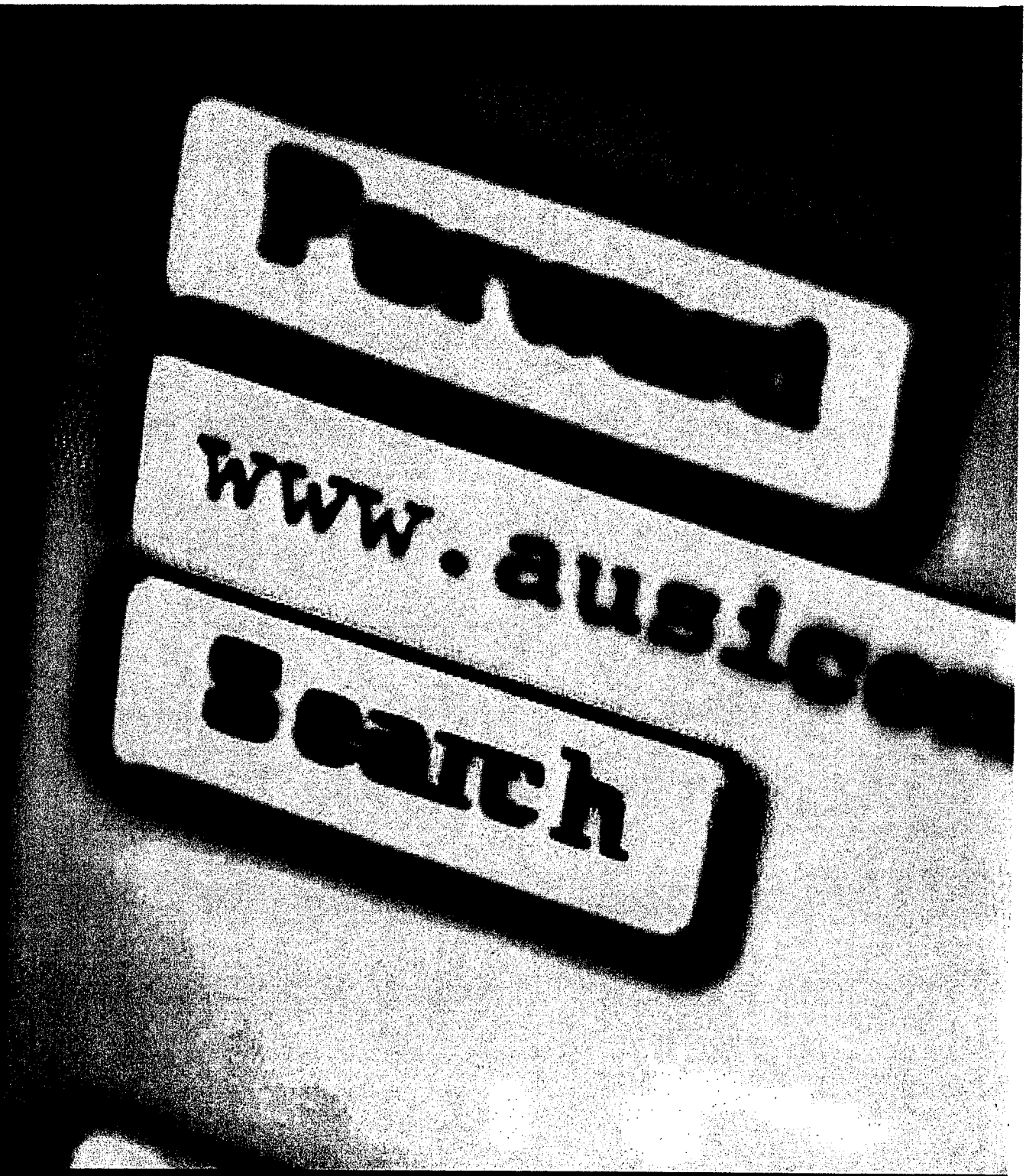

The Australian Institute for Commercialisation

Submission to the House of Representatives Standing Committee on Science and Innovation

Inquiry into Pathways to Technological Innovation

April 2005

AIC Australian Institute for Commercialisation

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Australian Institute
for Commercialisation

Working with Australian research institutions and industry to maximise returns from research and development investment.

26 April 2005

Committee Secretary
Standing Committee on Science and Innovation
House of Representatives
Parliament House
CANBERRA ACT 2600

Dear Sir,

The Australian Institute for Commercialisation (AIC) is a national, not-for-profit company that delivers programs to help improve the commercialisation of Australia's research investment.

