.

127 ATP Innovations, *Submission No. 6*, pp. 1-2.

> matched their enthusiasm for improved commercial outcomes with funding targeted for this purpose.[128]

Barriers to Collaboration—Universities

5.140 As with PFRAs, some evidence to the inquiry identified incompatibilities with university organisational objectives, structures and operating environments as the main barrier to engaging effectively with private industry.

5.141 For example, the company Memtec stated:

> … the main reason for problems [between universities and commercial enterprises], is the completely different expectations, culture, agendae … of each party to the relationship. For example, researchers at universities aim to publish results of research during and after the project. A commercial enterprise aims for strict confidentiality and exclusive access to the results of research to enable a competitive advantage to be gained.[129]

5.142 Other evidence has highlighted differing timeframes for commercialisation, IP ownership issues, and rigid legal and financial systems in universities as impediments to collaboration with private enterprise.[130]

5.143 In order to simplify university engagement with private enterprise, the University of Melbourne suggested that:

> Government agencies such as DEST or [DITR] could co-sponsor with the AVCC a review of research contracts between industry and universities with a view to developing nationally agreed templates …[131]

5.144 In addition, a significant volume of evidence noted that while governments have expected universities to take on third stream activities, additional 'third stream' funding to support these activities has not been offered.[132]

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128 Group of Eight, *Submission No. 62*, p. 5.

129 Memtec, *Submission No. 42*, p. 5.

130 Dr J Yencken and Professor Emeritus M Gillin, *Submission No. 41*, p. 3; Council for Humanities, Arts and Social Sciences, *Submission No. 77*, Attachment 1, p. 33; Dr M Bradley (ATP Innovations), *Transcript of Evidence*, 18 May 2005, p. 48.

131 University of Melbourne, *Submission No. 52*, p. 2.

132 KCA, *Submission No. 27*, p. 7; La Trobe University, *Submission No. 35*, pp. 3-4; University of Melbourne, *Submission No. 52*, p. 3; Group of Eight, *Submission No. 62*, pp. 4-5;

5.145 KCA expressed concern in its submission regarding the consequence of not providing additional funds for commercialisation activities, stating:

> DEST provides universities with considerable support whether directly or through related agencies in both research and teaching supported funding. However, the lack of specific funding for commercialisation means that for many institutions they must make the decision whether to engage in commercialisation and to divert funding from the core mission of research and teaching.[133]

5.146 KCA concluded that government funding to support university commercialisation activities in the range of 3–5 per cent of university research expenditure would:

> ... help lift knowledge transfer performance across all areas including industry contract research through to licensing arrangements through to the formation of university spin-off companies and various permutations of these.[134]

Third Stream Funding

5.147 With regard to improving the linkages and collaborations between businesses and universities, several submissions referred to the outcomes of the 2003 *Lambert Review of Business – University Collaboration* (UK).[135] Specifically, evidence to the inquiry emphasised the strong support given for third stream funding to promote knowledge transfer from universities to the private sector by the *Lambert Review*.[136]

5.148 In the United Kingdom (UK) third stream funding has been offered to universities through the **Higher Education Reach Out for Business and Community** (HEROBC) scheme.[137] The HEROBC scheme was

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Australian Innovation Association, *Submission No. 72*, p. 10; Council for Humanities, Arts and Social Sciences, *Submission No. 77*, Attachment 1, p. 33.

133 KCA, *Submission No. 27*, p. 7.

134 KCA, *Submission No. 27*, p. 7.

135 HM Treasury, 2003, *Lambert Review of Business-University Collaboration*, accessed 3 May 2006, <hm-treasury.gov.uk>.

136 For example see KCA, *Submission No.* 27, p. 2; Australian Institute for Commercialisation, *Submission No. 29*, p. 29; La Trobe University, *Submission No. 35*, p. 2; University of Melbourne, *Submission No. 52*, p. 3; Go8, *Submission No. 62*, p. 4.

137 KCA, *Submission No. 27,* p. 6; Australian Institute for Commercialisation, *Submission No. 29*, p. 29; La Trobe University, *Submission No. 35*, p. 2; Professor T Cole, *Submission*

introduced in the UK in 1999. Under HEROBC, higher education institutions in the UK were invited to apply for funds which 'enable universities and colleges of higher education to develop links with business and the wider community'.[138]

5.149 There have been two rounds of HEROBC funding to date (1999 and 2000), which have resulted in a funding commitment of over £400 million.[139]

5.150 In England[140], third stream funding provided through HEROBC has been complemented by the introduction of **Higher Education Innovation Fund** (HEIF) which has awarded a total of £171 million over 2004–05 and 2005–06 to support:

> ... knowledge transfer, entrepreneurship training, corporate spin-outs, seed venture funding and transferring knowledge into business and the community.[141]

5.151 A 2006 evaluation of the HEIF concluded that:

> ... third stream activity has been much improved within higher education institutions and their business and community partners as a result of the funding.[142]

Committee Comment

5.152 The Committee recognises that challenges remain in fostering collaboration between universities and the private sector. The Committee is also aware of the significant attention committed to developing strategies to address these challenges and enhance engagement between universities and the private sector.

5.153 In 2004, the BCA/AVCC report *Building Effective Systems of the Commercialisation of University Research* identified the need to build

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No. 40, p. 3; University of Melbourne, *Submission No. 52*, p. 3; Group of Eight, *Submission No. 62*, p. 4.

138 Higher Education and Research Opportunities in the United Kingdom, accessed 1 March 2006, <hero.ac.uk>.

139 Department of Education, Science and Training, *Submission No. 20*, p. 17.

140 Institutional funding for higher education in the UK is devolved, with separate educational development agencies in England, Scotland, Wales and Northern Ireland. The Higher Education Innovation Fund (HEIF) is administered through the Higher Education Funding Council for England (HEFCE) and is therefore only available in England.

141 Professor T Cole, *Submission No. 40*, p. 3.

142 Office of Science and Technology, *Higher Education Innovation Fund – Summary Evaluation of the First Round (2001-05)*, 2006, p. 1.

'effective partnerships in research commercialisation between the universities, business and finance provider.'[143]

5.154 Evidence received does suggest that universities are facing real challenges in developing partnerships for research commercialisation. However, there are some positive initiatives including the establishment and evolving role of TTOs in many universities (although smaller universities may face greater hurdles in providing this type of assistance).

5.155 One university suggested the development of nationally agreed templates for research contracts between industry and universities.[144] While supportive of this concept, the Committee disputes that there is a role for the Australian Government to co-sponsor a project such as this, and refers to the success of *FastTrack* which was developed by CSIRO in response to an identified need.

5.156 Therefore, the Committee urges the universities to take a collaborative approach among themselves to recognise the financial benefits of agreed national contract templates, and undertake to develop such templates through the coordinating body of the AVCC.

5.157 The Committee also notes a number of recent initiatives introduced by the Australian Government, including the establishment of the **Business-Industry-Higher Education Collaboration Council** (BIHECC) and the **Collaboration and Structural Reform** (CASR) **Fund**, to support greater collaboration between universities and other organisations and industry.

5.158 BIHECC was formally established in July 2004[145] to advise the Minister for Education, Science and Training on ways to improve communication between business/industry and higher education sectors. The Australian Government has allocated $200 000 in funding for the Council over 2005 and 2006.[146]

5.159 The key priorities of BIHECC include:

- coordinating the selection of business/industry/university collaboration projects for funding from the Collaboration and Structural Reform (CASR) Fund;

143 Business Council of Australia and Australian Vice-Chancellors' Committee, Allen Consulting Group, *Building Effective Systems of the Commercialisation of University Research,* August 2004, Executive Summary, p. viii.

144 University of Melbourne, *Submission No. 52*, p. 2.

145 Department of Education, Science and Training, *Higher Education Report 2004-05*, p. 10.

146 Department of Education, Science and Training, *Higher Education Report 2004-05*, p. 10.

- development of strategies to encourage greater industry/business involvement in the higher education sector; and
- facilitation of involvement of small and medium enterprises in collaborative arrangements.[147]

5.160 The CASR Fund of $36.6 million was established by the Australian Government in early 2005. It provides competitive funds to:

> … foster collaboration between universities and other universities, business, industry, professional associations, community groups or other relevant organisations, and to encourage innovation within the higher education sector.[148]

5.161 The first round of successful CASR Fund projects (ten in total) was announced by the Minister for Education, Science and Training in August 2005.[149] Expressions of interest for a second round of CASR Fund proposals closed on 29 May 2006.[150]

5.162 The Committee is encouraged by the establishment of the BIHECC and welcomes the establishment of the CASR Fund. The Fund will provide a valuable means of encouraging university linkages, including improved linkages with industry and businesses.

5.163 With regard to the call from universities for third stream funding, the Committee is cognisant of the pressures placed on universities as a result of changing roles and the greater emphasis on knowledge transfer and commercialisation activities. While third stream funding models such as the UK's HEROBC and HEIF schemes provide a framework for consideration, the Committee realises that any overseas funding model will need to be adapted and refined to reflect Australia's specific needs and higher education structure.

5.164 The Committee considers that if Australian universities believe third stream funding is required, then a more comprehensive cost-benefit based business case needs to be developed. The business case should consider returns on investment and the potential advantages and disadvantages of various third stream funding models for Australia. Detailed consideration needs to be given to the implementation of third stream funding models, particularly the means for determining funding awards.

147 Department of Education, Science and Training, accessed 21 January 2006, <dest.gov.au>.

148 *Our Universities: Backing Australia's Future*, Policy document, May 2003, p. 39.

149 Department of Education, Science and Training, accessed 4 May 2006, <dest.gov.au>.

150 Department of Education, Science and Training, accessed 30 May 2006, <dest.gov.au>.

5.165 Therefore, the Committee recommends that the Australian Government direct the BIHECC (as the national body which has been established to foster greater collaboration between the business and higher education sectors), or other appropriate entity, to examine and develop the business case for third stream funding to universities.

Recommendation 11

The Committee recommends that the Australian Government request the Business Industry Higher Education Collaboration Council to examine and develop the business case for third stream funding to universities.

University Linkage and Collaboration Programs

5.166 Much of the collaborative research conducted in Australian universities is supported by the **CRC Program** or the **ARC Linkage Projects Scheme**.

Cooperative Research Centres (CRC) Program

5.167 In recognition of the need to develop stronger linkages between research institutions and market, DEST established the CRC program in 1990. Total Government funding provided for the CRC program from 2001 to 2011 amounts to approximately $1.8 billion.[151]

5.168 The program places a strong emphasis on the importance of collaborative arrangements to:

> … forge closer links between Australian industry and researchers … from universities, the public sector (including CSIRO) and industry. The close interaction between researchers and end users of research at all stages is a key feature of CRCs.[152]

151 Department of Education, Science and Training, accessed 4 May 2006, <backingaus.innovation.gov.au>.

152 Department of Education, Science and Training, *Submission No. 20*, p. 25.

5.169 There have been nine selection rounds for the program, with a total of 158 successful applications (including renewals) resulting in 99 actual centres. In each funding round, applicants seek funding for a term of seven years.

5.170 Fifty-nine CRCs are currently in operation in the following broad areas:

- manufacturing technology;
- information and communication technology;
- mining and energy;
- agriculture and rural based manufacturing;
- environment; and
- medical science and technology.[153]

5.171 In 2003, an Australian Government commissioned review concluded that a more 'investment-focused' CRC program with greater emphasis on 'new business development' would better meet the program's objectives.[154] This resulted in a shift of emphasis away from CRCs catering for both commercial and public-good outcomes, to CRCs with a focus on commercial outcomes and economic growth in more recent funding rounds.[155]

5.172 Much of the evidence received in relation to the CRC program was supportive of the initiative, indicating that the program has facilitated the development of improved linkages between the higher education sector and private enterprise.[156]

5.173 In particular, some submissions highlighted the importance of the strong participation of end-users in the adoption process[157], with the

153 Cooperative Research Centres, accessed 3 November 2005, <crc.gov.au>.

154 Department of Education, Science and Training, *Evaluation of the Cooperative Research Centres Programme*, July 2003, Report Summary.

155 Cooperative Research Centre Committee, *Submission No. 11*, p. 2.

156 See for example Cooperative Research Centre Committee, *Submission No. 11*, p. 4; Australian Cotton Cooperative Research Centre, *Submission No. 57*, p. 2; Mr R Taylor (Robert Taylor and Associates), *Transcript of Evidence*, 5 August 2005, p. 42.

157 Cooperative Research Centre Association, *Submission No. 48*, p. 8; Australian Cotton Cooperative Research Centre, *Submission No. 57*, p. 3; Cooperative Research Centre for Cast Metals Manufacturing, *Submission No. 75*, p. 2.

CRC for Cast Metals Manufacturing noting that it is 'one of the great strengths of CRCs'.[158]

5.174 A number of submissions were supportive of the recent changes to the CRC program, expressing the view that the increased focus on commercial outcomes was appropriate and that the requirement for all new CRCs to be incorporated entities was operationally more functional (i.e. requiring a board with an independent chair) and would lead to improved commercial outcomes.[159]

5.175 Some evidence expressed concern regarding the sustainability of CRC activities following cessation of Australian Government funding through the program. In this regard, the CRC guidelines recommend that individual CRCs develop a wind-up strategy in consultation with all participants and with the governing board's approval.[160]

5.176 The Chair of the CRC Committee, Dr Geoffrey Vaughan, explained the importance of CRC activity continuing beyond funding provided under the program, stating:

> The sustained activity comes from the hope that, after a funding cycle or even two or three funding cycles, there will be continuity in the outcomes from that centre.[161]

5.177 Dr Mark Sceats noted that the development of a 'graduation mechanism' for successful CRCs had been debated within the CRC community since 1991, stating:

> … no mechanism has ever emerged. The only mechanism to graduate is either voluntarily, or by the loss of a bid [for the next CRC funding round]. It is not a system that allows for consultation and finesse.[162]

5.178 DSTC (a company that has operated incorporated ICT CRCs since 1992 and has over a 13 year period participated in four ICT-based CRCs) explained that following an unsuccessful bid for CRC funding under the ninth round of the Program, the company is in a funding 'no man's land' stating:

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158 Cooperative Research Centre for Cast Metals Manufacturing, *Submission No. 75*, p. 2.

159 Cooperative Research Centre Committee, *Submission No. 11*, p. 3; Dr M Sceats, *Submission No. 23*, p. 12.

160 *Cooperative Research Centre Program Wind-up Guidelines for CRCs*, June 2005, pp. 3-4.

161 Dr G Vaughan (Cooperative Research Centre Committee), *Transcript of Evidence*, 4 August 2005, p. 23.

162 Dr M Sceats, *Submission No. 23*, p. 17.

> We do not qualify for funding from the Australian Research Council (ARC) which targets research in higher education institutes and we do not qualify for funding under the Department of Industry's Commercial Ready program as we are a non-tax paying entity. DSTC and other CRCs have generated a wealth of commercially exploitable IP and commercialisation models, but our research programs have nowhere to go when CRC funding ceases and it's possible that the benefit associated with each CRC will be lost to the nation.[163]

Australian Research Council (ARC) Linkage Projects

5.179 The ARC Linkage projects represent another Australian Government program that specifically targets knowledge transfer through supporting the formation of linkages and collaborations. The ARC advised that Linkage projects encourage:

> … the formation of long-term alliances between university researchers and industry, government and community organisations (otherwise known as partner organisations). These alliances facilitate the transfer of skills and ideas as a basis for securing commercial and other benefits from research'.[164]

5.180 To be considered for funding under this scheme applications from Australian universities must include at least one collaborating organisation which may be a private sector organisation, a private non-profit organisation or a government agency.[165]

5.181 Linkage Project funding are awarded for one to five years, with grants typically ranging from $20 000 to $500 000 per annum.[166] In the 2004 funding rounds, 532 projects received a total of $119.9 million of funding from the ARC.[167]

5.182 The ARC outlined the role that the scheme plays in encouraging research and business linkages by highlighting the private partner contributions (in cash or in-kind) to Linkage Projects grants in 2004:

163 DSTC Pty Ltd, *Submission No. 69*, p. 14.

164 Australian Research Council, *Submission No. 19*, p. 9.

165 Australian Research Council, *Linkage Projects: Funding Rules for Funding commencing in 2006*, Appendix 2.

166 Australian Research Council, *Linkage Projects: Funding Rules for Funding commencing in 2006*, pp. 9-10.

167 Australian Research Council, *Submission No. 19*, p. 9.

> Approximately 59 per cent of the total partner contributions … was provided by private companies or industry partners. This is important given the relatively low level (compared to the OECD average) of Business Expenditure on Research and Development as indicated in figures provided by the Australian Bureau of Statistics.[168]

5.183 Although relatively few submissions commented on the ARC Linkage Projects, those that did were generally supportive of the program.[169]

Committee Comment

5.184 The Committee considers that both the CRC program and the ARC's Linkage Projects offer effective means for universities to build linkages with other organisations including private enterprise.

5.185 However, as CRCs are sector or project specific, there are research areas (both in universities and in industry) which are outside the scope of current CRC activities and which are therefore not able to access the linkage benefits of this program. The Committee recognises this, and notes that the selection of CRCs appropriately target areas of national priority.

5.186 While it is the role of Government to provide a framework of opportunities, it is also incumbent on universities (and on industry) to pursue greater collaboration where there are market opportunities. In this regard, the Committee notes that there are other mechanisms beyond CRCs which also facilitate collaborative ventures, in particular the ARC Linkages Projects and the newly established CASR Fund.

5.187 Some evidence to the inquiry raised the issue of a graduation mechanism for post CRC funding.[170] Given the requirement for the CRCs themselves to develop appropriate wind-up strategies well in advance of the end of the funding period[171], the Committee is not persuaded by the call for a more prescriptive or staged graduation mechanism.

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168 Australian Research Council, *Submission No. 19*, p. 9.

169 Council for Humanities, Arts and Social Sciences, *Submission No. 77*, p. 26; Mr M Bradley (ATP Innovations), *Transcript of Evidence*, 18 May 2005, p. 48; Mr H Hawthorn (ATP Innovations), *Transcript of Evidence*, 18 May 2005, p. 48.

170 Dr M Sceats, *Submission No. 23*, p. 17; DSTC Pty Ltd, *Submission No. 69*, p. 14.

171 Cooperative Research Centres, accessed 4 May 2006, <crc.gov.au>.

5.188 Similarly the Committee notes evidence relating to the 'no man's land' position of some CRC spin-off companies in relation to funding. However, the Committee is not persuaded by calls for a designated government program to support the activities of CRCs or their spin-off companies if they have failed to secure continued funding through the CRC program. The Committee considers that the business strategy of a spin-off company must take into account life beyond the CRC funding.