The AIC welcomes the opportunity to make this submission as a part of the inquiry process into science and innovation. In the following submission, we highlight some successful case studies of Australian innovation through commercialisation of publicly-funded research. In doing so, we also outline the barriers to commercialisation which we come across in our daily work, and which originally drove the formation of the AIC in 2002. The report describes several AIC initiatives that have been designed to lower these barriers and to assist the commercialisation of public sector research investments, as well as to move towards the ultimate national benefits that strong commercialisation performance would achieve.

The AIC is appreciative of the opportunity to raise the issues discussed in this submission and would be delighted to discuss these further with you. In particular, we would welcome opportunities to contribute to policies that can facilitate improved commercialisation of publicly funded research.

Yours sincerely,

Dr. Rowan Gilmore
Chief Executive Officer
Australian Institute for Commercialisation

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INTRODUCTION

The World Economic Forum's Global Competitiveness Report for 2004 provides competitive global benchmarking information on the health of a nation's economy and its ability to grow on a sustained basis. The report silently implies that greater effort is required by Australia in areas such as innovation and commercialisation. It indicates that Australia's global competitiveness has slipped to 14th from 10th in the previous year, and that the nation is now ranked just 17th in the overall innovation component of the index, down from 8th in 2002.

This slippage is in spite of an ongoing and quite significant investment in the development of R&D intellectual property (IP) within Australia's research institutions through initiatives such as Backing Australia's Ability (I and II). Over the past two decades, Governments throughout Australia have directly invested around $40 billion in R&D, and in the current year will invest well over $5 billion, over one-half of this in research at universities. When normalised to Gross Domestic Product (GDP), Australia is in the top 10 of all OECD nations in this investment. Regrettably, Australia falls near the bottom when business expenditure on R&D is added to the total for comparison, even though in absolute terms business investment is comparable to that of Government. This imbalance in Australia's innovation system places an onus on both the research sector and on industry to work more closely together to take the outcomes of research to market. We call this process *commercialisation*.

The commercialisation process is vital to Australia's interest, particularly as the benefit from continued macro and micro economic reform over the last decade or so diminishes as the reform agenda is completed. Australia's "fast-follower" strategy, importing and applying new technologies, has also resulted in growth, but not relative to other followers. Sustaining higher level GDP growth will require genuine expansion of the economy and increased knowledge intensity, not just doing what we do now more efficiently.

In spite of strong public funding of R&D and recognition of the importance of excellence in research, commercialisation remains an immature science. Although 'best practice' in the component parts of commercialisation can be found in various pockets throughout Australia, the best methodology has still not been recognised, let alone adopted. The soft infrastructure necessary for simpler and more widespread adoption of new research by industry is simply sub-scale and lacking strategic direction. Aggregation and attaining critical mass is essential in the Australian context, together with broader private sector involvement.

At its most basic, the difficulty in commercialisation can ultimately be reduced to two simple issues: resourcing (effectively funding specifically for this purpose) and people. Skills in commercialisation and in management practice are not innate and need to be learned. For instance, investment proposals from researchers are frequently of insufficient quality to demonstrate to the financial community that the potential reward justifies the risk. Deal flow is stifled by proposals that miss the investment criteria of the venture capital community, who in

turn are perceived to be risk averse. In addition, the creative ability of people needs to be nurtured by appropriate individual, corporate and government incentives, in the form of structures that recognise efforts of commercialisation, provide the agility to do so, and through appropriate tax concessions to encourage risk taking. Likewise, the boards of businesses need to play a more active role in leading innovation and investment for growth.

These issues in resourcing and people exist on both the *supply* side and *demand* sides of the innovation process. The supply of ideas is dependent on a continuing supply of outstanding, innovative research; on well structured research institutions that facilitate the management of IP to ensure it is free of encumbrances; and the soft infrastructure and proximate networks that enable interested stakeholders to collaborate and interact effectively. However, those most in need of innovation may not even recognise that they need it. The demand for innovation needs to be championed by industry. That requires balanced Boards of Directors with sound technological judgement; skilled managers receptive to incorporating and managing new technologies within their business models; and sensible targeted funding for project and new product development.

These challenges must be addressed together by research organisations, industry and governments.

The Australian Institute for Commercialisation's (AIC) role within this broader innovation process is to improve the way in which the potentially valuable research undertaken within public institutions can be successfully transformed into commercial opportunities. The AIC's key activity areas and programs address many of these issues surrounding people and resources on both the supply (research organisation) and demand (industry) side of the commercialisation process.

Barriers to Commercialisation

To achieve the full potential from our investment in research, it is essential that an even greater focus be placed on commercialisation, particularly at the very early stage of research when market input can be accommodated with minimal cost and adjustment. At this early stage, discoveries or inventions usually have uncertain market potential and require substantial additional development before they can attract appropriate levels of funding and support. 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
- a defined exit strategy

Typically, early-stage risk is both commercial and technical; pre-seed funding is usually needed to lower the commercial risk by identifying the potential market segment and customers, before venture capitalists are willing to invest.