Business to Business Collaborations

5.189 Research undertaken by industry accounts for approximately fifty per cent of R&D in Australia.[172] Therefore, there are many instances where technologies are developed and commercialised solely within the private sector, making effective linkages between businesses crucial.[173]

5.190 A key finding from the ABS business innovation survey for 2003 was that 27 per cent of innovating businesses were involved in some form of active collaboration. While 25 per cent of innovating businesses reported collaborations with other businesses, less than seven per cent reported collaborations with universities, governments and research institutions.[174]

5.191 The ABS innovation survey of 2003 also found that collaborative arrangements were most likely to be formed between businesses from within a 100 kilometre distance rather than with businesses from elsewhere in Australia or from overseas.[175]

5.192 Business to business collaborations range in size from alliances between two or more businesses, to industry-wide strategic collaborations such as those fostered under Australian Government initiated **Industry Action Agendas**.

5.193 Industry Action Agendas (Action Agendas), announced by the Australian Government in 1997, were described by DITR as:

172 *Building Effective Systems for the Commercialisation of University Research*, The Allen Consulting Group, Australian Vice-Chancellors' Committee/Business Council of Australia, August 2004, p.1. The report also states that twenty-five per cent of R&D is performed by PFRAs and another twenty-five per cent by universities.

173 Mr D Scott-Kemmis, *Submission No. 99*, p. 6.

174 Australian Bureau of Statistics, *2003 Innovation in Australian Business (ABS 8158.0)*, pp. 37-38.

175 Australian Bureau of Statistics, *2003 Innovation in Australian Business (ABS 8158.0)*, pp. 38-39.

> ... long term industry strategies to assist industries to identify their strengths, weaknesses, and to map new opportunities to achieve sustainable development and export growth. They are a partnership between government and industry sectors that provide a comprehensive insight faced by particular sectors. Action Agendas can identify commercialisation issues at a sectoral level.[176]

5.194 During the development phase of an Action Agenda, key industry leaders are assisted by policy makers in the relevant Government departments to develop a vision for the industry and a pathway to enable them to achieve that vision. Often industry leaders may identify impediments, such as skill shortages, regulatory hurdles or industry fragmentation. Recommendations to overcome these difficulties are jointly developed by industry and Government. Some Government assistance is provided in the following one to two years of implementation.

5.195 Most of the evidence on Action Agendas received by the Committee focused on specific recommendations arising from the Action Agendas, rather than commenting on the value of the support mechanism in general.

5.196 DITR claimed in its submission that Action Agendas have led to an increase in the industry's innovation capacity and resulted in a substantial increase in investment in R&D and commercialisation by industry noting 'over $600 million has been committed by Action Agenda industries in support of CRCs'.[177]

5.197 In addition to the Action Agendas, in 2004 the Australian Government announced the **Industry Cooperative Innovation Program** (ICIP). ICIP, administered by DITR though AusIndustry, provides $25 million of merit-based funding to:

> … support cooperative innovation projects by firms to develop and use new technologies, with priority being given to projects meeting strategic industry needs including those identified through an Action Agenda … ICIP will assist in building collaboration activity to strengthen the innovation capacity of an industry sector.[178]

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176 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 11.

177 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 11.

178 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 10.

5.198 The program is to be funded until 2011. Specific projects are to be conducted by a consortium of three of more entities (that is, they cannot be made up only of industry representative associations), on behalf of an industry.[179] In its submission to the inquiry, DITR informed the Committee that funding for the program is to be provided in two streams:

> Stream A will provide funds for small scale projects that explore sectoral innovation opportunities and paths to enhance sectoral innovation capacity; and Stream B will provide funds for major cooperative strategic sectoral innovation projects.[180]

5.199 As the ICIP scheme has only recently been launched, with the successful applications for the first round being announced in December 2005, there was very little evidence to the inquiry regarding the scheme. However, in its submission, the Australian Electrical and Electronic Manufacturers' Association (AEEMA) stated that:

> The response of our industry grouping to the recently announced Industry Cooperative Innovation Program … has been very favourable. [181]

5.200 In addition to linkages between businesses within Australia, a number of submissions also emphasised that export is an essential goal for most Australian businesses due to the limited size of the domestic market.[182]

5.201 Accessing the international market frequently requires the establishment of commercial collaboration with overseas companies or large multinationals.[183] The Queensland Department of State Development and Innovation explained:

> In many cases, established firms that are capable of providing expertise and experience of [international] markets, regulatory environments and distribution channels are not

179 Department of Industry, Tourism and Resources, accessed 7 November 2005, <industry.gov.au>.

180 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 10.

181 Australian Electrical and Electronic Manufacturers' Association, *Submission No. 30*, p. 3.

182 Citrix Systems Australasia R&D, *Submission No. 5*, p. 5; Australian Institute for Commercialisation, *Submission No. 29*, p. 24; GRP Technology, *Submission No. 45*, p. 6.

183 Citrix Systems Australasia R&D, *Submission No. 5*, p. 5; CEA Technologies, *Submission No. 8*, p. 8; Department of Communications, Information Technology and the Arts, *Submission No. 87*, p. 5.

> available in Australia, making international alliance more attractive.[184]

5.202 Similarly, Austrade, the Australian Government's principal trade and international business facilitation agency, explained that 'a local partner is an invaluable source of information on local conditions, the local culture and the local business climate.'[185] Austrade also emphasised that many of these linkages were initially developed through personal contact either at international conferences, seminars and trade shows, or visits overseas to specifically seek out partners.

Clusters

5.203 As noted previously, a key finding of the ABS business innovation survey was that geographical proximity is an important determinant for businesses seeking to establish collaborations. The AIC stated in its submission:

> Proximity matters. Localisation promotes fluidity of ideas, the very food for a knowledge ecosystem. For that reason, policies which bring together industry and science should, for the most part, be locally or regionally based.[186]

5.204 A large volume of evidence was received generally supporting the establishment of research and business linkages, and industry specific networks, primarily (though not exclusively) through the promotion of geographical collocation in knowledge precincts or technology parks.[187]

5.205 The concept of **clusters**, geographical concentrations of interconnected public and/or private sector groups, has attracted worldwide attention from academics and policymakers since the introduction of the concept in 1990 by Professor Michael Porter of Harvard University.

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184 Queensland Government, *Submission No. 74*, p. 8.

185 Austrade, *Submission No. 68*, p. 7.

186 Australian Institute for Commercialisation, *Submission No. 29*, p. 30.

187 Clusters Asia Pacific, *Submission No. 17*; Australian Institute for Commercialisation, *Submission No. 29*, pp. 30-32. Australian Electrical and Electronic Manufacturers' Association, *Submission No. 30*, p. 4; University of Sunshine Coast, *Submission No. 31*, p. 3; La Trobe University, *Submission No. 35*, p. 4; Australian Academy of Technological Sciences and Engineering Ltd., *Submission No. 49*, p. 4.

5.206 Professor Porter's concept is based on the premise that clusters form a critical mass of resources which promotes both competition and cooperation.[188]

5.207 Mr Alan Newton, Executive Manager of the Rural Research and Development Corporation Chairs Committee (RDC), explained:

> The whole idea of a cluster is that you develop not only an industry but you link in with technological capabilities, you link in with education and get an established platform in your domestic market and then you go global.[189]

5.208 Clusters Asia Pacific further explained that clusters are 'a connectivity mechanism at a number of levels.' These include:

- engaging otherwise unconnected researchers;
- engaging researchers with the 'right' type of companies i.e. those capable of taking research to the market; and
- linking Australian companies with overseas companies with a significant place in global markets.[190]

5.209 Evidence to the inquiry identified a number of Australian industry clusters for example, South Australia's water industry alliance, the wine industry cluster and the scientific instrument manufacturing industry cluster.[191] A number of submissions also highlighted the important role for state and local governments in promoting the development of regional and local clusters.[192]

188 M E Porter, *The Competitive Advantage of Nations,* Macmillan, London, 1990, p. 151.

189 Mr A Newton (Rural Research and Development Corporation Chairs Committee), *Transcript of Evidence*, 23 May 2005, p. 19.

190 Clusters Asia Pacific, *Submission No. 17*, p. 10.

191 Clusters Asia Pacific, *Submission No. 17*, pp. 6-7; Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 14; SIA, *Submission No. 61*, p. 20; Mr A Newton (Rural Research and Development Corporation Chairs Committee), *Transcript of Evidence*, 23 May 2005, p. 19.

192 Clusters Asia Pacific, *Submission No. 17*, p. 10; Queensland Government, *Submission No. 74*, p. 9; Tasmanian Government, *Submission No. 86*, pp. 9-11; Australian Electrical and Electronic Manufacturers' Association, *Submission No. 30*, p. 5; ACT Minister for Economic Development and Business, *Submission No. 85*, p. 1; Sutherland Shire Council, *Submission No. 92*, p. 3.

5.210 In demonstrating the potential benefits of clustering, several submissions provided information on successful international cluster models.[193] Clusters Asia Pacific argued that:

> … if the Australian Government is serious about research collaboration and commercialisation, it should develop a detailed cluster policy.[194]

Committee Comment

5.211 The Committee recognises that collaboration between businesses is a crucial factor in supporting and enhancing innovation. Given the collective importance of collaboration to facilitate technology interchanges, skill development and commercialisation outcomes, the Committee considers that there is a definite role for government in ensuring appropriate frameworks and opportunities are in place to maximise a dynamic interconnected system of linkages between businesses.

5.212 The Committee is encouraged by the high levels of participation from a range of industries in developing and implementing Action Agendas.[195] In addition, the Committee welcomes the establishment of AusIndustry's ICIP to encourage the development of collaboration between businesses.

5.213 The Committee also considers that clusters and similar networks are potentially effective mechanisms of establishing linkages and collaborations. However, the Committee notes that a review of the literature on clusters and on the development of Australian clusters concluded:

> … clusters cannot easily be artificially 'manufactured' … Effective clusters are 'natural' clusters, their naturalness only becomes apparent in hindsight, and there are many factors which contribute to their success or failure.

193 Clusters Asia Pacific, *Submission No. 17*, pp. 8-10; Australian Institute for Commercialisation, *Submission No. 29*, pp. 30-31.

194 Clusters Asia Pacific, *Submission No. 17*, p. 3.

195 Department of Industry, Tourism and Resources, accessed 2 March 2006, <industry.gov.au>. As of March 2006 there are 36 Action Agendas at various stages of development and implementation.

> However actions by governments, such as strategic investment in research organisations with the necessary critical mass, can help to make clusters sustainable.[196]

5.214 The Committee also notes evidence to the inquiry that emphasises the role of state/territory and local governments and industry to the development of clusters. Therefore, the Committee considers that state/territory and local governments and industry (via Action Agendas or industry associations) should take the lead in bringing together major focal points of R&D activity and innovation to drive cluster development.

5.215 The Committee notes that the New Zealand Government has recently introduced a program to encourage the development of clusters. The Cluster Development Program is administered by New Zealand's trade and economic development agency, New Zealand Trade and Enterprise, which advises:

> This funding is for facilitating clusters with significant growth potential. A total grant of up to $50 000 (plus GST) is available to contract a cluster facilitator to significantly progress the cluster's development. The funding represents less than 50per cent of the cost of a facilitator.[197]

5.216 The Committee has identified the need for a funded cluster development program to encourage the development of clusters in Australia. The Committee recommends that DITR and DEST examine the structure and implementation of New Zealand's initiative to determine whether it can be adapted to suit the Australian context.

Recommendation 12

The Committee recommends that the Australian Government introduce a funded cluster development program to encourage the Australia-wide development of clusters which bring together innovation in research, business and education.

196 Department of Education, Science and Training, *Mapping Australian Science and Innovation: Main Report*, 2003, p. 280.

197 New Zealand Trade and Enterprise, accessed 15 November 2005, <nzte.govt.nz>.

6

Life Cycle Support and Funding for Innovation and Commercialisation

6.1 This chapter examines:

- support for basic or discovery research;
- support for business research and development (R&D) and start-up enterprises; and
- support for commercialisation assistance and expansion capital.

6.2 Four consensus issues have emerged from the evidence in relation to life cycle support[1] and funding for innovation and commercialisation.

6.3 **Consensus Issue 1**—Adequate and appropriate support for basic and applied research occurring in Australia's publicly funded research institutions (PFRIs) is an important element of a robust innovation system. Some evidence suggested that there is a gap in transitional support (particularly a lack of assistance for proof of concept activities) for the development of innovative concepts emerging from research.

6.4 **Consensus Issue 2**—Adequate and appropriate support for R&D and other innovative activities occurring in businesses is essential. Some evidence suggested that the current tax incentives available for new and existing businesses could be enhanced to provide greater impetus for the commercialisation of intellectual property (IP) and innovation.

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1 Life cycle support describes the establishment of conditions necessary to foster and sustain the innovation process from initial research through to utilisation. See Australian Research Council, *Submission No. 19*, p. 6.

6.5 **Consensus Issue 3**—Access to adequate finance and venture capital is vital to support innovation development in new and existing businesses. Evidence suggested that accessing adequate finance is a significant challenge for many businesses due to:

- insufficient business angel activity and the relative immaturity and the risk averse nature of the venture capital industry in Australia; and
- the risk averse nature of the traditional finance sector in Australia.

6.6 **Consensus Issue 4**—support for later stage commercialisation activities (such as marketing, sales and export) are important for Australian businesses to grow and compete in increasingly competitive and global markets. Evidence suggested a lack of support measures and incentives directed toward these later stage commercialisation activities, and a lack of government support for Australian innovation through its procurement and purchasing practices.

6.7 As has been noted however, the innovation support framework is complex, needing to address different innovation needs at various stages of the innovation process, as well as sectoral specific needs. In addition, some innovation initiatives are intended to support a number of steps in the process, so consideration of particular programs in one category as opposed to another is to some degree discretionary.

6.8 However, while the Committee acknowledges that the linear model of innovation has now been superseded, it can provide a useful framework for consideration of Australian Government innovation support initiatives and programs. Therefore, the focus of this chapter is on Australian Government innovation support measures and fiscal initiatives that target specific stages of the innovation pathway.[2]

2 The Commercialising Emerging Technologies (COMET) program and the skills component of the Cooperative Research Centre (CRC) program are considered in chapter four, 'Human Capital—Knowledge and Skills'. The sectoral linkages component of the CRC program is considered in chapter five, 'Connecting Knowledge, People and Markets'.

Support for Basic or Discovery Research to Proof of Concept

6.9 In the technology push model of innovation, the generation of new knowledge from basic or discovery research is considered the 'engine' of innovation. Although the majority of innovation does not originate in this way, basic research[3] (the majority of which is conducted by PFRIs) represents a potential source of innovation and may contribute disproportionately to radical or step change.[4]

Australian Government Research Funding Agencies

6.10 The Australian Government commits a significant proportion of its science and innovation expenditure to supporting PFRIs (64 per cent in 2005–06). In addition to performance-based block funding[5] to support research and teaching activities, additional research funding for universities is also available through peer reviewed competitive grants administered either by the Australian Research Council (ARC) under the Education, Science and Training portfolio, or by the National Health and Medical Research Council (NHMRC) under the Health and Ageing portfolio.

6.11 Issues were raised regarding the level and appropriateness of ARC and NHMRC funding support for basic research with commercial potential, and the most effective means of providing this type of support.

6.12 In their submissions to the inquiry, both the ARC and NHMRC expressed the view that an appropriate level of support for basic research is a necessary foundation for a robust national innovation

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3 **Basic research**: experimental and theoretical work undertaken primarily to acquire new knowledge without a specific application in view. **Applied research**: original work undertaken to acquire new knowledge with a specific application in view.

4 Professors K Smith and J West, *Submission No. 18*, pp. 6-7; Australian Business Foundation, *Submission No. 64*, pp. 2-3; Mr D Scott-Kemmis, *Submission No. 99*, p. 4.

5 Department of Education, Science and Training, *Submission No. 20*, p. 23. Australian Government funding for higher education is largely provided through two performance-based funding schemes: an institutional grants scheme (IGS) providing block funds for general research and research training infrastructure, and a scheme providing grants to institutions for research training scholarships (RTS). Both schemes are administered by the Department of Education, Science and Training and are distributed to recognised Higher Education Providers as prescribed by the *Higher Education Support Act 2003.*

system.[6] While neither agency considered the commercialisation of research outcomes to be its principal mission[7], both acknowledged the increasing imperatives for researchers and their employing institutions to consider and contribute to innovation and commercialisation whenever possible and appropriate.

6.13 Outlining the research funding support available, the ARC noted that the majority of its funding is allocated through the **National Competitive Grants Program (NCGP).** The NCGP represents a $2.2 billion commitment under *Backing Australia's Ability*, and encompasses a range of initiatives, including the ARC's Linkage Projects and ARC Federation Fellowships[8] discussed earlier in the report (see discussion in chapter four). In addition, the NCGP also includes the ARC's **Discovery Project Grants**.

6.14 Discovery Project Grants represent the ARC's largest funding scheme, with a 2004–05 expenditure of approximately $260 million. With regard to Discovery Projects the ARC noted:

> Although the grants are not allocated in order to promote links with industry, they do provide a platform of basic research on which more applied work in a range of areas can build...[9]

6.15 Therefore, while not specifically aimed at promoting linkages with industry or commercial outcomes, the ARC stated in relation to Discovery Project Grants that:

> ARC-funded research has led to many outstanding breakthroughs that have served as a basis for the development of new products or processes – examples include the 'bionic ear' medical technology developed by Cochlear Ltd and the solar energy production technology of Pacific Solar that was on show at the Sydney Olympic Games.[10]

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6 Australian and New Zealand Association for the Advancement of Science, *Submission No. 2*, p. 3; Australian Research Council, *Submission No. 19*, p. 4; National Health and Medical Research Council, *Submission No. 81*, p. 8.

7 Australian Research Council, *Submission No. 19*, p. 2; National Health and Medical Research Council, *Submission No. 81*, p. 1.

8 Australian Research Council, *Submission No. 19*, p. 2.

9 Australian Research Council, *Submission No. 19*, p. 7.

10 Australian Research Council, *Submission No. 19*, p. 7.

6.16 The NHMRC supports research in the health and medical sector, including research with commercial potential.[11] In addition to the NHMRC Industry Fellowships considered earlier in the report (see discussion in chapter four), NHMRC funding schemes include **Project and Program Grants** and **Development Grants**.

6.17 The majority of NHMRC research funding is awarded through its Project and Program Grants schemes. NHMRC expenditure in 2004 comprised approximately $185 million on Project Grants and $115 million on Program Grants.[12] 'Development Grants provide funding for research commercialisation at the early proof of concept stage.' The total NHMRC expenditure in 2004 was $ 4 160 655.[13]

6.18 In contrast, the NHMRC's Development Grants implemented in response to the 1999 *Wills Review*[14], are intended to target support for research with commercial potential at the point where:

> ... high quality basic research program [ends] and... developments [are] required to make the project commercially attractive to potential investors.[15]

6.19 In evidence to the inquiry, Professor Pettigrew of the NHMRC noted that Development Grants were specifically directed toward addressing this gap through the provision of support for proof of concept activities.[16] Approximately $4 million has been awarded through two rounds of Development Grants in 2004.

6.20 However, the NHMRC noted that despite targeting a perceived gap in the research development continuum:

> ... the quality and number of [Development Grant] applications has been disappointing (this may reflect the negative attitude of researchers to commercialisation).[17]

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11 National Health and Medical Research Council, *Submission No. 81*, pp. 3-5.

12 Allocations recorded in the most recent National Health and Medical Research Council annual report, tabled in June 2005. See *National Health and Medical Research Council, Annual Report 2004: Investing in Australia's Health,* incorporating the 2005 Grants Book, Appendix XVIII, p. 233.

13 *National Health and Medical Research Council, Annual Report 2004: Investing in Australia's Health*, incorporating the 2005 Grants Book, Appendix XVIII, p. 184-85.

14 *The Virtuous Cycle – Working Together for Health and Medical Research*; Health and Medical Research Strategic Review 1999.

15 National Health and Medical Research Council, *Submission No. 81*, p. 3.

16 Professor A Pettigrew (National Health and Medical Research Council), *Transcript of Evidence*, 12 September 2005, p. 1.

17 National Health and Medical Research Council, *Submission No. 81*, p. 10.

6.21 In its submission the NHMRC advised that an evaluation of the Development Grants Scheme had been undertaken, but at the time of writing this report the outcomes are not yet available.[18]

Committee Comment

6.22 The Committee acknowledges that providing support for the commercialisation of research is not the principal mission of either the ARC or the NHMRC. Nevertheless, both research funding agencies have acknowledged the value of appropriate support for research with commercial potential.

6.23 To promote and support the needs of research with commercial potential, the Committee notes that the NHMRC has amended the selection criteria of its existing schemes to encourage commercial outcomes where appropriate and has introduced the Development Grants Scheme.

6.24 While not compromising the core objectives of the NHMRC's funding of basic discovery research, it would seem appropriate for a proportion of research funding to be made available to pursue applied research, including research with potential commercial outcomes where these exist. To that end, the Committee commends the introduction of the Development Grants Scheme.

6.25 While ARC Linkage Projects are available to strengthen research collaboration between universities and other organisations (including, but not exclusively with industry), the Committee notes that the ARC does not provide specific funding to support commercialisation or proof of concept development.

6.26 In relation to access to funding for proof of concept[19] development, the Group of Eight (Go8) advised that this was 'the one policy initiative most likely to result in improved university research commercialisation outcomes'.[20] Go8 clarified that, in seeking support for proof of concept, this was not for basic or discovery research but

18 National Health and Medical Research Council, *Submission No. 81*, p. 3.

19 Proof of concept is commonly understood as the process and steps required to move from research to outcomes that can be commercialised. For example, the National Health and Medical Research Council requires applicants for development grants to demonstrate' the process and steps to a market, the nature of the market; the milestones and risks of the venture; and an understanding of possible means of handling intellectual property connected with the project'. National Health and Medical Research Council, accessed 31 May 2006, <nhmrc.gov.au >.

20 Group of Eight, *Submission No. 21.1*, p. 1.

rather the subsequent stage of the process where the commercial viability of the IP is established.

6.27 Go8 explained the implications of the proof of concept funding gap:

> The funding gap from the cessation of research grant funding to the stage necessary to attract investment restricts the flow of new technology ventures.[21]

6.28 In this regard, the Go8 provided a supplementary submission outlining a proposal for a proof of concept funding scheme.

6.29 The proposal would establish an 'Innovation Stimulation Fund' of $45 million over three years to encourage universities themselves to invest in research of commercial potential at the proof of concept stage. Under the proposal the Australian Government would provide 3:1 investment matching for proof of concept investment, with total funding per project limited to $100 000.[22]

6.30 Under such a scheme, $15 million a year would be made available on a competitive basis—matched by $5 million from universities. This would provide a funding pool capable of funding a minimum of 200 proof of concept projects per year, or 600 projects over the proposed initial three year life of the scheme.

6.31 While inevitably some projects funded under such a scheme would fail, some projects would develop through to a later commercialisation stage which is then more attractive to venture capitalists. By providing 3:1 matched funding, universities would be encouraged to invest in research of commercial potential at the proof of concept stage, and a significant gap in the innovation pathway could be addressed.

21 Group of Eight, *Submission No. 21.1*, pp. 1-2.

22 Group of Eight, *Submission No.* 21.1, p. 2.

Recommendation 13

The Committee recommends that the Australian Government introduce a funded proof of concept scheme, based on the Group of Eight Innovation Stimulation Fund proposal and providing the following for university research projects with high potential for commercial outcomes:

- **matched Australian Government and university funding investment in the suggested ratio of 3:1;**
- **a maximum funding per project of $100 000; and**
- **funded for an initial three year period to a maximum Australian Government investment of $45 million.**

6.32 In making this recommendation, the Committee notes the concerns, expressed by Professor Pettigrew, that research funding agencies alone cannot, and should not, be responsible for supporting research from basic discovery all the way though to the completion of a marketable product.[23]

The Innovation Progression Gap

6.33 As noted in the previous section, some evidence to the inquiry has suggested that there is difficulty in securing support and funding for the further development of research with potential commercial outcomes.[24] This is sometimes referred to as the innovation progression or funding gap and represents a gap in funding to support the development of basic research to the level where it becomes a commercially attractive, investment ready proposition.

23 Professor A Pettigrew (National Health and Medical Research Council), *Transcript of Evidence*, 12 September 2005, p. 3.

24 For example see i3 Aerospace Technologies, *Submission No. 1*, p. 4; ATP Innovations, *Submission No. 6*, p. 4; Biomedical Consulting Services, *Submission No. 16*, p. 3; Australian Research Council, *Submission No. 19*, p. 6; Australian Institute for Commercialisation, *Submission No. 29*, p. 23; La Trobe University, *Submission No. 35*, pp. 1-2; CHAMP Ventures, *Submission No. 59*, p. 4; Science Industry Australia, *Submission No. 61*, p. 6; Australian Institute for Marine Science, *Submission No. 65*, p. 5; Department of Industry, Tourism and Resources, *Submission No. 82*, p. 26, Professor A Pettigrew (National Health and Medical Research Council), *Transcript of Evidence*, 12 September 2005, p. 12.

6.34 While there is some debate over the extent of the innovation progression gap, it results in a lack of funding support for activities such as proof of concept, prototype/product development. A 2003 Department of Industry, Tourism and Resources (DITR) survey reported:

> The most common assertion is that there is a funding gap in the range of $250,000–$1 million, and possibly extending to $2 million—which is often the range of funding needed at the research commercialisation (pre-seed) stage.[25]

6.35 In its submission the Department of Education, Science and Training (DEST) stated:

> Without access to funds to bridge the 'proof of concept' stage an innovation stands a higher chance of failing to attract investors, leaving the innovation in a virtually impossible position and the research investment wasted constituting a market failure.[26]

6.36 With the introduction of *Backing Australia's Ability (BAA)*, the Australian Government has introduced a number of initiatives intended to close the innovation progression gap. These include programs to improve cross-sectoral linkages such as the Cooperative Research Centre (CRC) program, and funding initiatives such as DITR's **Pre-Seed Funds** (PSF).[27]

6.37 The Industry Research and Development (IR&D) Board, which is responsible for assisting DITR with the administration of the PSF scheme, described the initiative as:

> ... a competitive pre-seed fund for universities and public sector research agencies which addresses the gap between promising scientific discoveries and commercialisation.[28]

6.38 DITR noted that the Australian Government has committed $72.7 million to four PSFs, managed by venture capitalists with experience in research commercialisation and the development of sustainable businesses.[29]

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25 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 26.

26 Department of Education, Science and Training, *Submission No. 20*, p. 16.

27 Pre-seed funding provides investment for the very early stages of innovation. This includes proof of concept activities.

28 Industry Research and Development Board, *Submission No. 53*, p. 2.

29 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 26.

6.39 However, some evidence to the inquiry has suggested that the PSFs do not effectively address the innovation progression gap due to the risk averse nature of the PSF managers.[30] Elaborating on this point, Mr Robert Taylor explained:

> Whilst pre-seed and VC fund support is being provided by various governments, generally what tends to happen is once you set up the fund then the fund manager moves to a less risky position, which does not help in the very early stage of demonstration and evaluation.[31]

6.40 To address the perceived reluctance of professional fund managers to invest in early stage technology-based innovation, Professor Frank Larkins of the University of Melbourne described an alternative pre-seed fund established jointly by the Universities of Melbourne and Queensland, stating:

> Because of the serious gap that we are faced with, the University of Melbourne, along with the University of Queensland, established the company Uniseed … We each put $10 million into an investment fund. While there are these investment bodies, as mentioned by others, they are still fairly risk averse … We found that, in order to get some of these VC funds to invest, we had to be prepared to put some money into protection of IP and possibly into start-up companies' further development.[32]

6.41 However, with regard to DITR's PSF (and a number of other Australian Government innovation support measures), some concern was expressed in relation to the requirement to be an incorporated entity to access Australian Government assistance.

6.42 Several submissions have suggested that, particularly for Intellectual Property (IP) emerging from the public sector, company formation may not necessarily represent the optimal pathway for the development of an innovative product, process or service.[33] As a company specialising in the commercialisation of IP, QPSX, noted:

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30 ATP Innovations, *Submission No. 6*, p. 5; La Trobe University, *Submission No. 35*, p. 2; Defence Science and Technology Organisation, *Submission No. 83*, p. 8; Dr J Yencken, *Transcript of Evidence*, 4 August 2005, p. 25; Mr R Taylor (Robert Taylor and Associates), *Transcript of Evidence*, 5 August 2005, p. 37.

31 Mr R Taylor (Robert Taylor and Associates), *Transcript of Evidence*, 5 August 2005, p. 37.

32 Professor F Larkins (University of Melbourne), *Transcript of Evidence*, 4 August 2005, p. 5.

33 Knowledge Commercialisation Australasia, *Submission No. 27*, p. 7; Dr J Yencken and Professor Emeritus M Gillin, *Submission No. 41*, pp. 6-7; QPSX, *Submission No. 47*, p. 4;

> The spin-off path is only suitable for a small proportion of technologies that have the potential to sustain a whole company. In their current form, many government funding programs such as AusIndustry's Commercial Ready and COMET do not adequately facilitate further development work for the licensing pathway.
>
> Without sufficient support for commercialisation via licensing, many economically useful technologies and process improvements will remain 'on the shelf' in R&D laboratories.[34]

6.43 Similarly, Dr Yencken emphasised that pre-seed funds are needed to support proof of concept activities regardless of whether the objective is to create a new firm or to licence the new technology to an existing company.[35] Dr Yencken contrasted the proof of concept funding situation in Australia with that of Singapore, noting:

> We were advised that for any reasonable proposal, the University will provide to the student a grant of S$50 000 towards achieving proof of concept ('technology that works') and identifying the market opportunity. The venture does not have to be incorporated at this stage.[36]

6.44 Another concern expressed by some relates to the $1 million investment limit associated with the PSF. Commonwealth Scientific and Industrial Research Organisation (CSIRO) suggested that this amount was not adequate to support innovation in certain sectors. Dr Jack Steele of CSIRO concluded:

> ... if you are after something like capital up to $1 million, particularly if you are in the half-a-million-dollar space, then there are four pre-seed funds and a number of [business] angels playing in that space. When you are asking for $5 million, there is a very limited number of places you can go, and that is a serious impediment in the system at the moment.[37]

Australian Institute for Marine Science, *Submission No. 65*, p. 5; Professor C Rider, *Submission No. 98*, pp. 3-8.

34 QPSX, *Submission No. 47*, p. 4.

35 Dr J Yencken, *Submission No. 41.1*, p. 2.

36 Dr J Yencken, *Submission No. 41.1*, p. 2.

37 Dr J Steele (Commonwealth Scientific and Industrial Research Organisation [CSIRO]), *Transcript of Evidence*, 18 May 2005, p. 7.

6.45 Similarly, while generally supportive of the PSF, CHAMP Ventures expressed concern with the limited opportunities for subsequent and more substantial early stage venture capital funding, stating:

> The Pre-seed Fund is a great initiative but limits funding to $1 m[illion] per company. My concern is whether the early stage venture capital will be available for companies within this program to be able to raise next round [of investment finance].[38]

Committee Comment

6.46 On the basis of the evidence presented, the Committee recognises that the innovation progression gap continues to represent a significant challenge for the development and commercialisation of innovation, despite measures intended to support commercialisation through enhanced cross sectoral linkages (e.g. CRC program and ARC Linkage Projects) and the introduction of the PSF scheme.

6.47 The Committee considers that the introduction of a university proof of concept funding scheme, as recommended in this chapter, and the continued refinement of the NHMRC's Development Grants will go some way to addressing the innovation progression gap. However, there are limits to the extent that ARC and NHMRC can address the innovation progression gap.

6.48 In relation to the PSF, the Committee notes the concerns with regard to the risk averse nature of PSF managers and the $1 million investment limit. The Committee is also aware that DITR is due to complete an interim evaluation of the PSF by 30 June 2006.[39]

6.49 In light of DITR's evaluation, the Committee does not make specific recommendations with regard to the PSF but anticipates that concerns regarding the risk averse nature of the PSF managers and the investment limit will be addressed.

6.50 It is the Committee's view that a scheme such as the PSF which targets the innovation progression gap, particularly investment in the development publicly funded research with commercial potential, is

38 CHAMP Ventures, *Submission No. 59*, p. 4.

39 Department of Industry, Tourism and Resources, *Portfolio Budget Statement 2006-07*, p. 51.

an important element of the Australian Government's support for innovation.

6.51 In addition, the Committee has acknowledged the multiplicity of possible pathways to innovation and commercialisation. Therefore, the Committee notes concerns raised by some with regard to the relative lack of Australian Government support that is capable of facilitating the progression and development of innovation through pathways other than the formation of start-up companies. The Committee considers that this issue requires further investigation.

Recommendation 14

The Committee recommends that the Australian Government implement additional support mechanisms to specifically assist the progression of innovation through pathways other than the formation of start-up companies.

Support for Business R&D and Start-up Enterprises

6.52 Evidence has indicated that continuing investment in R&D is an important factor for some businesses in maintaining a competitive advantage.[40]

6.53 The Australian Government provides a number of incentives to assist businesses with R&D. This assistance is available through a range of Government supported tax incentives, venture capital schemes and competitive grants.

Tax Incentives and Assistance

6.54 Evidence to the inquiry from several submissions has emphasised the importance of providing well-structured tax system to encourage innovation within business.[41]

40 Citrix Systems Australasia R&D, *Submission No. 5*, p. 1; CEA Technologies, *Submission No. 8*, p. 7; KCS, *Submission No. 24*, p. 4.

41 Professors K Smith and J West, *Submission No. 18*, p. 4; Australian Institute for Commercialisation, *Submission No. 29*, pp. 22-23; Professor C Rider, *Submission No. 98*, p. 1.

6.55 One of the principal forms of assistance for business R&D is provided through **R&D Tax Concessions.** R&D Tax Concessions are jointly administered by the IR&D Board, assisted by AusIndustry and the Australian Taxation Office (ATO).[42]

6.56 AusIndustry's *Tax Concession for Research and Development Overview* indicates that the R&D Tax Concessions comprise three key elements:

- a basic 125 per cent Tax Concession for investment in R&D;
- an Incremental (175 per cent Premium) Tax Concession for additional investment in R&D; and
- an R&D Tax Offset for small companies. The R&D Tax offset directly reduces tax payable by a company by the amount of approved R&D expenses. If the amount of the offset exceeds the amount of tax that the company would otherwise have to pay, then the excess is refundable.[43]

6.57 Evidence to the inquiry indicated that business R&D activities had benefited from the support provided by R&D Tax Concessions.[44] However, concerns were raised regarding the level of incentive provided by the R&D Tax Concessions and some aspects of the eligibility criteria.

Incentive

6.58 With regard to the incentive provided by R&D Tax Concessions, several submissions questioned whether this was sufficient for businesses to actually increase their expenditure on R&D activities.[45] For example, Dr Susan Anderson of BAE Systems Australia explained that the R&D Tax Concessions, while useful, were not sufficient incentive to increase R&D investment stating: 'While that [the R&D Tax Concessions] is not a driver it is an enabler and it does help us in our path.'[46]

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42 AusIndusty, *Tax Concession for Research and Development Overview*, September 2005, p. 1.

43 AusIndusty, *Tax Concession for Research and Development Overview*, September 2005, p. 1.

44 For examples see Dynamic Hearing, *Submission No. 10*, p. 3; AGC, *Submission No. 71*; Dr J Fox (Australian Innovation Association), *Transcript of Evidence*, 4 August 2005, p. 42; Dr S Anderson (BAE Systems Australia), *Transcript of Evidence*, 5 August 2005, p. 31.

45 KCS, *Submission No. 24.1*, p. 3; Australian Institute for Commercialisation, *Submission No. 29*, p. 23; Science Industry Australia Inc, *Submission No. 61*, p. 11; Australian Innovation Association, *Submission No. 72*, p. 7.

46 Dr S Anderson (BAE Systems Australia), T *Transcript of Evidence*, 5 August 2005, p. 31.

6.59 The erosion of the real value of R&D Tax Concessions as an incentive for businesses over recent years was also highlighted in evidence.[47] The erosion is a consequence of a 1995–96 reduction of the R&D Tax Concession from 150 per cent to its current level of 125 per cent, and of lower corporate tax rates.