When the AIC was in its formative stages, a number of forums were held with stakeholders from all sectors of research and industry to identify the barriers to commercialisation. Many of the barriers identified were unique to Australia, such as the tax treatment of employee share option schemes or investments in early stage technology companies, or the liability and insolvent trading provisions of the Corporations Act that effectively limit the pool of directors willing to oversee such companies. Other barriers, however, are faced globally. They include the need to bring science and industry closer together; the lack of entrepreneurs experienced in running start-up companies; and the lack of suitable analysis and output measures to benchmark our performance and to better manage the commercialisation process.

The barriers are numerous. Smaller universities and many Cooperative Research Centres (CRCs) often lack the depth of capabilities to commercialise IP possessed by larger institutions. Small to Medium Enterprises (SMEs) and potential licensors of technology face an 'knowledge gap', making it difficult to identify appropriate IP within public research institutions and to engage with them. Closing these gaps is vital to achieving the excellent economic outcomes that are possible with improved collaboration.

A more detailed listing of some of the barriers to commercialisation observed by the AIC is provided in Appendix I. The barriers, while numerous, *can* be overcome, and the case studies we outline in this submission are testimony to what can be achieved with proper funding, resourcing, and motivation.

THE PRIZE

A serious and underappreciated challenge for Australia is to transform our national investment in research into economic outcomes.

Australia's Return on Investment in Research

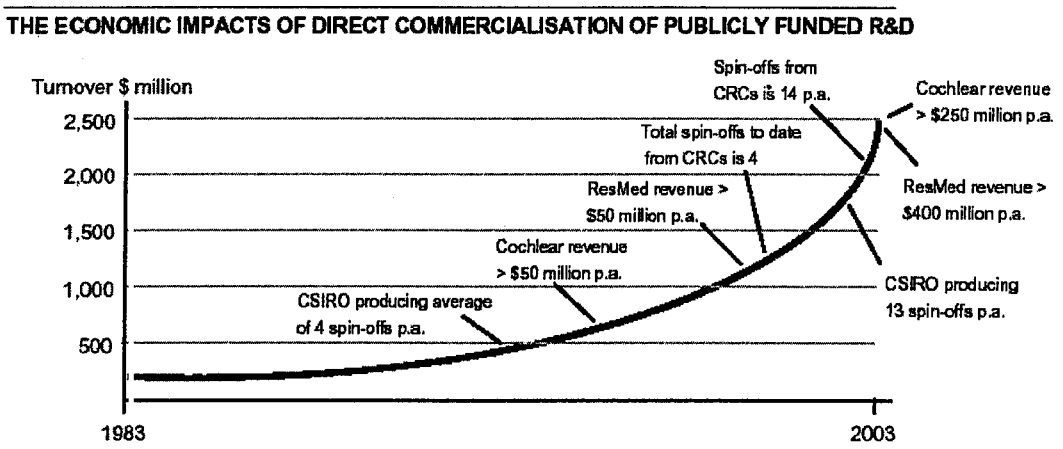
Data prepared for the Australian Research Council[1] suggests that the rate of return on ARC-funded research is 39 percent, even when important health, educational, social, and cultural benefits are excluded from the calculation. Expressed as a net present value over a future 15 year time span, for each $18 that every Australian on average contributes towards ARC research in 2003 through tax dollars, consumption is estimated to be $14 per capita higher in 2003 than it would otherwise be. Among the benefits directly attributable to the research are building the basic stock of knowledge, improvements to the skills base, and direct commercialisation.

[1] Allen Consulting Group, http://www.arc.gov.au/pdf/ARC_wealth_of_knowledge.pdf , 'A Wealth of Knowledge', September 2003

However, these benefits tend to reflect the traditional research and education missions of a university, normally expressed in terms of outcomes of excellence in research and the preparation of an educated workforce. A so-called 'third stream', support for industry, is increasingly being added to these two. Today there are approximately 1500 small, high-growth technology-based companies in Australia. Increasing this to 3300 by the year 2020 would represent strong and continuing commercialisation performance. Recent research commissioned by the AIC[2] revealed that continuing to improve the commercialisation performance of the nation's public research institutions could add nearly $20 billion in exports to the economy by 2020.

This figure was arrived at by a historical examination of the companies that have already been spawned by public research and their contribution to the national economy. The historical growth in annual revenue from such companies is shown in Figure 1 below.

Figure 1



However, looking across the entire two decades from 1983 to 2003 the direct commercialisation returns from public investment in R&D are not particularly impressive. From the investment of $40 billion (in 2002 dollars) over this period, the overall economic impacts delivered through direct commercialisation equate to approximately:

- 0.2 jobs per $ million invested
- $60,000 of company turnover per $ million invested
- $50,000 of exports per $ million invested.