6.60 In its submission the Australian Innovation Association (AIA) identified three main problems with the current R&D Tax Concessions framework:

- A 125 percent deduction coupled with a 30 percent corporate tax rate provides only a few cents in the dollar benefit - not likely to change policy at board level.
- Providing a concession to moderately sized companies spending less than, say, three percent of revenue on R&D is putting money into places with no serious commitment to R&D.
- The 175 percent concession for improvement is merely a 'one year blip' incentive, of little use to serious R&D spenders in their long term planning.[48]

6.61 To enhance the effectiveness of R&D Tax Concessions Dr Fox of the AIA suggested introducing a sliding scale commensurate with the level of R&D investment stating:

> ... I would bias the concession rate towards higher R&D spenders on the basis that a company that spends one or two per cent of its turnover on R&D is probably not going to be a major exporter; it is probably going to be a domestic based company or a commodity producer. But a company that is spending seven, eight or nine per cent of its turnover on R&D would surely be a high-value product or service company selling offshore. There is a way to bias it towards companies that spend more without changing the overall cost of that concession. You can reweight it so that down at one per cent you are at a 100 per cent tax concession and, if you are spending seven or eight per cent of your sales, your tax concession rate might be 175 per cent. You can reweight it towards people who are doing what you want them to do.[49]

47 Science Industry Australia, *Submission No. 61*, p. 11; Dr R Gilmore (Australian Institute for Commercialisation), *Transcript of Evidence*, 5 September 2005, p. 13.

48 Australian Innovation Association, *Submission No. 72*, p. 7.

49 Dr J Fox, *Transcript of Evidence*, 4 August 2005, p. 42.

6.62 Evidence to the inquiry suggested increasing the 125 per cent basic R&D Tax Concession to either 150 or 175 per cent.[50]

6.63 In considering R&D Tax Concessions as an R&D incentive, the ratio of compliance cost to benefit was also identified as an important factor. The complexity of the application process, monitoring and reporting requirements associated with the R&D Tax Concessions were identified as disincentives, especially for smaller businesses. For example, Science Industry Australia (SIA) expressed its concern that 'the potential benefits that science companies derive from the R&D Tax Concession Program are outweighed by the compliance costs.'[51]

6.64 Specifically with regard to the Tax Offset which is intended to provide R&D incentives for small businesses (including businesses in a tax loss situation), the AIIA also expressed its concerns with the $1 million R&D expenditure cut-off noting:

> There are some very valuable Government assistance programs in place in relation to R&D support—Tax Concession, BITS, and Tax Offset—but there are gaps. This is particularly the case with start-ups. For example the tax offset cuts out once companies have invested over $1 m[illion]—a figure easily breached by ICT [information and communications technology] companies with global aspirations.[52]

Eligibility

6.65 In describing eligibility for R&D Tax Concessions, AusIndustry's *Tax Concession R&D Overview* states 'All companies incorporated in Australia and undertaking eligible R&D activities[53] are entitled to apply for registration for the R&D Tax Concession.'[54]

50 KCS, *Submission No. 24.1*, p. 3; Mr R Grey (GBC Scientific Equipment), *Transcript of Evidence*, 4 August 2005, p. 51.

51 Science Industry Australia, *Submission No. 61*, p. 12.

52 Australian Information Industry Association, *Submission No. 60*, p. 7.

53 Eligible R&D activities are defined in section 73B of the *Income Tax Assessment Act 1936* (*ITAA 1936*) which states that research and development activities means: (a) systematic, investigative and experimental activities that involve innovation or high levels of technical risk and are carried on for the purpose of: (i) acquiring new knowledge (whether or not that knowledge will have a specific practical application); or (ii) creating new or improved materials, products, devices, processes or services; or (b) other activities that are carried on for a purpose directly related to the carrying on of activities of the kind referred to in paragraph (a).

54 AusIndustry, accessed 6 October 2005, *Tax Concession for Research and Development Overview*, September 2005, p. 2, <ausindustry.gov.au>.

6.66 Regarding accessibility of R&D Tax Concessions to start-up companies originating from PFRIs, some evidence expressed concern with eligibility criteria.[55] The Australian Institute for Commercialisation (AIC) listed the following concerns:

- Grant eligibility - most government grant schemes to encourage ideas to move from proof-of-concept to a business stage require the applicant to be incorporated. For an unincorporated entity, this generates a number of costs and could be a business strategy that is not necessarily the most appropriate or feasible for its stage of development.
- The R&D cash rebate [Tax Offset] scheme has two direct effects on new start-up companies:
  - ⇒ it prohibits any tax exempt organisation to hold greater than 25% ownership to be eligible; and
  - ⇒ it requires a three year financial history to be eligible - start-up companies have cash flow issues.
  - ⇒ Many research institutions are tax exempt, and thus ineligible to apply for tax exemptions, and for many other government grant schemes. [56]

6.67 A submission from Professor Cameron Rider (Professor of Taxation Law at the University of Melbourne) concluded that anomalies in the current taxation framework with regard to the commercialisation of IP present significant impediments to technological innovation.[57]

6.68 Professor Rider explained that the benefits potentially derived from various tax assistance measures (including the R&D Tax Concessions, Pooled Development Funds, Venture Capital Limited Partnerships and Capital Gains Tax discount) may be offset by other costs and taxes associated with the formation an incorporated entity.

6.69 In summary, the four problems arising as a consequence of the requirement to form a company to access tax assistance include:

- the immediate tax impost on unrealised gains associated with the transfer of IP assets to a company in exchange for shares;
- the immediate tax impost on unrealised gains associated with employee share option schemes;

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55 Australian Institute for Commercialisation, *Submission No. 29*, p. 22; Professor C Rider, *Submission No. 98*, pp. 3-4; Mr H Hawthorn (ATP Innovations), *Transcript of Evidence*, 18 May 2005, pp. 49-50.

56 Australian Institute for Commercialisation, *Submission No. 29*, p. 22.

57 Professor C Rider, *Submission No. 98*, pp. 3-9.

- the lack of tax relief for company start-up losses which are retained within the company and cannot be deducted against other income of the owners. This is in contrast with the taxation treatment of other business structures such as partnerships or unincorporated joint ventures where losses can be offset against other income of the owners; and
- the effective loss of tax free status for tax exempt shareholders, including PFRIs, which have to pay company tax on income. Again, this contrasts with a partnership business structure, where the share of income from tax exempt investors remains tax exempt.[58]

6.70 Other concerns raised with regard to the R&D Tax Concessions include the definition of eligible R&D activities, specifically the exclusion of R&D occurring in the humanities, social sciences and arts.[59]

6.71 A joint submission from the Australian Film Commission (AFC), the Australia Council for the Arts (the Australia Council) and the Australian Film, Television and Radio School (AFTRS) recommended extension of the R&D Tax Concessions to include the digital industry.[60]

6.72 The Council for Humanities, Arts and Social Sciences (CHASS) suggested a review of the *ITTA 1936* definition of R&D thereby:

> … allowing eligibility for the R&D tax concession for research in the humanities, arts and social science by amending the Income Tax Assessment Act.[61]

6.73 In addition, the inquiry received evidence regarding the inaccessibility of R&D Tax Concessions to foreign owned multinational companies and their Australian based subsidiaries.[62]

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58 Professor C Rider, *Submission No. 98*, pp. 3-9.

59 Australian Film Commission, the Australia Council for the Arts and the Australian Film, Television and Radio School, *Submission No. 67*, p. 15; Council for Humanities, Arts and Social Sciences, *Submission No. 77*, p. 31. Under section 73B(2C)(f) of *ITAA 1936* 'research in social sciences, arts or humanities' are classified as 'activities [that] are taken not to be systematic, investigative and experimental activities'.

60 Australian Film Commission, the Australia Council for the Arts and the Australian Film, Television and Radio School, *Submission No. 67*, p. 15.

61 Council for Humanities, Arts and Social Sciences, *Submission No. 77*, p. 37.

62 Citrix Systems Australasia R&D, *Submission No. 5*, p. 4; Merck Sharp and Dohme Australia, *Submission No. 56*, p. 5; Australian Information Industry Association, *Submission No. 60*, p. 7.

Evidence noted that the potential advantages of encouraging multinational companies to site their R&D activities in Australia include improved access to resources, the provision of employment opportunities, the development of skills and expertise and the establishment of international networks.[63]

6.74 The reasons for inaccessibility of R&D Tax Concessions for Australian based subsidiaries vary, contingent on the precise nature of the relationship with their foreign owned parent company. For example, Citrix Systems Australasia R&D explained why it, as part of a global technology company, found the benefits from R&D Tax Concessions to be less accessible, stating:

> In Citrix's case, our R&D facility exists as a separate legal entity and typically, this Centre will generate minimal profits and dividends for its holding company. When applied to this small profit, the R&D tax concession produces minimal savings, which are largely marginal in nature when sent back in the form of a dividend to our corporate holding company. As such, the full impact of the measure in alleviating the cost of undertaking R&D in Australia by a multinational cannot be realised.[64]

6.75 However, it is worth noting that the major objective of the R&D Tax Concessions Scheme is to support Australian innovation. This requires companies to be incorporated in Australia, and places strict eligibility requirements with regard to Australian content and ownership of IP.

6.76 Nevertheless, evidence has indicated that innovation, knowledge flows and networks are becoming increasingly international.[65] In certain sectors (e.g. pharmaceuticals), the high risk nature of the innovation and lengthy timeframes involved in development mean that often it is only multi-national companies that have the capacity to support the necessary R&D. Evidence has suggested that if Australia wants a share of these lucrative markets, then this is more likely to eventuate through support for Australian based subsidiaries of multinational companies.[66]

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63 Citrix Systems Australasia R&D, *Submission No. 5*, p. 6.

64 Citrix Systems Australasia R&D, *Submission No. 5*, p. 4.

65 Mr D Scott-Kemmis, *Submission No. 99*, pp. 3; 6.

66 Merck Sharp and Dohme Australia, *Submission No. 56*, p. 5.

6.77 Not all evidence however, was supportive of increasing the accessibility of Australian Government support to foreign owned multinational companies. For example, one submission stated that 'Australia should demand and consider its own ROI [return on investment], before subsidising foreign-owned research.'[67]

Committee Comment

6.78 The Committee does not underestimate the importance of an appropriate tax system to encourage greater business investment in R&D, technological innovation though IP commercialisation and the formation of start-up enterprises.

6.79 The Committee notes that tax assistance was considered in some detail previously by the House of Representatives Standing Committee on Science and Innovation in its 2002–03 inquiry into business R&D expenditure in Australia.

6.80 The resulting inquiry report *Riding the Innovation Wave: The Case for Increasing Business Investment in R&D* made a number of recommendations relating to the tax assistance available for R&D and start-up enterprises.[68]

6.81 In summary, recommendations made relating to tax assistance and R&D Tax Concessions included:

- reviewing the taxation treatment of employee share options schemes;
- simplification of the process of applying for R&D Tax Concessions and a reduction of the compliance burden through more streamlined reporting requirements;
- extension of the allowable activities to include the costs of IP application and protection; and
- modification of the current eligibility criteria for R&D Tax Concessions, including adjustment of the current turnover thresholds for the Tax Offset Program.

67 GBC Scientific Equipment, *Submission No. 76*, p. 9.

68 House of Representatives Standing Committee on Science and Innovation, *Riding the Innovation Wave*: *The Case for Increasing Business Investment in R&D'*, June 2003.

6.82 The Committee notes that the majority of the report's recommendations on tax assistance were not supported by the Australian Government.[69] Further, with regard to R&D Tax Concessions, DITR's 2003 evaluation concluded that the 125 per cent R&D Tax Concession is an appropriate and effective policy measure.[70]

6.83 Several concerns have been raised in evidence relating to the 175 per cent Premium Tax Concession and the Tax Offset, for example the 'one off' nature of the incentive offered by the Premium Tax Concession and the $1 million expenditure threshold associated with the R&D Tax Offset.

6.84 The Committee notes that DITR's 2003 evaluation of R&D Tax Concessions concluded that there was insufficient data to review the 175 per cent Premium Tax Concession and the Tax Offset as both were comparatively new (having been introduced in 2001–02). A future evaluation of both measures was recommended.

6.85 The Committee is therefore pleased to note that DITR is due to complete a formal evaluation of the 175 per cent Premium Tax Concession and the Tax Offset components of the R&D Tax Concessions package by the end of June 2006.

6.86 The Committee notes the evidence regarding the administrative compliance burden associated with accessing R&D Tax Concessions, which may act as a significant disincentive, especially for small businesses. With regard to this, the Committee is pleased to note that measures introduced in the 2006–07 Australian Government Budget include an additional $28 million over four years to support administration of the R&D Tax Concessions.

6.87 In relation to this measure, the 2006–07 Budget papers state:

> The funding will meet growing demand for the tax concession and increase compliance monitoring and legal oversight to minimise inappropriate claims.
>
> This measure includes $5.4 million in capital funding over two years for the Department of Industry, Tourism and Resources to develop a new information management system

69 *Australian Government Response to the House of Representatives Standing Committee on Science and Innovation Report:* Riding the Innovation Wave: The Case for Increasing Business Investment in R&D, March 2004.

70 Department of Industry, Tourism and Resources, accessed 23 March 2006, <industry.gov.au>.

> to manage registrations and programme participation, and to provide for improved risk management.[71]

6.88 The Committee anticipates that the new information management system will improve the efficiency of the scheme's operation for the administrators (i.e. IR&D Board, AusIndustry and the ATO). However, it is unclear to what degree this new system might decrease the administrative and compliance burden experienced by businesses attempting to access the scheme. The Committee strongly urges DITR to ensure that the new system is also effective in reducing the administrative and compliance burden for business.

6.89 The Committee also notes other amendments to the R&D Tax Concessions proposed in the 2006–07 Budget. These include:

> ... amending taxation legislation to clarify the law, remove unintended consequences and ensure that the law reflects the original policy intent. Some measures will broaden the range of potential claimants; others will streamline their claim processes.[72]

6.90 Evidence to this inquiry has differed regarding the overall advantages or disadvantages to Australia deriving from the activities of foreign owned multinational companies. The Committee recognises that the debate regarding the contribution of multinational companies to the national innovation system and to the Australian economy is complex.

6.91 However, the Committee considers that for Australia to participate in and contribute to innovation in certain fields, such as pharmaceuticals, business must be competitive in the global market. If adequate incentives are not made accessible for multinational companies to conduct business R&D activities in Australia then Australia will risk providing a production 'labour pool' rather than accessing the potential benefits of skills transfer and skilled employment opportunities through R&D involvement.

6.92 The Committee notes that the major objective of R&D Tax Concessions is to support Australian innovation. This requires companies to be incorporated in Australia and places strict requirements with regard to Australian content and ownership of IP. While it is appropriate for most Australian Government innovation programs to support Australian owned companies, the Committee

71 Australian Government 2006, *Budget 2006-07*, *Budget Paper No. 2*, p. 308.

72 Australian Government 2006, *Budget 2006-07, Budget Paper No. 2,* p. 319.

considers that the case for making the R&D Tax Concession available to Australian-based subsidiaries should be investigated and assessed.

Recommendation 15

The Committee recommends that the Australian Government assess the revenue implications and potential economic returns of extending the R&D Tax Concessions eligibility to include Australian based subsidiaries of multinational companies.

Support for Commercialisation and Business Growth

6.93 In addition to support for R&D, the Australian Government provides support for commercialisation and business growth through a range of initiatives. These initiatives include schemes intended to encourage investment in, and growth of, innovative Australian businesses and to enhance export.

6.94 Evidence to the inquiry has suggested that securing adequate investment at various stages of a company's development is a significant challenge for many innovating businesses.[73] In reviewing this evidence, the Committee is aware of other significant Australian Government activities in this area. These activities include:

- DITR's Review of the Venture Capital Industry; and
- Department of Communications, Information Technology and the Arts (DCITA) Review of Business Angel Networks in Australia.

6.95 DITR's Review of the Venture Capital Industry was announced by the Minister for Industry, Tourism and Resources in May 2005. The review's terms of reference were to investigate the venture capital and later stage private equity investment industry, and the

73 For example see i3 Aerospace Technologies, *Submission No. 1*, p. 1; ATP Innovations, *Submission No. 6*, p. 4; Australian Research Council, *Submission No. 19*, p. 6; Australian Institute for Commercialisation, *Submission No. 29*, p. 23; La Trobe University, *Submission No. 35*, pp. 1-2; CHAMP Ventures, *Submission No. 59*, p. 4, Science Industry Australia, *Submission No. 61*, p. 6; Australian Institute for Marine Science, *Submission No. 65*, p. 5; Department of Industry, Tourism and Resources, *Submission No. 82*, p. 26.

appropriateness, effectiveness and efficiency of existing Government support.[74]

6.96 The review was completed in late 2005. In response to key findings, the Australian Government announced measures in its 2006–07 Budget. The measures affect a number of existing Government venture capital schemes (including the Innovation Investment Funds, Pooled Development Funds and Venture Capital Limited Partnerships) and result in the introduction of a new venture capital scheme—the Early Stage Venture Capital Limited Partnership (ESVCLP). These schemes are discussed in more detail later in this chapter.

6.97 With regard to DCITA's Review of Business Angel Networks in Australia, the Committee notes that the report of the investigation is due to be finalised during 2006.[75]

Finance for Small to Medium Enterprise and Start-up Companies

6.98 While acknowledging that technological innovation occurs frequently under the auspices of already established larger businesses, much of the evidence to this inquiry has concerned the challenges faced by SMEs or start-up companies in accessing finance to support technological innovation.

6.99 Typically, finance for new SMEs from start-up to mature business will progress through a stage of informal investment to a stage of formal investment sourced from professional business investment companies.

6.100 Informal investment is often provided initially either by the company principals, and/or relatives and friends of the principals—the so-called 'three Fs'— friends, families and fools.[76]

6.101 Following this initial informal stage of early investment, additional finance may be sought from business angels, defined as high net worth individuals who are willing to invest their own capital in innovative firms.

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74 Department of Industry, Tourism and Resources, accessed 14 March 2005, <industry.gov.au>.

75 Department of Communications, Information Technology and the Arts, *Annual Report 2004-05*, pp. 187-88.

76 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 24.

6.102 As enterprises develop and the quantum of finance required increases, additional investment is usually sought through formal channels, either from professional venture capital firms or from banks and other financial institutions.

6.103 In addition to pre-seed investment considered earlier in this chapter, the three basic financing stages for a company are:

- Seed finance: support for the growth of early stage ventures which typically do not have fully established commercial operations, and require funding to assist in launching new products or services. It may also involve some level of continuing research and product development.
- Early Stage or Start-up finance: innovation development has been completed but the new product or service has not been sold commercially. Funding is required to initiate pilot production, commercial manufacturing and sales.
- Late Stage or Expansion finance: manufacturing and commercial sales of the innovation have been established, but capital is required for growth and expansion to meet growth targets and to seek out new markets.

Seed and Early Stage Finance

6.104 A significant body of evidence to the inquiry has identified a shortage of early stage venture capital in Australia as a major impediment to the commercialisation of innovation.[77] In particular it has been suggested that obtaining capital beyond the initial 'three Fs' investment is particularly problematic for technology-based start-ups.

6.105 Describing the consequences of this funding gap, and the lack of accessible early stage finance in Australia generally, i3 Aerospace Technologies stated:

> The absence of 'seed capital' to finance the earliest stages of technology innovation and demonstration up to the

77 For example see i3 Aerospace Technologies, *Submission No. 1*, p. 1; ATP Innovations, *Submission No. 6*, p. 4; Australian Research Council, *Submission No. 19*, p. 6; Australian Institute for Commercialisation, *Submission No. 29*, p. 23; La Trobe University, *Submission No. 35*, pp. 1-2; CHAMP Ventures, *Submission No. 59*, p. 4, Science Industry Australia, *Submission No. 61*, p. 6; Australian Institute for Marine Science, *Submission No. 65*, p. 5; Department of Industry, Tourism and Resources, *Submission No. 82*, p. 26.

> 'prototype stage' creates a huge barrier to technology innovation.[78]

6.106 Essentially, two possible explanations for the lack of early stage finance have been proposed. These are that:

- the venture capital sector in Australia is too risk averse due to its immaturity and lack of investors with sufficient expertise; and/or
- there is a lack of quality investment opportunities for investors. [79]

6.107 As suggested by DEST, it is likely that both factors contribute to the lack of capital investment in early stage technology-based start-up companies.[80]

Business Angel Investment

6.108 Given the limited capacity of most individuals to raise sufficient capital to support the entire commercialisation process of technological innovation, investment from business angels offers an alternative source of additional finance.

6.109 The potential contribution of business angels to supporting innovative activity in Australia was described by a global information and communications technology (ICT) firm, Citrix Systems Australasia R&D:

> An angel investor is an individual or company who injects funds into a start up company at its inception, commonly when the company is in a high risk or precarious phase. Typically the company's product development cycle is in its infancy and sometimes there is no product but merely an idea or concept in existence. An angel investor will inject capital at the 'ground floor' to kick the company off. Once the company has matured somewhat - say a product has been developed or customers have been signed up - then a venture capitalist may chose to become involved.[81]

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78 i3 Aerospace Technologies, *Submission No. 1*, p. 1.

79 Department of Education, Science and Training, *Submission No. 20*, p. 16; ATSE, *Submission No. 49*, p. 8; QPSX, *Submission No. 47*, p. 5; Science Industry Australia, *Submission No. 61*, pp. 6-7; Department of Industry, Tourism and Resources, *Submission No. 82*, pp. 25-26.

80 Department of Education, Science and Training, *Submission No. 20*, p. 16.

81 Citrix Systems Australasia R&D, *Submission No. 5*, p. 5.

6.110 However, it has been suggested that there is a lack of business angel activity in Australia.[82] Furthermore, i3 Aerospace Technologies argued in its submission that the relatively low level of business angel investment in Australia is exacerbated by a failure of potential investors to recognise the value of IP and human capital.[83]

6.111 i3 Aerospace Technologies contrasted this situation with that in the United States, stating:

> In the U. S. my experience (and that of others) is that sophisticated investors recognize **that the ideas and intellectual property are the CORE assets of a technology business and the primary source of value creation, and should be recognized by the investor as a highly valuable contribution by the entrepreneur and his team.**[84]

6.112 Several submissions suggested that business angel activity could be increased by the introduction of appropriate tax incentives on any capital gains realised from the investment.[85] As Mr Matthew Griffith, a COMET business advisor, explained:

> ... if I looked at one thing that would make a massive difference in our space, it would be lowering the tax rate for [business] angels to invest in start-ups, making it far more financially attractive for them because there is so much more risk attached to it.[86]

6.113 In addition, it has been suggested that business angel activity may be enhanced via the establishment of business angel networks.[87] For example, the SIA suggested:

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82 Citrix Systems Australasia R&D, *Submission No. 5*, p. 5; Metrics of Research Commercialisation Working Group, *Submission No. 7*, p. 2; Science Industry Australia, *Submission No. 61*, p. 7; Mr M Griffiths (Commercialising Emerging Technologies [COMET] program Business Adviser), *Transcript of Evidence*, 18 May 2005, p. 33; Mr B Johansson (Gazelle Monitoring), *Transcript of Evidence*, 18 May 2005, p. 72.

83 i3 Aerospace Technologies, *Submission No. 1*, p. 4.

84 i3 Aerospace Technologies, *Submission No.* 1, p. 4.

85 Citrix Systems Australasia R&D, *Submission No. 5*, p. 5; Australian Institute for Commercialisation, *Submission No. 29*, p. 23; Mr B Johansson (Gazelle Monitoring), *Transcript of Evidence*, 18 May 2005, p. 72.

86 Mr M Griffiths (Commercialising Emerging Technologies [COMET] program Business Adviser), *Transcript of Evidence*, 18 May 2005, p. 33.

87 i3 Aerospace Technologies, *Submission No. 1*, p. 4; ATP Innovations, *Submission No. 6*, p. 5; Science Industry Australia Inc, *Submission No. 61*, p. 9; Mr M Duursma (Citrix Systems Australasia R&D), *Transcript of Evidence*, 18 May 2005, p. 53; Mr K Besgrove (Department of Communications, Information Technology and the Arts), *Transcript of Evidence*, 5 December 2005, p. 24.

> Establish[ment of] a national register of business angels. This could be developed by the relevant industry associations using any existing business angels listings that they may have. Government could also provide some assistance through its existing programs.[88]

Committee Comment

6.114 The Committee acknowledges the potential contribution of business angel investment to technological innovation in Australia. It considers that the introduction of tax incentives and support for business angel networks are both strategies that might be applied to promote business angel investment in technology-based start-up companies.

6.115 As indicated earlier in this chapter, the Committee notes that DCITA is in the process of conducting a review of business angel activity in Australia. Given the expected release of DCITA's Review of Business Angel Networks in Australia (i.e. during 2006), the Committee does not wish to foreshadow the findings of that review.

6.116 From its discussions with DCITA the Committee is satisfied that the Department is aware of the concerns relating to angel investors and the Committee looks forward to the outcomes of the DCITA review.

Venture Capital Investment

6.117 The venture capital sector also provides a formal mechanism for those seeking early stage investments to support technological innovation. Venture capital, as defined by the Australian Bureau of Statistics (ABS) is 'high risk private equity capital for typically new, innovative or fast growing unlisted companies'.[89]

6.118 While noting that the size of the venture capital market in Australia is relatively small, being less than one per cent of Australia's capital market, there are indications that suggest Australia's venture capital market is increasing.[90]

6.119 Nevertheless, evidence to the inquiry suggested that there continues to be a shortage of venture capital finance in Australia and that the

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88 Science Industry Australia, *Submission No. 61*, p. 9.

89 Australian Bureau of Statistics, *Venture Capital Australia 2004-05*, Catalogue No. 5678.0, p. 20.

90 *Australian Government's Innovation Report 2004-05: Real Results Real Jobs*, p. 15; Australian Bureau of Statistics, *Venture Capital Australia 2004-05*, Catalogue No. 5678.0, p. 5.

industry is generally too risk averse and lacking in experienced investors.[91]

6.120 For example, Momentum Funds Management expressed the following concern:

> For the large number of early stage technology companies that are being encouraged by various governments and government programs to advance their businesses there is likely to be almost nowhere to go when the time comes to raise sums of capital in excess of the initial 'angel' capital from family and friends.[92]

6.121 The AIC also noted the following challenges experienced by companies attempting to access venture capital finance:

> In assessing potential deals, venture capitalists will demand:
>
> - differentiated IP that has been de-risked and is unencumbered;
> - an articulate champion to spearhead the scientific development;
> - proof of a market and customers with a demonstrated need; [and]
> - a defined exit strategy.[93]

6.122 The Australian Government has a number of measures which seek to encourage greater venture capital investment early stage innovation. These initiatives include the **Innovation Investment Funds** (IIF), **Pooled Development Funds** (PDF) and **Venture Capital Limited Partnerships** (VCLP).

6.123 All three of these programs are administered by DITR, which described the nature of the programs in the following way:

> The IIF and Pre-seed Funds are 'co-investment' programs where the Government has established licensed funds with part government and part private sector investors. The investment decisions are made by the funds, within guidelines established for the programs. There are also tax

91 i3 Aerospace Technologies, *Submission No. 1*, p. 3; Biomedical Consulting Services, *Submission No. 16*, pp. 2-3; Department of Education, Science and Training, *Submission No. 20*, p. 16; DSTC Pty Ltd, *Submission No. 69*, p. 2.

92 Momentum Funds Management, *Submission No 51*, p. 3.

93 Australian Institute for Commercialisation, *Submission No. 29*, p. 5.

> incentive based programs to encourage investment in early stage ventures, including the PDF and the VCLP.'[94]

6.124 Describing the investment incentives offered by these venture capital programs, Ms Amanda Heyworth of Playford Capital explained:

> Where the government subsidises a venture capital fund, it effectively lowers its required rate of return on any individual business. Therefore, the number of businesses … that can be funded increases. In effect what we are doing is saying if the hurdle was a $100 million exit with no subsidy, that is a very significant business that can achieve that in such a short time frame. The effect of the subsidy is to lower that hurdle from $100 million downwards, thereby allowing the next best of the opportunities through.[95]

Innovation Investment Funds

6.125 The co-investment IIF program was announced by the Australian Government in 1997 and is administered by AusIndustry and the IR&D Board. The IIF is intended to provide capital to support small technology-based companies and the development of a 'self-sustaining Australian early stage, technology-based venture capital industry'. [96]

6.126 The IIF requires the Australian Government investment of $221 million to be matched by the private sector up to a maximum ratio of two to one. Nine private sector venture capital fund managers have been licensed through two rounds of the program to date.[97] The licensed funds administer the pool of investment capital, making all investment decisions relating to their IIF money.

6.127 Despite the intent of the IIF, some evidence to the inquiry has suggested that the IIF venture capital managers are too risk averse and inexperienced to invest in early stage ventures.[98] For example, i3 Aerospace Technologies stated:

> ... the government sponsored Innovation Investment Fund (IIF) designed specifically to support early stage companies

94 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 26.

95 Ms A Heyworth (Playford Capital), *Transcript of Evidence*, 5 August 2005, p. 46.

96 AusIndustry, *Round Two IIF Guidelines, 14 December 1999*, pp. 1-2.

97 Industry Research and Development Board, *Submission No. 53*, p. 2.

98 i3 Aerospace Technologies, *Submission No. 1*, p. 3; Dr J Yencken, *Transcript of Evidence*, 4 August 2005, p. 26.

> are in fact limited, through the policies of their venture capital managers, to those firms that have already removed the technology development risk from the table, preferably using the entrepreneur's internal resources.[99]

6.128 In addition, with regard to the development of a self-sustaining early stage technology-based venture capital industry in Australia, submissions from two venture capital investment groups emphasised the importance of a long-term commitment by the Australian Government.[100]

6.129 Both Momentum Funds Management and CHAMP Ventures called for further rounds of the IIF program that are also open to venture capital funds that have previously been successful in accessing assistance through the scheme. In this regard, Momentum Funds Management noted that in Australia 'IIF licences were "one-off" events' and that '[a]lmost all the existing IIF Fund Managers have struggled to raise new funds.' [101]

Pooled Development Funds and Venture Capital Limited Partnerships

6.130 The two remaining Australian Government venture capital programs, the PDF and the VCLP program, both provide tax incentives to investors to encourage investment in early start-up companies.

6.131 Describing the objectives of the PDF program, DITR stated that the program:

> ... is designed to increase the supply of equity capital for growing Australian SMEs. PDFs are private sector investment companies established under the PDF Act [*Pooled Development Funds Act 1992*] which raise capital from investors and use it to invest in Australian companies.'[102]

6.132 PDF investments are made by acquiring newly issued shares in small and medium enterprises (SMEs) with total assets of less than $50 million. The investee company must have issued shares for the purpose of raising capital to:

- establish a new business activity;

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99 i3 Aerospace Technologies, *Submission No. 1*, p. 1.

100 CHAMP Ventures, *Submission No. 59*, p. 4; Momentum Funds Management, *Submission No. 51*, p. 3.

101 Momentum Funds Management, *Submission No. 51*, p. 3.

102 Department of Industry, Tourism and Resources, *Submission No. 82,* p. 26.

- expand production capacity or services; and/or
- expand or develop markets. [103]

6.133 PDFs operate by providing tax benefits on the income derived from equity investments in SMEs. The PDFs are taxed at 15 per cent on income and gains derived from equity, and PDF shareholders are exempt from tax on the income and gains derived from holding and disposing of PDF shares.[104]

6.134 The stated objective of the VCLP program is to:

> Facilitate foreign investment in the Australian venture capital industry by providing incentives for increased investment which will support patient equity capital investments in relatively high risk start-up and expanding businesses that would otherwise have difficulty in attracting investment through normal commercial means. [105]

6.135 DITR described the operation of the VCLP program as follows:

> ... [it] provides for the registration of limited partnerships as venture capital limited partnerships and is designed to increase the supply of venture capital to Australian companies by providing tax incentives to non-resident investors in Australian VC.'[106]

6.136 These tax incentives apply to investors from Canada, France, Germany, Japan, United Kingdom and the US. Since the program commenced in 2002, eight VCLPs have been registered and $950 million in capital commitments have been obtained from VCLPs.[107]

6.137 The inquiry received only a small volume of evidence with regard to the operation and effectiveness of the PDF and VCLP. However, in relation to the VCLP Mr Nelson of Divergent Capital expressed concern with regard to potentially restrictive requirements for Australian ownership and business location, stating:

> ... I still believe that a company with its shareholders in Australia, that has since successfully migrated to the States and is exporting all around the world, if that company sends

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103 AusIndustry, *Pooled Development Funds Fact Sheet*, 23 November 2004.

104 AusIndustry, *Pooled Development Funds: Tax Concessions Fact Sheet*.

105 AusIndustry, *Program Profile Venture Capital Limited Partnerships (VCLP) Program*, p. 1.

106 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 27.

107 AusIndustry, *Program Profile Venture Capital Limited Partnerships (VCLP) Program*, p. 1.

> $50 million back to its Australian shareholders, that is a better outcome than not having had that company at all. That furthers the legacy of entrepreneurship and ealry stage innovation. Therefore, I guess, I would be against rules that prescribe certain amounts of the company having to stay domiciled in Australia.[108]

6.138 This comment reflects concerns expressed more broadly in the media with regard to Government over-regulation of VCLPs, which it is claimed is acting as a disincentive for overseas investors.[109]

Banks and Financial Institution Investment

6.139 Investment from banks and other financial institutions potentially offers an alternative source of financial support for technological innovation. However, a significant volume of evidence to the inquiry has suggested that banks and financial institutions are reluctant to invest in the venture capital sector unless loans are secured against property or other liquefiable asset.[110]

6.140 For example, AWS Clinical Waste noted:

> The banking sector has assisted with overdraft lending secured by private assets but have [sic] been of no assistance with risk investment due to a lack of understanding or interest in our activities despite a relationship of more than 20 years with the one bank. Banks in fact tend to be least helpful at the time of greatest need.[111]

6.141 It has also been suggested that the risk averse attitude of banks and financial institutions with regard to supporting technology-based innovation is exacerbated by a general reluctance to recognise the value of human capital and knowledge assets, and a poor understanding of the risk-reward profile of innovative businesses.[112]

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108 Mr D Nelson (Divergent Capital), *Transcript of Evidence*, 18 May 2005, p. 33.

109 J May, 'Foreign Money Scared Off', *Business Review Weekly*, December 1-7, 2005, pp. 18-19.

110 For examples see Science Industry Australia, *Submission No. 61*, p. 8; Momentum Funds Management, *Submission No. 51*, p. 2; AWS Clinical Waste, *Submission No. 63*, p. 4; S Hudson and Associates, *Submission No. 80*, p. 5.

111 AWS Clinical Waste, *Submission No. 63*, p. 4.

112 i3 Aerospace Technologies, *Submission No. 1*, p. 4; Mr S Jeffrey, *Submission No. 25*, pp. 8-9; Momentum Funds Management, *Submission No. 51*, p. 2; S Hudson and Associates, *Submission No. 80*, p. 5.

6.142 In addition, the issue of how to encourage more investment in early stage technological innovation from superannuation funds was raised on several occasions. As with the traditional banking and financial institution sector, the risk averse nature of superannuation funds and the absence of a 'track record' for early stage innovation investment in Australia are seen as significant impediments.[113]

6.143 Dr James Fox of the AIA emphasised the difficulties faced by superannuation funds in making seemingly 'risky investment decisions' unless offset by financial incentives provided by government, stating:

> That is where you have an overarching set of financial rules that will encourage them [superannuation funds] to not allocate 0.001 per cent but 0.5 per cent. Why will they do that? They will do that because the risk they perceive has been now balanced by a return profile that is in part underwritten.[114]

6.144 Similarly, in its submission the AIC suggested that superannuation fund investment in innovation could be 'encourage[d] through legislation or rebates'.[115]

6.145 Mr Brett Morris of Neo Technology Ventures suggested that the imperative should be for the technology-based innovation sector to demonstrate its worth, stating:

> What we should not do is mandate that a certain percentage of those funds be bigger. What we need to do is prove that this alternative asset subclass is worthy of investment. We need to put the different pieces of the puzzle together that can demonstrate to the guardians of that superannuation money that this deserves their attention, that the data or performance is worth putting 10 per cent, to use your example, into this area. We need to be coordinating all these different things and that is why our ultimately our aim should be about attracting capital into this area.[116]

6.146 Also emphasising the importance of establishing a track record to encourage investment in technology-based, Ms Patricia Kelly of DITR suggested that some of the Australian Government's venture capital

113 Mr D Nelson (Divergent Capital), *Transcript of Evidence*, 18 May 2005, pp. 31-32; Dr J Fox (Australian Innovation Association), *Transcript of Evidence*, 4 August 2005, p. 44.