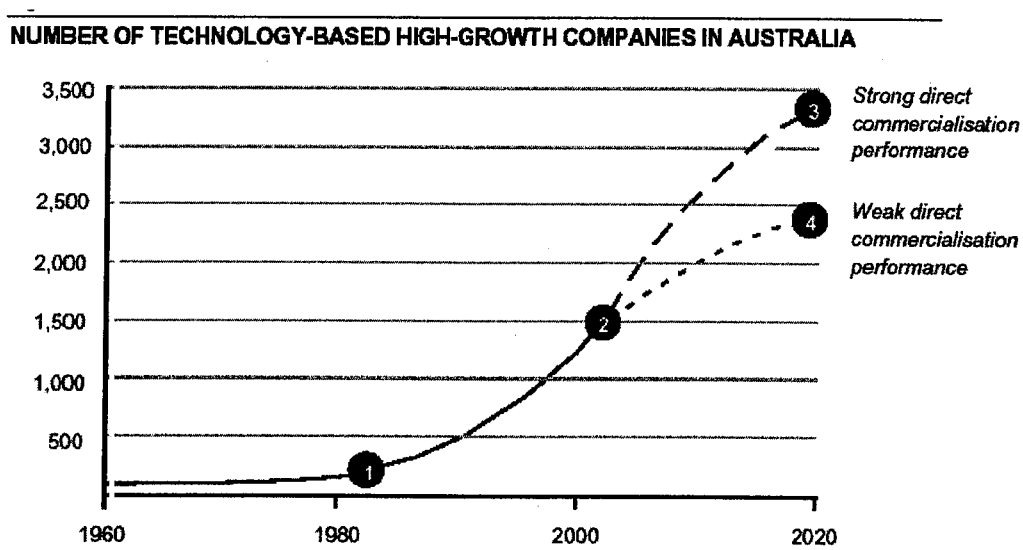
However, as shown in the Figure 1, performance has been on a sharply rising trend. Over 60 per cent of the total benefits over the 20 year period were actually realised in the past five years. Indications are that the benefits accruing will continue to rise in the future.

[2] AIC, "The Economic Impact of the Commercialisation of Publicly Funded R&D in Australia", October 2003.

Unfortunately, analysis of the system is hampered by the long time lags between the research input and consequent commercial success.

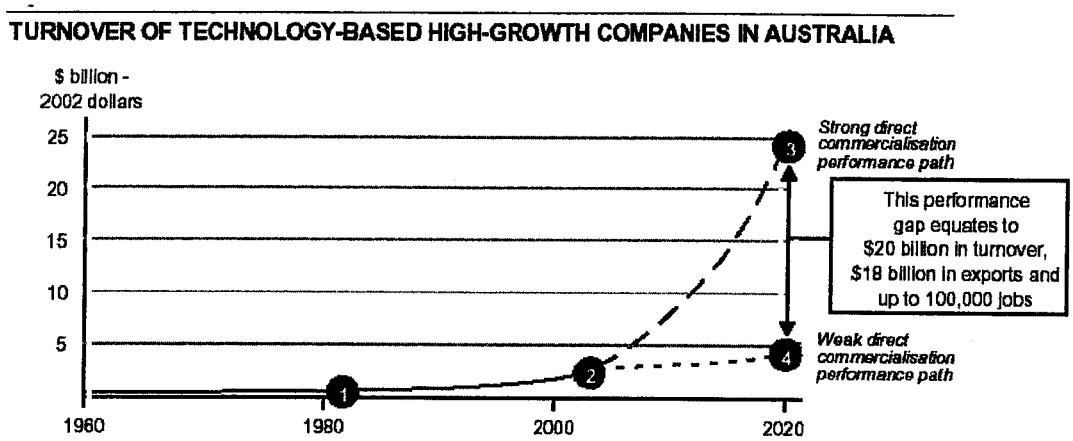
Several case studies demonstrate that the pay-offs from commercialisation in successful cases can be very high - Cochlear and ResMed are the 'star' performers most frequently cited. However, the number of such performers has been very low. Even the number of 'solid' performers generated – those with revenues exceeding $50 million per year - has been quite limited and hence the overall return on total public R&D funding through commercialisation has been low. Currently Australia has produced just 2 or 3 star performers, about 10 solid performers and several hundred small companies based on publicly funded research. Crucial to reaping future economic pay-offs from public investment in research will be lifting the conversion rate of starters to solid and star performers.

Figure 2



This is illustrated in Figure 2 above, which shows that over the past 20 years the number of companies in Australia that can be described as high-growth technology-based companies has increased by 600-700 per cent, to approximately 1500 in the year 2000. This translates to an annual increase in the pool of such companies of around 60 per annum. However, based on analysis of the rate that new start-up companies are being generated from public research institutions, it would appear that Australia is now approaching best practice levels in this area. A continuation of this current rate of pool growth is shown in Figure 2 as representing 'strong' performance. By contrast, 'weak' performance is defined as a halving of the current rate of growth of this pool of companies over the period to 2020.

Figure 3



The turnover of these companies, and their contribution to exports, has been estimated in Figure 3 above. Achieving the 'strong' performance outcome requires:

- a continuation of the current growth rate in the pool of high-growth technology-based companies
- a continuation of recent improvements in the 'conversion rate' of new companies into mature companies having annual revenues exceeding $50 million
- an increase in the average size of these successful companies.

The difference between following a strong commercialisation pathway and one with weakening efforts is $20 billion in total revenue and $18 billion in exports, per annum. Clearly, this is significant. However, our current good economic performance, resulting from impressive productivity gains due to technology adoption and the micro and macro-economic reform completed during the past decade, has masked the urgency of maintaining the momentum. Our past growth strategies can be, and are, copied and accelerated by other competitor nations, such as South Korea, Taiwan, and India. As Australia's reform agenda is completed and the productivity improvements from it wane, a new 'wave' of reform, built upon applying our innovation and growing new businesses from it, will be required to maintain the improvement in our growth curve.

Without a 'blockbuster' or large windfall, the best performing research institutions will reap at best somewhere between 7 to 10 percent of R&D expenditure within 7 - 10 years of commercialisation. Overseas studies and experience suggest that achieving this requires an annual expenditure of between 1.5 percent and 5.0 percent of annual R&D expenditure on commercialisation. In Australia, reliable measures are not available, but industry sources estimate that the nation's total spend on commercialisation of the outcomes of publicly-funded research is significantly less than 1 percent of annual research expenditures -- a minuscule and inadequate amount. There is no mandated requirement by either the

Australian Research Council (ARC) or National Health and Medical Research Council (NHMRC) to set aside part of their research funding for commercialisation activity. Current levels set aside fall far short of the investment required to ensure we achieve excellence in commercialisation across the nation.

However, the ultimate performance measure for commercialisation must ultimately be framed in terms of broader economic benefits to the community. Thus while the revenue from the Technology Licence Office of the Massachusetts Institute of Technology (MIT) in Boston is just over $US80 million – a figure perhaps just double that of the University of Queensland – the MIT benchmark is that MIT graduates have founded 4000 companies employing over one million people, and that taken together, these companies would rank as the 24th largest economy among nations. In the case of health and medical research, the metric might be patients touched by the research, or the social impacts of policies implemented, as well as the economic benefits.

The prize is indeed great, but the winner is the economy as a whole. The returns to an individual university are tenuous and long in coming, and hardly sufficient motivation for it to branch out from its core teaching and research mission. Therefore, governments need to remain involved and committed to commercialisation, not only to help reduce the risks for those who choose to run the race, but also in setting the course.

AIC PROGRAMS AND POLICY INITIATIVES

There is a broad, emerging international consensus on the characteristics and value of policies that impact directly on innovation. This consensus recognises that:

- innovative firms are the key building block for productivity growth and stronger economic performance
- firms under-invest in knowledge creation because it is difficult for them to secure full returns from their investments
- governments therefore have roles in supporting innovation through activities such as ensuring effective linkages between firms and other organisations, providing grants for research and supporting skills development

Government policy is an important component in determining the national innovative capacity. Its setting is made particularly difficult by the generally lengthy time lag for new companies to reach maturity. Our first recommendation therefore is that policy makers need to 'stay the course'. The impetus from Backing Australia's Ability (I and II) and in particular the improvements to the CRC system and to the CSIRO's commercialisation efforts will take some time to show their expected rewards. These rewards should be great, but require consistency of effort and planning, with progress subject to constant review, but without wholesale change to the policy framework.

The AIC has a number of other policy recommendations for improved commercialisation across the board in Australia. These relate to improving the national innovation capacity generally; drawing industry and science more closely together; encouraging boards of all institutions to implement rights and responsibilities associated with the ownership of IP; incentivising commercialisation through taxation incentives; benchmarking the nation's commercialisation performance to monitor and manage the process; and supporting an entrepreneurial culture and the people within it. A more detailed listing on policy recommendations is given in Appendix II.

The AIC itself offers a number of products and services that fill gaps in the spectra of commercialisation support. Our national pilot TechFast program, funded by a grant from the Department of Industry, Tourism and Resources, works with technologically receptive SMEs and provides services to help transfer novel IP from research institutions across the country. Our Gateway products help researchers to manage their IP and provide resources and templates that can help them transform a piece of technology into an investible proposition. Our suite of education programs, and in particular the acclaimed Commercialisation Bootcamp, has helped change the cultural attitudes of hundreds of researchers towards commercialisation, equipping them with basic skills to begin the track from ideas to markets.