114 Dr J Fox (Australian Innovation Association), *Transcript of Evidence*, 4 August 2005, p. 45.

115 Australian Institute for Commercialisation, *Submission No. 29*, p. 32.

116 Mr B Morris (Neo Technology Ventures), *Transcript of Evidence*, 18 May 2005, p. 30.

programs were assisting in this process. However, Ms Kelly suggested that even with a better established track record, superannuation funds would most likely invest at a later rather than earlier stage of the innovation process, stating:

> ... once they [Australian Government venture capital programs] have the track record of managing a fund successfully for a period they then have a much better chance of attracting funds from people like superannuation funds. They are going on to raise funds which are mostly for a little bit further up the food chain, in that they are not the very ealry stage but the follow-on investments.[117]

6.147 Ms Kelly also advised the Committee that issues associated with superannuation fund investment in innovation were being considered in DITR's Review of Venture Capital in Australia.[118]

6.148 To address the lack of accessible early stage finance, evidence from some submissions and witnesses suggested the introduction of a Government funded or subsidised loans scheme targeting business innovation.[119] Outlining a potential advantage of accessing finance via a loan rather than through venture capital investment, one witness explained:

> You have to look at loans because the liquidity event against a loan is a lot easier; it is revenue. If you bring in revenue, you can pay your debts. You can pay back a loan. You do not have to sell your business in order for your shareholders or stakeholders to get their money back. That is the issue.[120]

6.149 While the details of how such a Government funded commercialisation loans scheme might operate varied between submissions and witnesses, the common elements for consideration included:

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117 Ms P Kelly (Department of Industry, Tourism and Resources), *Transcript of Evidence*, 28 November 2005, p. 22.

118 Ms P Kelly (Department of Industry, Tourism and Resources), *Transcript of Evidence*, 28 November 2005, pp. 11-12.

119 Professor K Smith and J West, *Submission No. 18*, pp. 13-14; S Hudson and Associates, *Submission No. 80*, pp. 12-21; Dr K Williams (Proteome Systems), *Transcript of Evidence*, 18 May 2005, p. 21; Mr M Griffith (Commercialising Emerging Technologies [COMET] program Business Adviser), *Transcript of Evidence*, 18 May 2005, p. 32; Mr M Johansson (Gazelle Monitoring System), *Transcript of Evidence*, 18 May 2005, pp. 71-72.

120 Mr M Griffith (Commercialising Emerging Technologies [COMET] program Business Adviser), *Transcript of Evidence*, 18 May 2005, p. 32.

- rigorous eligibility and due diligence requirements (e.g. well-developed business plans and staged loan payments contingent on achieving agreed progress);
- selection of investments by independent private investors with no conflict of interest, rather than by Government employees;
- a level of co-investment from the loan recipients to guard against extremely high-risk or inappropriate investment behaviour;
- loans which are fully repayable plus royalties if the venture is successful, but non-repayable if the venture fails; and
- the capacity for any returns loans to replenish the pool and be reinvested.

Later Stage Commercialisation Assistance and Expansion Capital

6.150 While much of the evidence regarding capital risk and investment has emphasised a lack of early stage funding for technology-based companies, concern has also been raised with regard to the availability of later stage commercialisation assistance and expansion capital.[121]

6.151 Later stage capital is required to support expansion by already established businesses and may be used either to develop new innovations or to access new markets. Referring to the lack of later stage capital to support the growth of SMEs, Mr Gaul of CEA Technologies stated:

> On the issue of management and financial credibility, again it is in policy areas that we are letting ourselves down a bit in Australia. Our venture capital industry is not mature enough or big enough and does not have the critical mass to provide the funding that is so necessary to grow SMEs and give them the backing so that they can implement their innovation. [122]

6.152 The shortage of expansion capital has also been highlighted in the 2005 Prime Minister's Science, Engineering and Innovation Council (PMSEIC) Working Group Report *Growing Technology-based SMEs* which noted:

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121 CEA Technologies, *Submission No. 8*, p. 10; Queensland Government, *Submission No. 74*, p. 6.

122 Mr D Gaul (CEA Technologies), *Transcript of Evidence*, 20 June 2005, p. 9.

> The Government makes a substantial investment in early stage businesses, through financial and other assistance for innovation, early commercialisation of products and export promotion and should capitalise on its investment by backing the transition of these businesses through the expansion stage and beyond.[123]

6.153 Similarly, the Queensland Government outlined a perceived need for the Australian Government to consider the provision of more support for:

> Development of later stage venture capital funds capable of injecting investment into mid-sized knowledge-based companies, taking them to the point where they can raise sufficient capital to be internationally competitive. Investment at this level is not available from the Commonwealth Innovation Investment Funds, and there are very few other funds operating in Australia capable of making such large investments. This is a key area the Commonwealth should be directing investment into.[124]

6.154 Emphasising the importance of providing support for innovation occurring within already established businesses, Mr Laver of the ATSE stated:

> Real innovation takes place where people already have money, where people do not have to mortgage the house and borrow from grandfather but where they work under the shelter of an existing company that has cash flows that actually allow them to do these things. Policy really needs to do some thinking about how to encourage those companies to act in a more entrepreneurial way.[125]

6.155 Similarly, Dr James Fox of AIA suggested:

> ... I think there should be a bit more emphasis on encouraging the other form of start-up [under the protection of an established company], which would reduce the risk to taxpayers who fund various programs and schemes.[126]

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123 *Prime Minister's Science, Engineering and Innovation Council Working Group Report: Growing Technology-based SMEs*, 2005, p. 3.

124 Queensland Government, *Submission No. 74*, p. 6.

125 Mr P Laver (ATSE), *Transcript of Evidence*, 4 August 2005, p. 32.

126 Dr J Fox (Australian Innovation Association), *Transcript of Evidence*, 4 August 2005, p. 43.

6.156 Elaborating on the benefits of growing a start-up business under the protection of an already established company, Dr Fox explained that the start-up could take advantage of existing 'infrastructure, R&D, finance, legals, offshore marketing and selling'.[127] In contrast, self-standing start-ups needed to 'Find a business manager, tame the scientist, get an accountant, [and] throw seed capital at it'.[128]

Committee Comment

6.157 As mentioned earlier, the Committee notes that the Australian Government has announced a number of measures through its 2006-07 Budget to address key issues arising from DITR's Review of the Venture Capital Industry.

6.158 In summary, the Budget has resulted in three reforms to the venture capital sector to stimulate greater investment in early stage innovation and commercialisation of Australian products and services. These are:

- provision of $200 million for a third round IIF. The new round will appoint up to two new Venture Capital managers each year for five consecutive years with $40 million per annum in funding available for successful fund managers. The government funding will be matched dollar for dollar by the private sector[129];
- establishment of a new ESVCLP investment vehicle which will progressively replace the existing PDF by 31 December 2006. The ESVCLP will provide tax benefits to domestic and foreign investors, with the income received by the partners being exempt from taxation[130]; and
- amendments to the operation VCLP to remove restrictions on the country of residence of investors and minimum partnership capital required for registration.[131]

6.159 The Committee is pleased to note that a number of issues raised in evidence to the inquiry have been addressed through these measures, including the removal of restrictions associated with the VCLP and the provision of funding for a third round of the IIF.

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127 Dr J Fox (Australian Innovation Association), *Transcript of Evidence*, 4 August 2005, p. 43.
128 Dr J Fox (Australian Innovation Association), *Transcript of Evidence*, 4 August 2005, p. 43.
129 Australian Government 2006, *Budget 2006-07, Budget Paper No. 2*, p. 310.
130 Australian Government 2006, *Budget 2006-07, Budget Paper No. 2*, p. 36.
131 Australian Government 2006, *Budget 2006-07, Budget Paper No. 2*, p. 36.

6.160 Regarding the third round of the IIF, the Committee notes that the scheme will assist in growing Australia's venture capital base by enabling new venture capital fund managers to enter the industry. However, IIF managers funded through earlier rounds of IIF have reported difficulties in raising new funds. Consequently the Committee is concerned that issues of sustainability beyond the life of the scheme have not been addressed and urges that further consideration be given to this matter.

6.161 Further, the Committee agrees with the assertion that the focus of venture capital programs is skewed toward the provision of support for new start-up companies, while there is a lack of equivalent initiatives for later stage investment to promote innovation within existing businesses.

Commercial Ready Program

6.162 In addition to support for commercialisation offered through the Australian Governments venture capital programs considered above, AusIndustry's **Commercial Ready Program (CRP)** which commenced in 2004, provides $200 million a year until 2011 to:

> ... encourage the growth of innovative Australian companies and to ensure that new innovative products, processes and services make it onto the market.[132]

6.163 The CRP builds on the success of three earlier innovation programs, namely R&D Start, the Biotechnology Innovation Fund (BIF) and Innovation Access which have now concluded and been replaced by the CRP.[133]

6.164 The main aims of the CRP are to:

- encourage the growth and successful innovation of Australian companies by increasing the level of research and development, proof-of-concept and early stage commercialisation by Australian businesses;
- increase the international competitiveness of Australian businesses;
- foster greater collaboration between industry and industry and research institutions; and
- generate national benefit for the Australian economy. [134]

132 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 9.

133 Department of Industry, Tourism and Resources, *Submission No. 82*, p. 9.

134 AusIndustry, *Commercial Ready Customer Information Guide, 31 August 2005*, p. 3.

6.165 To be eligible to apply for CRP applicants must:

- be a non-tax exempt company incorporated under the *Corporations Act 2001*;
- have, or be part of a group, that has an annual turnover of less than $50 million in each of the three financial years prior to the application;
- be able to demonstrate that it will match the amount of the grant from non-government and other approved sources on a dollar-for-dollar basis over the life of the project; and
- be able to demonstrate that it has access to, or the beneficial use of, any intellectual property necessary to carry out and/or commercialise the proposed project.

6.166 While the CRP aims to support product innovation through to commercialisation stage, evidence contended that the program should complement its early stage focus with more support for late stage transition into the market place.[135]

6.167 In commenting on the scope of activities supported under the CRP, S Hudson and Associates noted that there is no funding for the 'most crucial' stage of product and service development, the 'marketability stage'[136], stating:

> [t]here is no funding available for established companies with new product innovation that will fund the rollout of the product into the market. Without this funding there is no ROI [return on investment] on the R&D investment and thus that key profit driver for R&D investment is diminished.[137]

6.168 Similarly, the ACS recommended that:

> … grants and awards provided by the Government to help SMEs must allow (and encourage) part of the assistance

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135 CEA Technologies, *Submission No. 8*, p. 10; Proteome Systems, *Submission No. 55*, p. 2, and see discussion below.

136 S Hudson and Associates, *Submission No. 80*, p. 8. Marketability is defined as 'that stage of development that occurs prior to gaining the first order. For Innovation this is also known as pre-launch and includes the activities of: gearing up for production; implementation of the marketing and sales plans; investment in people, services and systems to ensure a successful launch. With Export this includes: stocking up; product modification; export marketing; distribution establishment; and technology and training.'

137 S Hudson and Associates, *Submission No. 80*, p. 4.

> package to be used for sales and marketing and not insist that it be used for research and development purposes alone.[138]

6.169 Another issue was the exclusion of PFRI originated spin-off companies from accessing CRP funding, under the 'majority ownership rule'. [139] ATP Innovations, a university-owned technology commercialisation hub[140] which supports start-up businesses in the biotechnology, ICT and electronics sectors, advised:

> This is a major hurdle for these companies. It is our experience that access to matching 'Commercial Ready dollars' is the one of the critical circuit breakers in assisting a new venture to establish itself through accelerated investment in product development and is a key driver in enabling an entity to successfully migrate from the university environment to a more commercial setting.[141]

6.170 As a consequence, PFRI spin-off companies are also disadvantaged when attempting to obtain investment from other venture capital sources:

> It is a key issue for being able to leverage investment. If you have two similar deals on the table and a venture capitalist is looking at both, if they are able to leverage dollar-for-dollar their investment in company A versus no opportunity of leveraging company B, you are at a substantial disadvantage.[142]

6.171 In addition to accessibility restrictions relating to PFRI spin-offs, evidence was also received that raised concerns with regard to the accessibility of the CRP to SMEs and start-up companies. Specifically in this regard, a number of submissions identified difficulties for

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138 Australian Computer Society, *Submission No. 38*, p. 3.

139 During the early phase of development many of these spin-off companies are majority owned by the university or research institution. This excludes them from accessing the program. See ATP Innovations, *Submission No. 6*, p. 5 and see Knowledge Commercialisation Australasia, *Submission No. 27*, p. 7; Group of Eight, *Submission No. 62*, p. 4.

140 Joint ownership by the University of New South Wales, the University of Sydney, the University of Technology Sydney and the Australian National University.

141 ATP Innovations, *Submission No. 6*, p. 5.

142 Mr H Hawthorn (ATP Innovations), *Transcript of Evidence*, 18 May 2005, p. 43.

SMEs in raising the 50 per cent matching finance required to receive CRP funding.[143]

6.172 The risk averse nature of CRP support was emphasised in the submission from i3 Aerospace Technologies, which claimed that:

> … we have found that senior Commercial Ready program managers do not have an appetite for start-up businesses, and proposals submitted from start-up firms seeking R&D funding are hitting a wall.[144]

6.173 Evidence from two submissions also noted that Australian subsidiaries of multinational companies are unable to access assistance from CRP due to Australian ownership and control rules, and the capped $50 million turnover eligibility criterion.[145]

6.174 Specifically, with regard to the capped $50 million turnover, the SIA expressed concern that for the science industry, this criterion is 'unrealistic and it acts as an impediment to further investment in R&D'.[146] The SIA suggested that the science industry 'considers that a limit of $200 million would be more realistic.'[147]

Committee Comment

6.175 While acknowledging that the CRP has only been in operation since 2004, the Committee notes the evidence presented to the inquiry raising concerns with some aspects of the CRP support and accessibility.

6.176 The CRP provides funding for early commercialisation activities such as trial production runs, IP management and protection, trials and demonstrations and market research. However, it does not support later stage commercialisation activities such as the implementation of marketing and sales plans or assistance with product launch.

6.177 Given the importance of marketing and sales activities to commercialisation, the Committee is concerned by evidence that

143 CEA Technologies, *Submission No. 8*, p. 10; Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Submission No. 32*, p. 11; i3 Aerospace, *Submission No. 1*, p. 8.

144 i3 Aerospace Technologies, *Submission No. 1*, p. 1.

145 QPSX, *Submission No. 47*, p. 4; Science Industry Australia, *Submission No. 61*, p. 12.

146 Science Industry Australia, *Submission No. 61*, p. 12.

147 Science Industry Australia, *Submission No. 61*, p. 12.

suggests there may be a lack of Government support for those activities at the later stages of the commercialisation process.

6.178 Therefore the Committee recommends that DITR introduce appropriate measures to support marketing and sales activities either by extending the range of activities eligible for CRP support, or by establishing an alternative scheme to support these later stage commercialisation activities.

Recommendation 16

The Committee recommends that the Australian Government Department of Industry, Tourism and Resources extend the support available to provide for later stage commercialisation activities, such as market identification, marketing and sales strategies.

This support may be provided either by extending the range of activities eligible under the Commercial Ready Program or by establishing alternative mechanisms of assistance which are compliant with World Trade Organisation and other trade agreement conditions.

6.179 Regarding the ineligibility of PFRI spin-off companies, the Committee notes that the concerns expressed are similar to those expressed with regard to the R&D Tax Concessions. Again the Committee considers that this highlights the absence of adequate transitional measures to support commercialisation of IP originating from the public sector and that recommendations made earlier in the report are pertinent.

6.180 Similarly, the Committee notes the concerns raised regarding accessibility of CRP support to Australian subsidiaries of foreign owned companies. The Committee suggests that this be considered again in light of its earlier comments made with regard to the accessibility of R&D Tax Concessions for Australian subsidiaries of multinational companies.

6.181 The Committee strongly suggests that other eligibility issues, including the requirement for companies to provide matching funds and the current annual expenditure turnover threshold, are investigated further over the next 12 months. Their impact on accessibility of support through the CRP should be specifically addressed when the program is first formally reviewed with a view to

ascertaining whether the co-contribution requirements are too onerous and the turnover threshold too restrictive.

Recommendation 17

The Committee recommends that the Australian Department of Industry, Tourism and Resources conduct a formal review by 30 June 2007 of the effectiveness of the Commercial Ready Program, giving particular consideration to the following possible program amendments:

- **extending eligibility to spin-off companies from publicly funded research institutions;**
- **extending eligibility to Australian-based subsidiaries of foreign owned companies; and**
- **reducing the co-contribution requirements and increasing the turnover thresholds.**

Government Agency Investment and Procurement

6.182 Some evidence presented to the inquiry has also suggested that the Australian Government should consider a review of its purchasing and procurement policies to make them more supportive of Australian innovative and technology-based SMEs.[148]

6.183 For example, the ATSE suggested that:

> Australian Governments should encourage, and if possible, adopt a policy of government buying from selected Australian innovative industries.[149]

6.184 Describing the benefits of Australian Government support through the purchasing of local innovative technology, the AIC noted:

> The importance of innovation can be highlighted and branded both within government itself and through

148 CEA Technologies, *Submission No. 8*, p. 4; Albox Australia, *Submission No. 14*, pp. 1-2; Australian Institute for Commercialisation, *Submission No. 29*, p. 28; Australian Computer Society, *Submission No. 38*, p. 1; Wave Global, *Submission No. 43,* p. 1; ATSE, *Submission No. 49*, p. 9; Australian Information Industry Association, *Submission No. 60*, p. 8.