From these programs, the AIC has built a wealth of knowledge on leading practice in commercialisation and a number of case studies from which lessons can be learned.

TECHFAST CASE STUDIES OF COMMERCIALISATION

The AIC TechFast Program is currently in the pilot phase of its national release, with funding from the Department of Industry, Tourism and Resources. There are a number of innovative Australian SMEs the AIC is currently helping under this program. The experience of two of them is described below.

TechFast Case Study 1: Vortex Insect Control Holdings

Vortex Insect Control Pty. Ltd. is a Queensland company based near Townsville. The company is approximately three years old and is currently in the process of expanding the commercialisation of its flagship technology, the Vortex Bug Bin. The product is a device that attracts and catches insects that are considered pests. Its initial application has been in the agricultural sector where farmers place the bins out amongst their crops. The company has relied on a direct sales method and word of mouth to penetrate the agricultural markets. This market has been successful for the company to date and continues to grow. The company is now moving into the domestic and industrial insect pest control markets.

TechFast Assistance

The Australian Institute for Commercialisation (AIC) selected Vortex to participate in the pilot TechFast Program in 2004. After facilitating a 'needs and opportunity' analysis of the Vortex business, the AIC commenced the process of looking for new technologies from within Australian research organisations that could assist Vortex to expand the market for their insect control technology. To date, the AIC has contacted and held discussions with the following research organisations, regarding new technologies to complement Vortex's business and current technology:

- The Queensland Department of Primary Industry & Fisheries
- The Commonwealth Scientific and Industrial Research Organisation
- The University of Queensland
- The Australian National University
- The University of New England
- Griffith University
- Queensland Institute of Medical Research
- Dr Edward Koch Foundation
- The CRC for Micro Technology
- Rural Industries Research & Development Corporation

The AIC has also spoken to three Australian companies about potential relationships with Vortex and has made appropriate links.

The AIC through TechFast has undertaken independent market research for Vortex, providing them with valuable information regarding several key agricultural markets for their technology. Additional research is currently being undertaken covering new domestic applications, including golf courses, mining sites and resorts.

TechFast Outcomes

The AIC TechFast team has undertaken considerable work on behalf of Vortex in seeking, assessing and discarding or pursuing new IP and commercial partners. This *partnership* is progressively yielding new tangible benefits for Vortex. **The AIC's ability to farm IP from public research organisations across Australia, on behalf of SMEs, is an expertise that currently is not facilitated in any other Government-funded initiative.** Specifically to date, the following commercial results have been achieved with assistance through TechFast:

1) The AIC has arranged for Vortex to conduct technical trials of a new moth attractant technology developed by the University of New England, with the aim of potentially including the technology into the Vortex Bug Bin *(to commence later this year)*;

2) The AIC has facilitated an agreement between Vortex and The Dr Edward Koch Foundation in North QLD, to trial the Vortex technology with mosquito attractant technology. Part of this relationship will see the foundation provide expertise to Vortex in terms of actually redesigning their system to incorporate the mosquito attractant technology efficiently and effectively into the Bug Bin *(to commence April 2005)*;

3) The AIC was instrumental in assisting Vortex negotiate with and undertake due diligence on a large Melbourne based agricultural equipment distribution company to distribute the Vortex Bug Bin domestically and abroad. Vortex has chosen not to execute this agreement at this stage whilst they review their commercialisation strategy;

4) Vortex has recently entered into a new joint venture partnership with a large Queensland plastic manufacturer. Under this agreement, the partner will manufacture the Bug Bins, reducing Vortex's cost of production by approximately 50 percent;

5) The above milestones have enabled Vortex to commence discussions with a large developer of resorts, who has shown real interest in incorporating the Bug Bins into the designs of several new eco-resorts currently in planning. Discussions to date with the developer indicate a supply deal could be worth in excess of $1 million for Vortex. Success of the mosquito attractant trials previously mentioned are the key to finalisation of this deal;

6) Vortex believes that the above milestones have greatly assisted them to gradually attract the interest of larger professional investment organisations. Two potential investors are currently conducting due diligence on Vortex with the aim of investing $1.5 million to fund business growth.

Vortex has also commented that the AIC TechFast relationship has provided other intangible benefits such as:

- Advice and guidance on negotiating partner relationships at critical points
- Strategic advice regarding accessing both private and public funding
- Introductions to numerous valuable industry contacts
- Invaluable exposure through TechFast Program marketing initiates
- A general sounding board on business issues that have arisen

TechFast Case Study 2: Merino Pty Ltd

Merino Pty Ltd is a Queensland based company that manufactures paper, plastic and non-woven products. The company also operates a paper recycler located at Crestmead QLD

which recycles over 8,000 tonnes of office waste paper into paper products every year. A result of the recycling process is that 12 tonnes of waste sludge are produced per day.