149 Australian Academy of Technological Sciences and Engineering, *Submission No. 49*, p. 9.

> government focus on the application of new technology. Government purchasing initiatives can be used as a tool.[150]

6.185 Similarly, CEA Technologies emphasised the potential advantage of government support for Australian innovation when seeking to access international markets, noting 'the perceived need by overseas buyers for "sales endorsement" by one's own home Government.'[151]

6.186 A number of submissions drew attention to the **Small Business Innovation Research (SBIR)** program administered by the US Federal Government's Small Business Administration.[152]

6.187 ATP Innovations described the operation and objectives and of the SBIR as follows:

> By reserving a specific percentage of federal R&D funds for small business, SBIR protects the small business and enables it to compete on the same level as larger businesses. SBIR funds the critical start-up and development stages and it encourages the commercialisation of the technology, product, or service, which, in turn, stimulates the U.S. economy.[153]

6.188 i3 Aerospace Technologies also noted:

> Many technology businesses have been launched using SBIR contracts as the 'seed funding', and the government has accepted the risk of dealing with 'start-up' companies recognizing [sic]that the people in these companies are highly motivated, and will work tirelessly to convert their ideas to successful products. [154]

6.189 The submission also noted that a secondary benefit of the SBIR program was the strengthening of linkages between government and businesses of all sizes.[155]

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150 Australian Institute for Commercialisation, *Submission No. 29*, p. 28.

151 CEA Technologies, *Submission No. 8*, p. 3.

152 i3 Aerospace Technologies, *Submission No. 1*, p. 7; ATP Innovations, *Submission No. 6*, p. 7.

153 ATP Innovations, *Submission No. 6*, p. 7.

154 i3 Aerospace Technologies, *Submission No. 1*, p. 7.

155 i3 Aerospace Technologies, *Submission No. 1*, p. 8.

Committee Comment

6.190 The Committee notes concerns expressed with regard to a perceived lack of support from Australian Government through its purchasing and procurement of innovative products, processes or services from Australian based SMEs.

6.191 The Committee notes that Australian Government Procurement Guidelines state that '[t]he Government is committed to FMA[156] agencies sourcing at least 10 per cent of their purchases by value from SMEs'.[157]

6.192 The director of one company expressed the view that in applying the 10 per cent purchasing rule, the focus tends to be on non-technology-based consumables rather than technologically advanced and innovative products. Dr Williams of Proteome Systems stated:

> When you look at the 10 per cent rule at the moment it is mostly toilet paper and computers sold by Harvey Norman. The support of the local technology industry does not get translated in that process, and that is an issue that needs to be looked at pretty carefully.[158]

6.193 The Committee is aware that the Australian Government procurement policies must balance measures to support Australian business with the principles of 'value for money'. Notwithstanding this, the Committee notes the comments made regarding the reluctance for Government to direct the 10 per cent purchasing rule to innovative technologies.

6.194 Therefore, the Committee recommends that the Australian Government report publicly on the proportion of the 10 per cent purchasing from SMEs that is directed toward technological innovation.

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156 FMA agencies include all departments and agencies prescribed for the purposes of the *Financial Management Accountability Act 1997* (FMA Act), including all Australian Government departments.

157 Department of Finance and Administration, *Australian Government Procurement Guidelines January 2005*, p. 19.

158 Dr K Williams (Proteome Systems), *Transcript of Evidence*, 18 May 2005, p. 21.

Recommendation 18

The Committee recommends that the Australian Government:

- **direct all Government agencies to report publicly on what proportion of the 10 per cent purchasing from small to medium enterprises, which is set out in Australian Government Procurement Guidelines, is directed toward technological innovation; and**
- **investigate mechanisms to encourage Government procurement of technological innovation from Australian small to medium enterprises where available.**

Austrade and Export Market Development Grants

6.195 A number of submissions highlighted the importance for businesses of accessing international markets.[159] Partnering with multi-national or foreign owned companies has been identified in evidence as one strategy available to facilitate access to international markets. Restrictions on access to some Australian Government innovation assistance initiatives associated with the adoption of this strategy have been considered earlier in the chapter.

6.196 However, the Australian Government does provide some targeted assistance for aspiring and current exporting businesses. This assistance is provided primarily through the Australian Trade Commission (Austrade) which is a statutory authority within the Foreign Affairs and Trade portfolio.

6.197 In its submission to the inquiry, Austrade outlined its role as:

> … the Australian Government's principal trade and international business facilitation agency. Austrade assists Australian companies prepare for and succeed in exporting to international markets.

159 Citrix Systems Australasia R&D, *Submission No. 5*, p. 5; ATP Innovations, *Submission No. 6*, p. 6; CEA Technologies, *Submission No. 8*, p. 2; Dynamic Hearing, *Submission No. 9*, pp. 3-4, Australian Institute for Commercialisation, *Submission No. 29*, p. 24; GRP Technologies, *Submission No. 45*, p. 8; Industry Research and Development Board, *Submission No. 53*, p. 3; Flavourtech, *Submission No. 84*, p. 3.

> Through its network of offices in Australia and in 58 countries worldwide, Austrade is able to provide practical advice, market intelligence and ongoing support, including financial support under the Export Market Development Scheme, to Australian businesses looking to develop international markets. Austrade also offers advice and guidance on overseas investment and joint venture opportunities and helps Australian businesses to make contact with potential overseas investors.[160]

6.198 Evidence submitted to this inquiry has been generally positive with regard to the assistance received from Austrade. In describing the value of the assistance received from Austrade in accessing international markets, one witness told the Committee:

> Austrade have been absolutely sensational for us in really difficult corners of the world … They are a sensational group and have provided key assistance to us. I personally would double Austrade's Budget tomorrow as a key step in this innovation process because, if you are not selling offshore, you will go bust.[161]

6.199 Elaborating on the nature of the support available through Austrade, Dr Fox explained:

> I was [in] a meeting in Japan a few weeks ago. We had a youngish—relative to me—Austrade guy there, who had great business sense, could speak fluent Japanese and could read Japanese. He sat in on the meeting we had with our business partner of about 10 years, who we were having a blue with. He would say, 'X has just said Y and you need to respond. They did not say it that way but that is what is going on.' It was absolutely invaluable. He had a business brain and a capacity to open doors.[162]

6.200 Several submissions also identified Export Market Development Grants (EMDG) as being instrumental in facilitating access to international markets or expanding export markets.[163]

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160 Austrade, *Submission No. 68*, p. 1.

161 Dr J Fox (Australian Innovation Association), *Transcript of Evidence*, 4 August 2005, p. 43.

162 Dr J Fox (Australian Innovation Association), *Transcript of Evidence*, 4 August 2005, p. 48.

163 For example see Citrix Systems Australasia R&D, *Submission No. 5*, p. 5; CEA Technologies, *Submission No. 8*, p. 1; Dynamic Hearing, *Submission No. 10*, p. 3; Science Industry Australia Inc, *Submission No. 61*, p. 6; AWS Clinical Waste, *Submission No. 63*, p. 3; Australian Geoscience Council, *Submission No. 71*, pp. 44-45.

6.201 The EMDG scheme encourages Australian SMEs to develop and expand export markets by reimbursing up to 50 per cent of expenses incurred on eligible export promotion activities, less the first $15 000. To access the scheme for the first time, businesses need to have spent $15 000 over two years on eligible export marketing expenses.[164]

6.202 In the 2004–05 financial year, 3 277 grants paid $123.9 million to businesses under the EMDG scheme. For grants relating to the 2003-04 grant year (paid in 2004–05), the average grant was $37 145. Over three-quarters of businesses receiving an EMDG reported an annual income of $5 million or less.

6.203 Some evidence to the inquiry has recommended that Austrade could improve its services by making better use of its website to promote Australian businesses and innovation internationally[165], and by increasing its ability to support particular sectors with specific market requirements.[166] One submission also suggested that the assistance available through Austrade was also expensive and not always appropriate for early stage companies.[167]

Committee Comment

6.204 The Committee notes that in 2004–05, in accordance with the *Export Market Development Grants Act 1997*, an evaluation and review of the EMDG was conducted. The review resulted in a series of recommendations for improving the scheme's performance by:

- increasing the incentive for SMEs to internationalise by visiting overseas markets;
- updating the scheme to better support new and emerging export sectors and practices;
- reducing risk and administration costs; and
- improving the certainty of payment.

6.205 The review concluded that the EMDG scheme should be extended until 2010–11, noting:

> Extending the scheme indefinitely would offer greatest certainty to industry. However, a five-year extension, with a

164 Austrade, accessed 23 October 2005, <austrade.gov.au>.

165 GRP Technology, *Submission No. 45*, p. 7.

166 CEA Technologies, *Submission No. 8*, p. 10.

167 ATP Innovations, *Submission No. 6*, p. 6.

> review before the end of that period, would ensure accountability and give business, industry, governments and the broader community an opportunity to again review the program's performance. A five-year extension would balance the need for certainty with the need for accountability and transparency.[168]

6.206 In light of the comprehensive nature of the EMDG review[169], its recommendations to improve the scheme's performance and the generally positive views expressed in evidence to this inquiry, the Committee considers that no further action is required.

6.207 The Committee also notes the recommendation that there should be another review of the scheme with a report provided to the Minister for Trade by 30 June 2010.

168 Austrade, accessed 18 November 2005, *Review of Export Market Development Grants Scheme 2005*, p. 7, <austrade.gov.au>.

169 Austrade took into account: strong business and industry views, expressed in public submissions and through the review facilitation process; the independent survey of recent Export Market Development Grant scheme recipients and analysis of the results; and Austrade's own experience as the administrator of the scheme.

A

Appendix A—List of submissions

Submission	Organisation/Individual
1	i3 Aerospace Technologies Pty Ltd
2	Australian and New Zealand Association for the Advancement of Science Inc
3	Roach Industries Pty Ltd
4	Meat and Livestock Australia Ltd
5	Citrix Systems Australasia R&D Pty Ltd
6	ATP Innovations Pty Ltd
7	Coordination Committee on Science and Technology Working Group on the Metrics of Commercialisation
8	CEA Technologies Pty Ltd
9	Dr Robin Batterham
10	Dynamic Hearing Pty Ltd
11	Cooperative Research Centres Committee
12	Haddon / Perceptions Pty Ltd
13	Anssen Technologies
14	Albox Australia Pty Ltd
15	Park Bench Technology Pty Ltd
16	Biomedical Consulting Services

17	Clusters Asia Pacific Inc
18	Professor Keith Smith and Professor Jonathon West
19	Australian Research Council
20	Department of Education, Science and Training
21	Melbourne Ventures Pty Ltd
22	The Royal Australian Chemical Institute Inc
23	Dr Mark Sceats
24	KCS Pty Ltd
24.1	KCS Pty Ltd
25	Integrated Company Growth Services
26	Dr Richard Rowe
27	Knowledge Commercialisation Australasia
28	Environmental Research and Information Consortium Pty Ltd
29	Australian Institute for Commercialisation Ltd
30	Australian Electrical and Electronic Manufacturers' Association Ltd
31	University of the Sunshine Coast
32	CSIRO (Commonwealth Scientific and Industrial Research Organisation)
33	Society for Engineering in Agriculture
34	Robert Taylor and Associates Pty Ltd
35	La Trobe University
36	Energetech Australia Pty Ltd
37	Ampcontrol
38	Australian Computer Society
39	Dr Wallace Bridge
40	Professor Trevor Cole
41	Dr John Yencken and Professor Emeritus Murray Gillin AM
41.1	Dr John Yencken and Professor Emeritus Murray Gillin AM

42	Memtec Ltd
43	Wave Global Pty Ltd
44	Salmond and Associates R&D Services
45	GRP Technology
46	Mr Bruce Williams and Dr Richard Vaughan
47	QPSX Ltd
48	Cooperative Research Centres Association
49	Australian Academy of Technological Sciences and Engineering
50	Care-Free Water Conditioners Australia
51	Momentum Funds Management Pty Ltd
52	The University of Melbourne
53	Industry Research and Development Board
54	Rural Research and Development Corporation Chairs Committee
55	Proteome Systems Ltd
56	Merck Sharp and Dohme (Australia) Pty Ltd
57	Australian Cotton Cooperative Research Centre
58	New South Wales Department of Education and Training
59	CHAMP Ventures Pty Ltd
60	Australian Information Industry Association
61	Science Industry Australia Inc
62	The Group of Eight Ltd
62.1	The Group of Eight Ltd
62.2	The Group of Eight Ltd
63	Australian Waste Services Pty Ltd
64	Australian Business Foundation Ltd
65	Australian Institute of Marine Science
66	BAE Systems Australia

67	Australian Film Commission, Australia Council for the Arts and Australian Film, Television and Radio School
68	Austrade
69	DSTC Pty Ltd
70	Australian Nuclear Science and Technology Organisation
71	Australian Geoscience Council Inc
72	Australian Innovation Association
73	Mr Michael Cochran
74	Queensland Government
75	Cooperative Research Centre for Cast Metals Manufacturing
76	GBC Scientific Equipment Pty Ltd
77	Council for Humanities, Arts and Social Sciences
78	Mr Simon Fenton-Jones
78.1	Mr Simon Fenton-Jones
79	Confidential
80	S. Hudson and Associates Pty Ltd
81	National Health and Medical Research Council
82	Department of Industry, Tourism and Resources
83	Defence Science and Technology Organisation
84	Flavourtech Pty Ltd
85	ACT (Australian Capital Territory) Government
86	Tasmanian Government
87	Department of Communications, Information Technology and the Arts
88	BHP Billiton Ltd
89	Environment Business Australia
90	Department of Agriculture, Fisheries and Forestry
91	New South Wales Department of State and Regional Development

92 Sutherland Shire Council

93 Dr Charles Lawson and Dr Catherine Pickering

94 Barokes Wines

95 Mr Jim Sinclair

96 Land and Water Australia

97 Children's Discovery Museum Ltd

98 Professor Cameron Rider

99 Mr Don Scott-Kemmis

B

Appendix B—List of Exhibits

1 Innovation Dynamics

'Embracing Change' and 'Sectoral Case Studies' from Innovation Dynamics

2 Business Council of Australia

Developing a Framework for the Financing and Governance of Australian Universities

3 Bureau of Rural Sciences

Technical Report - Salinity Mapping Methods in the Australian Context

4 CSIRO

Aspects of CSIRO Commercialisation Experience

(Related to Submission No. 32)

5 Rural R&D Chairs Committee

The Rural Research and Development Corporations: A case study for innovation

(Related to Submission No. 54)

6 Department of Industry, Tourism and Resources

How Venture Capital Thwarts Innovation

7 Environment Business Australia

Documents and submissions to other relevant enquires

(Related to Submission No. 89)

8 CONFIDENTIAL

9 Department of Defence

Review of DSTO's External Engagement and Contribution to Australia's Wealth

C

Appendix C—List of Hearings and Witnesses

Organisations and persons are listed in alphabetical order under each public hearing day.

Wednesday, 18 May 2005—Eveleigh

ATP Innovations Pty Ltd

Dr Mark Bradley, Chief Executive Officer

Mr Hamish Hawthorn, Director, Life Sciences and Technology

Mr Charles Lindop, Director, Business Programs

Austrade

Mr Lino Strangis, Manager, Industry Policy Unit

Citrix Systems Australasia R&D Pty Ltd

Mr Martin Duursma, Vice President, Advanced Products Group

CSIRO

Mr Jon King, General Manager

Dr Katherine Kociuba, Senior Manager, Commercialisation, Corporate Business Development and Commercialisation Group

Dr Jack Steele, Chief of Staff, Business Development and Commercialisation Group

Debraneys Pty Ltd

Mr John Tregea, Technology Director

Department of Industry, Tourism and Resources

Mr Matthew Griffiths, COMET Program

Divergent Capital

Mr David Nelson, Managing Director

Gazelle Monitoring System Pty Ltd

Mr Bruce Johansson, Chairman

Meat & Livestock Australia

Dr Reuben Rose, General Manager, Livestock Production Innovation

Neo Technology Ventures Pty Ltd

Mr Brett Morris, Chief Executive

Mr Marc Woodward, Executive Director

Proteome Systems Limited

Dr Keith Williams, Founder Director

Thehairstyler.com

Mr Michael Gerace, Director/Web Developer

Monday, 23 May 2005—Canberra

Cooperative Research Centre for Greenhouse Gas Technologies

Dr Peter Cook, Chief Executive

Cooperative Research Centres Association Inc

Dr Anne Campbell, Executive Manager

Pest Animal Control Cooperative Research

Mr Christopher Buller, Business Manager

Rural R&D Corporation Chairs Committee

Mr Alan Newton, Executive Manager

Sustainable Tourism Holdings and Decipher Technologies Pty Ltd

Mr Peter O'Clery, Managing Director

Monday, 30 May 2005—Canberra

Chief Scientist

Dr Robin Batterham,

Monday, 20 June 2005—Canberra

CEA Technologies Pty Ltd

Mr David Gaul, President

Environmental Research and Information Consortium Pty Ltd

Mr Robert Gourlay, Managing Director

Thursday, 4 August 2005—Melbourne

Private capacity

Dr John Yencken

Australian Academy of Technological Sciences and Engineering

Mr Peter Laver, Vice President and Chairman, Project and Activities Committee

Professor Ian Rae, Technical Director

Australian Innovation Association

Dr James Fox, Deputy Chairman

Cooperative Research Centres Committee

Dr Geoffrey Vaughan, Chairman

Dynamic Hearing Pty Ltd

Dr Elaine Saunders, Chief Executive Officer

GBC Scientific Equipment Pty Ltd

Mr Neil O'Loghlen, Strategic Affairs Consultant

KCS Pty Ltd

Mr Kurt Schnepf, Managing Director

La Trobe University

Associate Professor Paul Pigram, Associate Dean (Commercialisation and Industry), Faculty of Science, Technology and Engineering

La Trobe University R&D Park

Mrs Susan Bell, Director

Melbourne Ventures Pty Ltd

Dr Charles Day, Managing Director

The University of Melbourne

Professor Frank P. Larkins, Deputy Vice-Chancellor (Research)

Friday, 5 August 2005—Adelaide

Private capacity

Mr Michael Cochran

BAE Systems Australia

Dr Susan Anderson, Research and Technology Manager

GRP Technology

Mr Graham Porter, Chief Executive Officer

Playford Capital Pty Ltd

Ms Amanda Heyworth, Chief Executive Officer

Robert Taylor and Associates Pty Ltd

Mr Robert Taylor, Director

Monday, 5 September 2005—Canberra

Australian Institute for Commercialisation Ltd

Mr Alex Blauensteiner, TechFast Manager, Queensland

Dr Rowan Gilmore, Chief Executive Officer

Dr John Kapeleris, Director, Regional Commercialisation Services

Defence Science and Technology Organisation

Dr Ken Anderson, Deputy Chief Defence Scientist (Policy)

Mr Andrew Gray, Assistant Secretary

Monday, 12 September 2005—Canberra

Australian Nuclear Science and Technology Organisation

Dr Warren Bradey, General Manager, Access

Dr George Collins, Chief of Research

Dr Miriam Goodwin, Senior Adviser, Science Policy and Planning

National Health and Medical Research Council

Ms Suzanne Northcott, Executive Director, Centre for Research Management and Policy

Monday, 28 November 2005—Canberra

Department of Industry, Tourism and Resources

Ms Tricia Berman, General Manager, Innovation Policy Branch

Ms Patricia Kelly, Deputy Secretary

Mr Craig Pennifold, Head, Innovation Division

AusIndustry

Mr Bill Peel, Executive General Manager

Ms Judith Zielke, General Manager, Innovation and Collaboration

IP Australia

Dr Ian Heath, Director General

Monday, 5 December 2005—Canberra

Australian Research Council

Mr Gregory Harper, Deputy Chief Executive

Professor Peter Hoj, Chief Executive

Dr Stephen Walker, Director, Engineering and Environmental Sciences

Department of Communications, Information Technology and the Arts

Mr Philip Allnutt, General Manager, ICT Industry Branch

Mr Keith Besgrove, Chief General Manager, Information Economy Division

Dr Lee Boldeman, Manager, Information Economy Division

Department of Education, Science and Training

Dr Evan Arthur, Group Manager, Innovation and Research Systems Group

Ms Jessie Borthwick, Group Manager, Science Group

Inspections

Organisations are listed in alphabetical order under each inspection day. Representatives from organisations who led the inspection are also listed in alphabetical order.