Merino Business needs

Merino Pty Ltd spends approximately $300,000 per annum to dispose of the waste paper sludge. The company is exploring the potential of converting this waste into usable products with positive economic and ecological benefits.

Merino Pty Ltd is seeking a solution that will either:

1) reduce or eliminate the cost of disposing of the waste paper sludge; or
2) create a process that will convert the waste sludge into a value-added product.

Merino Pty Ltd was referred to the AIC's TechFast Program as a means to develop possible new product and process opportunities for the waste paper sludge. The AIC conducted a situational analysis to identify the specific business needs of the company and commercialisation options for its waste sludge.

The AIC has assisted the company, through the TechFast Program, to explore a number of avenues of use for this material. The assistance provided to Merino Pty Ltd to date includes:

- Conducting market research to identify commercial opportunities for the waste sludge
- Identifying a number of potential partner research organisations for novel technical solutions to Merino's problems
- Identifying potential customers for the waste sludge

Identification of New Opportunities

Following the situational and business analysis conducted by the AIC, Merino Pty Ltd was presented with the following three commercialisation options for use of the paper waste sludge:

1) The sale of the raw waste sludge as feedstock for the production of other products
2) Processing the waste sludge into a value-added product. This process may be developed in partnership with the IP of a Research Organisation
3) Licensing this process to other paper manufacturers in Australia and abroad

These commercialisation options create new opportunities for Merino Pty Ltd to develop new products, enter new markets and to increase profits. Ultimately these opportunities are intended to increase the company's value.

The AIC conducted market research on behalf of Merino Pty Ltd to identify the commercial potential of the waste paper sludge. The market research identified a number of commercial opportunities for use of the waste sludge.

The AIC has also commenced the process of identifying research organisations that may be able to develop in partnership with Merino Pty Ltd a process that will value-add to the waste paper sludge. To date, the AIC has approached and held discussions with three Australian Research Organisations *(University of Southern QLD – Fibre Composites Construction and Design, Aust. Sustainable Industry Research Centre & Environmental Biotechnology CRC)* as well as four Australian businesses in terms of exploring potential uses for the material.

Of these three organisations, the Environmental Biotechnology CRC has commenced an evaluation of Merino Pty Ltd's operations. The Environmental Biotechnology CRC has identified a number of its research outcomes that could be used value-add to the waste sludge.

Secondary Benefits

The AIC is currently holding discussions with a medium sized concrete and fibre composites manufacturer based in Queensland, who is reviewing the material for potential use in their business. A second smaller sized eco-friendly concrete manufacturer is also reviewing the substance for potential use in their products.

TechFast Outcomes

The AIC has provided a significant amount of support to Merino Pty Ltd by providing the company with market intelligence and identifying potential R&D partners and customers. These are intended to develop into formalised discussions, technology transfer and commercialisations as a result of the TechFast Program.

The immediate benefit of the TechFast Program to Merino Pty Ltd is that the company will be able to develop a strategy based on the information gained as a result of the linkage with research organisations that provide technology or IP. The ultimate benefit will be a new and novel product or process that will present new commercial opportunities.

Specifically the benefits of TechFast to date include:

1. The AIC identified a number of research organisations that may be able to provide intellectual property for developing a process that would value-add to the waste paper sludge. In particular the AIC have arranged for the Environmental Biotechnology CRC to hold discussions with Merino Pty Ltd. A result of this relationship may see the CRC providing expertise to the company in terms of developing this new process. The key benefits and purpose of TechFast is to provide:

    a. linkages to appropriate expertise from research organisations and
    b. services and support downstream to commercialise these opportunities.

Secondary benefits and outcomes include:

2. The AIC has identified and initiated discussions with a number of manufacturers to explore the potential for the sale of the waste paper sludge as feed stock for concrete and composite fibre products. These discussions will identify for Merino Pty Ltd the potential revenue for the waste paper sludge.

3. The AIC has, through its discussions with research organisations and manufacturers established new and potentially beneficial relationships. The relationships will provide Merino Pty Ltd with the opportunity to maximise the commercial potential of its waste products.

4. The AIC has identified a number of options that provide direct environmental benefits. Commercially exploiting the waste paper sludge will avoid its dumping as land fill which has been demonstrated to be environmentally unsound.

5. The AIC has identified that waste paper sludge converted to high value building materials is attracting revenues of approximately $122AUD per tonne in the UK. Potentially Merino Pty Ltd may be able to turn the cost of disposal into additional profit.

Other potential uses such as fertiliser or compost could reduce the company's annual $300,000 disposal bill significantly through the sale of these products.