14 April 2005—Melbourne

CSIRO Energy Technologies—Clayton Laboratories

Dr Greg Simpson, Molecular Science, Deputy Chief and Program Leader

CSL Ltd

Dr Andrew Cuthbertson, Chief Scientific Officer

CRC-P Polymers

Dr Ian Dagley, Centre Director

Thursday, 19 May 2005—Sydney

Argus Solutions

Mr Bruce Lyman, Chief Executive Officer

Mr Greg Sampson, National Sales and Marketing Director

Evolution Broadcast Pty Ltd (Nexus Systems)

Mr Tom Barnett, Executive Director

Mr Mark Stoneham, Executive Director

Mr David Sabine, Director Technology and Development

Sirtex Medical

Dr Bruce Gray, Chairman

Mr Gilman Wong, Chief Operating Officer

Mr Marius van den Berg, Sales and Marketing Director

D

Appendix D—Australian Government's Funding Commitment to *Backing Australia's Ability*

R&D Programs	BAA-II 2006-07 to 2010-11* $ (million)	BAA-I and BAA-II 10 year total $ (million)
National Competitive Grants Program (NCGP)	1 466.0	2 200.6
Research Infrastructure Block Grants (RIBG)	560.6	899.9
Systemic Infrastructure Initiative (SII)	0	241.0
Major National Research Facilities (MNRF)	0	153.2
National Collaborative Research Infrastructure Strategy	527.2	544.3
Innovation Access Program - International Science & Technology/International Science Linkages	55.9	90.7
Developing Quality and Accessibility Frameworks for Publicly Funded Research	0	2.8
Extension of Regional Protection Funding	6.4	12.5
CSIRO National Flagship Program	240.0	305.0
Health and Medical Research - Overhead Infrastructure Support (NH&MRC)	147.9	201.0
Extension of the Building on IT Strengths (BITS) Advanced Network Program (ANP)	5.4	21.0
ICT World Class Centre of Excellence	126.3	193.3
Research Support for Counter-Terrorism	4.2	7.2
R&D Tax Concession - New Elements Continued	460.0	405.1
Total R&D Programs	**3 599.9**	**5 277.6**

Commercial Programs	BAA-II 2006-07 to 2010-11* $ (million)	BAA-I and BAA-II 10 year total $ (million)
Research and Development (R&D) Start	0	439.8
Innovation Access Program - Industry	0	41.7
Innovation Access Program - Information Technology Online	0.8	12.9
Biotechnology Innovation Fund	0	19.9
Commercial Ready Program	1102.5	1119.9
Industry Cooperative Innovation Program	21.8	25.0
Commercialising Emerging Technologies (COMET) Program	81.4	140.0
Biotechnology World Class Centre of Excellence/Extend Support for National Stem Cell Centre	30.4	54.4
Refocussing the Cooperative Research Centres (CRC) Program	178.5	354.5
Pre-Seed Fund	27.8	78.7
Extension of the Building on IT Strengths (BITS) Incubator Program	12.0	36.0
New Industries Development Program (NIDP) Mark III	13.7	32.8
Total Commercial Programs	**1 468.9**	**2 355.6**
Skills Programs	**BAA-II 2006-07 to 2010-11* $ (million)**	**BAA-I and BAA-II 10 year total $ (million)**
Questacon Smart Moves - Raising Science Awareness in Schools and the Broader Community	8.8	15.1
National Innovation Awareness Strategy/Science Connections Program	25.1	57.2
Fostering Scientific, Mathematical and Technological Skills and Innovation in Government Schools	465.9	757.2
2000 University Places	195.0	345.1
Boosting Innovation, Science, Technology and Mathematics Teaching	21.8	38.9
Extend and Enhance National Biotechnology Strategy and Biotechnology Australia	10.0	20.0
Online Curriculum Content for Schools	0	34.4
Post Graduate Education Loans Scheme (PELS)	0	-36.6
Attracting ICT Workers	0	-3.5
Total Skills Program	**726.7**	**1227.8**

* Based on Forward Estimates NB: These figures contain rounding.

Source *Adapted from* Australian Science and Innovation System: A Statistical Snapshot 200*5, Table 2.1.27* Overview of the Australian Government's funding commitment to *Backing Australia's Ability, p. 44.*

E

Appendix E—Summary of Government Innovation/Commercialisation Programs

Program	Description	Financial Summary[1] $m				
		2001-02	2002-03	2003-04	2004-05	2005-06
R&D Start (DITR) *Started: 1996* *Completed: 2004*	R&D Start Grants and Loans were a competitive, merit based grants and loans allocation program that supported businesses to undertake R&D and commercialisation. R&D Start was an AusIndustry grant for research and development projects for companies with less than $50 million annual turnover. The grants ranged from amounts of $250,000 to $5 million and were provided on a 50/50 basis of up to 50 per cent of eligible project costs. To be eligible to receive the grant, that Project must have involved R&D and/or product development with degree of technical excellence and risk. It must have clearly identified commercial potential, managed outcomes and require R&D Start support. In total, R&D Start provided funding of $1.01 billion to 1134 companies since its establishment in 1996. Commercial Ready replaced R&D Start. The five year total expenditure for 2001-02 to 2005-06 is $534.9 million.	-	41.9	117.6	174.7	200.7

1 The financial data for each program is provided in *The Australian Government's innovation report 2004-2005: Real results, real jobs*, unless otherwise indicated.

Program	Description	Financial Summary[1] $m				
		2001-02	2002-03	2003-04	2004-05	2005-06
Biotechnology Innovation Fund (DITR) *Started: 2001* *Completed: 2004*	The Biotechnology Innovation Fund (BIF) was a merit-based competitive grants program, which aimed to increase the rate of commercialisation of biotechnology research developed in Australia. It provided financial assistance to companies to demonstrate proof of concept between the initial research stage of a biotechnology project and the early stage of its commercialisation. BIF funded up to $250 000, or 50 per cent of the project's expenditure. The company or proposed company applying must have had access to the intellectual property concerned. The company must have been able to demonstrate that it could fund its share of the project. Since the launch of the Biotechnology Innovation Fund, 160 projects received grants totalling $47.7 million.	5.0	5.0	10.0	-	-
Commercial Ready Program (DITR) *Started: 2004*	The Commercial Ready Program (CRP) was established to encourage the growth of innovative Australian companies in emerging and high-technology industries. More than 1 700 SMEs will be supported to undertake R&D, proof of concept, technology diffusion and early stage commercialisation. The program aims to stimulate greater innovation and productivity growth in the private sector by providing around $200 million per year in competitive grants between 2004-05 and 2010-11. Participants are required to demonstrate: capacity to complete the research and/or commercialisation activity through a detailed business plan; the commercial potential of the project, capacity for product development and a strategy to fund commercialisation through a commercialisation plan; and a commitment to match the Government's funding.	-	-	-	5.5	16.7

Program	Description	Financial Summary[1] $m				
		2001-02	2002-03	2003-04	2004-05	2005-06
COMET (DITR) *Started: 1999*	The Commercialising Emerging Technologies (COMET) Program is a grants program that supports businesses and individuals increase the commercialisation of innovative products, processes and services. COMET assistance can be given to early rowth stage companies in the beginning stages of commercialising and innovation, spin-off companies or to individuals. COMET engages private sector managers and Business Advisors across Australia to give advice to applicants and provide them with expertise. Businesses must have a turnover over the last two years with a total less than $8 million with not more than $5 in a single year. Successful applicants are required to work with a Business Adviser and COMET assistance is available for up to two years under the following two assistance streams, the Tailored Assistance for Commercialisation (TAC) stream and the Management Skills Development (MSD) stream. COMET has been extended until June 2011 with a further $100 million in funding. In its first five years, COMET raised around $275 million in capital and established over 500 alliances, license and other agreements.	10.0	10.0	10.0	10.0	-
Cooperative Research Centres (CRC) Program (DEST) *Started: 1990*	The Cooperative Research Centres (CRC) Program was established in 1990 to improve the effectiveness of Australia's R&D efforts. It links researchers with industry to focus R&D efforts on progress towards utilisation and commercialisation. The Minister for Education, Science and Training has overall responsibility for the CRC program and appoints a committee to advise on the selection and evaluation of Centres and on the conditions to apply to the provision of	-	-	55.0	57.0	64.0

Program	Description	Financial Summary[1] $m				
		2001-02	2002-03	2003-04	2004-05	2005-06
	funds under the Program. Successful CRC applicants are required to enter into a formal agreement with the Australian Government. The Australian Government requires CRC's to produce annual reports and a Management Data Questionnaire on its activities every year. Each CRC is also required to develop and implement a Commercialisation Plan.					
Pre-Seed Fund (DITR) *Started: 2001*	The Pre-Seed Fund program assists the commercialisation of research and development undertaken by universities and public sector research agencies. The Pre-Seed Fund program established four early-stage venture capital funds to invest in projects or companies emerging from universities or government agencies. These funds are managed by venture capitalists experienced in research commercialisation and the development of sustainable businesses. The fund managers acquire an equity interest in the companies or projects, and provide management and technical advice to develop the commercial potential of the technology. The maximum investment in any project or company is $1 million. A project must also be undertaken in Australia and not have generated any sales revenue. They may alternatively be using intellectual property that is at least 50 per cent owned by a university, a public sector research agency or a qualifying researcher. Companies must be incorporated and operate substantially in Australia and have not generated any sales revenue. While there is no new funding for the program, $27.8 million will be expanded to cover 2006–07 to 2010–11.	3.7	12.6	12.6	12.6	9.6
ICT Incubators Program (ICTIP)	The ICT incubators provide incubation services, such as seed capital, business advice, and assistance with raising follow-on capital, to start up ICT	-	-	-	13.0	11.0

Program	Description	Financial Summary[1] $m				
		2001-02	2002-03	2003-04	2004-05	2005-06
(previously Building on IT Strengths (BITS) Incubators (DCITA) *Started: 2004*	companies to accelerate their growth. The objective is to support the better-performing incubators previously funded under the BITS Incubator Program. The existing BITS participants were invited to submit proposals to demonstrate their ability to continue to provide incubation services and to achieve financial self reliance for another four ears. Participants are required to provide annual reports on their activities.					
ARC National Competitive Grants Programme (DEST/ARC) *Started: 2001*	The Australian Research Council's (ARC) National Competitive Grants Program is administered by the ARC to fund the work of promising researchers. Discovery grants target individuals and projects, and Linkage grants broker partnerships between sectors. Reporting requirements for each grant include: progress Reports; final reports; end of year reports; audited financial statements; annual reports; and Industry Partner/Collaborating Organisation Agreed Contribution Report (for Linkage Projects only)	19.2	92.5	142.8	205.4	276.5
CSIRO National Flagships Initiative (CSIRO) *Started: 2004*	Flagships are large-scale collaborative partnerships which link CSIRO with organisations across Australia to research areas of national need. Flagships are partnerships of leading Australian scientists, research institutions, commercial companies, CSIRO and selected international groups. They are targeted at six fields of national endeavour - health, water, energy, food, light metals and oceans. Features of the initiative include the Flagship Collaborative Research Programme, the Flagship Visiting Fellowships and the Flagship Student Programme. The Government has awarded additional funding of $305 million for Flagships over the next seven years. The combination of new	-	-	-	-	30.0

Program	Description	Financial Summary[1] $m				
		2001-02	2002-03	2003-04	2004-05	2005-06
	Government funding, redirected CSIRO funding and external revenue will take the total investment to close to $1.5 billion.					
Building on IT Strengths (BITS) Advanced Network (DCITA) *Started: 2000*	The Advanced Networks Program (ANP) was established in 2000 as part of Building Information Technology Strengths (BITS). The program encourages a collaborative approach to the development of advanced networks and test beds. There is an initial desktop assessment of the applications by DCITA case managers, examination by a specialist technical/network consultant (PricewaterhouseCoopers/Consultel) and assessment by a private sector expert advisory panel. An independent auditor approves the selection process and documentation. The Australian Government is providing $21 million to extend the ANP until 2006-07. This will bring total Australian Government funding for the program to $60 million since its commencement in 2000.	-	-	-	-	8.3
R&D Tax Concession (DITR) *Started: 1985*	The R&D Tax Concession enables companies incorporated in Australia and registered with the Industry Research and Development Board, to claim a tax deduction for their eligible R&D expenditure. The objective of the R&D Tax Concession is to provide a tax incentive, in the form of a deduction, to make eligible companies more internationally competitive by encouraging and increasing the investment of research and development activities and creating an environment that is conducive to increased commercialisation of new processes and product technologies developed by eligible companies. Companies are required to be incorporated in Australia. In order to claim the concession an applicant must spend over $20,000 in an income year unless the R&D is contracted to a Registered Research Agency	6.0	4.0	-3.6	20.6	32.0

Program	Description	Financial Summary[1] $m				
		2001-02	2002-03	2003-04	2004-05	2005-06
	(RRA). The R&D Tax Concession includes a 125 per cent deduction for expenditure on R&D and a 175 per cent premium deduction (the R&D Incremental Tax Concession) for additional R&D expenditure above their average over the previous three years. They are also able to apply a R&D Tax Offset (Rebate), which allows eligible small companies (i.e. with group turnover under $5 million and annual grouped R&D expenditure up to $1million) to 'cash out' their R&D tax losses.					
Pooled Development Fund (DITR) *Started: 1992*	The Pooled Development Fund (PDF) Program is designed to increase the supply of equity capital for growing Australian SMEs. PDFs raise capital from investors and use the capital to invest in Australian companies. Through a range of taxation incentives, the program encourages investment in PDFs which in turn provide a pool of funds which specialist managers invest in companies with total assets of not more than $50 million, that they expect will provide high returns. The principal concessions provided are concessional income tax treatment of PDFs, and capital gains tax exemption on the sale of PDF shares by investors. In the period from 1992 up to June 2004, PDFs had raised more than $766 million and invested more than $635 million in 482 companies. At 18 May 2005 there were 96 registered PDFs.	5.0	6.0	6.0	6.0	6.0[2]
Innovation Investment Fund (DITR)	The Innovation Investment Fund (IIF) program is designed to promote the commercialisation of Australian R&D through the injection of venture capital into small, high-technology companies in their	27.3	24.7	17.6	22.1	13.9[3]

2 Department of Education, Science and Training. *The Australian Government's 2005-06 science and innovation budget tables*. p. 6

3 Department of Education, Science and Training. *The Australian Government's 2005-06 science and innovation budget tables*. p. 4

Program	Description	Financial Summary[1] $m				
		2001-02	2002-03	2003-04	2004-05	2005-06
Started: 1997	seed, start-up or early expansion stage. Licensed private sector fund managers administer the pool of investment capital. To be eligible for Innovation Investment Fund support, a company must meet a number of criteria. It must be commercialising the results of R&D activities. The majority of its employees must be inside Australia at the time the licensed fund first invests in the company. Its average annual revenue must have been $4 million or less over the past two years, with a maximum of $5 million in either of the two years. The company must be in its seed, start-up or early expansion stage. The Australian Government is investing about $221 million, which will be matched by the private sector up to a maximum ratio of two to one.					
Export Market Development Grants (Austrade) *Started: 1974*	The Export Market Development Grants (EMDG) scheme is the principal financial assistance program for aspiring and current exporters. The purpose of the scheme is to encourage Australian SMEs to develop export markets. EMDG reimburses up to 50 per cent of expenses incurred on eligible export promotion activities, less the first $15 000. The businesses annual income must not be more than $30 million and they must spent at least $15 000 on eligible export promotional activities during the financial year before the application period. The business must own the product/service they are promoting. For the first grant they may claim expenses incurred over the last two financial years. In the 2004-05 financial year, $123.9 million and 3 277 grants were paid to businesses under the EMDG scheme.	150.4	150.4	150.4	150.4	170.4[4]

4 Foreign Affairs and Trade Portfolio: Portfolio Budget Statements 2001-02 to 2005-06

Program	Description	Financial Summary[1] $m				
		2001-02	2002-03	2003-04	2004-05	2005-06
Industry Cooperative Innovation Program (DITR) *Started: 2005*	Industry Cooperative Innovation Program (ICIP) aims to encourage business-to-business cooperation on innovation projects within a sector that enhances the productivity, growth and international competitiveness of Australian industries. The program has two streams that cover different types and sized activities. For both streams, eligible applications ranked as the most competitive may be offered funding of up to 50 per cent of the eligible expenses for the approved project. A consortium with a minimum of three entities must be formed to cooperatively conduct an ICIP project. Stream A supporting projects can include project scoping or innovation mapping activities in an industry sector. Maximum funding of $150,000 is available and projects must be completed within 18 months. Stream B is for more extensive cooperative projects that aim at progressing strategic innovation and achieving significant benefits for an industry sector. Funding of up to $3 million is available and projects must be completed within three years. ICIP)is a $25 million commitment which is funded until 2011.	-	-	-	-	4.4[5]

5 Department of Education, Science and Training. *The Australian Government's 2005-06 science and innovation budget tables*. p. 5