As the company progresses through TechFast and these opportunities are pursued, PricewaterhouseCoopers has indicated that the TechFast investment may have a direct positive benefit to Merino of between $300,000 and $1.1 million over three years. Additionally, pursuing these commercial opportunities may create additional employment and positively impact the environment through waste reduction.

AUSTRALIAN CASE STUDIES PROJECT

The AIC has developed a library of case studies and case vignettes on the commercialisation of technology and/or research by Australian companies and businesses. The Case Studies Project is part of the AIC 'Know-How' portfolio. Vignette-style case studies currently available include:

- Triple P International Pty Ltd
- Benitec Pty Ltd
- Xenome Pty Ltd
- Alchemia Pty Ltd
- PanBio Pty Ltd
- Genetraks Pty Ltd
- Wedgetail Communications Pty Ltd

- Vortex Insect Control Holding Ltd (Techfast Pilot)

In addition, the AIC continues to identify potential case organisations and presently has a number of case studies in the pipeline.

As part of a project with the Melbourne Business School, University of Melbourne to produce 12 Australian commercialisation case studies, the AIC has developed the following four case studies intended for graduate-level study:

Astracon (established in Queensland, moved to the USA and was a casualty of the 2000/2001 tech crash)
Fultec Pty Ltd (established in Queensland and moved to the USA)
SAAB ITS (headquartered in Brisbane QLD)
Ventracor Ltd (headquartered in Chatswood NSW)

All case studies are available from the AIC for education activities and also form part of the content and materials used in the AIC education courses and programs. Cases are also used by AIC's partner in education, Melbourne University Private.

CASE STUDY ABSTRACTS

1. TripleP International Pty Ltd

Triple P – Positive Parenting Program is a system of easy to implement, proven parenting solutions that promote good communication and strong relationships between parents and children. The program was developed in 1979 by the School of Psychology at The University of Queensland (UQ) in Brisbane, Australia. This Triple P case study illustrates an example of an internal university initiative and the commercialisation processes involved to spin-out into an international company. Currently, Triple P International, the Queensland company commercialising the Positive Parenting Program, has established a significant presence in 12 countries and is the subject of a British TV series on parenting.

This case study is of particular interest for a number of reasons:

- It demonstrates the commercialisation of non-patentable IP and is an excellent example of the commercialisation of services
- It demonstrates that the researcher can achieve a number of additional (i.e. non monetary) benefits from commercialisation. In this case, commercialisation has enabled the research team to develop an unparalleled, global database and brought them enormous prestige
- It demonstrates that the public good can often best be served by following a commercial pathway

The research community and policy makers have been vocal about the importance of excellence in research for some time, but it has been only recently that *excellence in commercialisation* has come to the fore. Interestingly, there are still many segments of the research community that are indifferent to commercialisation, suggesting that their research is for 'public good', as if this were mutually exclusive with being commercialised.

In fact, the impact of 'public good' research can frequently be deeper and broader when good commercialisation principles are followed. For example, product management – marketing, bundling, distribution, and so on, can be used to great effect. In this case study, by branding and packaging their 'Triple P Positive Parenting Strategy' with marketing and training collateral, the research team have unarguably extended the reach of their social research to a global audience, and far more effectively distributed the impact of public good than had the research remained confined to its local suburban Brisbane roots. Furthermore, the ability to perform further research based on global data has subsequently brought to the school a level of prestige and funding that would never have been possible without applying good commercial practice to their research.

2. Benitec Pty Ltd

Benitec is a biotechnology company focused on commercialising its proprietary technology, DNA directed RNA interference (ddRNAi) for biomedical and therapeutic applications. This case study discusses the IP ownership and protection issues faced within this company.

3. Xenome Pty Ltd

Xenome is a biopharmaceutical company, focusing on the discovery and development of novel venom compounds into pharmaceutical products. This case study focuses on the product pipeline, and undertakes an analysis of the business strategy and value chain for the forecast product life cycle. The Xenome case study highlights the importance of capital raising, IP and human resources in the product pipeline of the traditional pharmaceutical commercialisation process.

4. Alchemia Pty Ltd

Alchemia is a biotechnology company that specialises in the discovery, development and synthesis of carbohydrate-based molecules for pharmaceutical applications. This case study assesses its drug development pipeline compared with major pharmaceutical company's anticipated lead time to commercialisation.

5. PanBio Pty Ltd

PanBio is a globally focused biotechnology company specialising in the development, manufacturing and marketing of medical diagnostic kits for infectious diseases. This

case study systematically evaluates its competitive advantage by a strength, weakness, opportunities and threats (SWOT) analysis to its R&D and IP position.

6. Genetraks Pty Ltd

Genetraks is a bioinformatics company commercialising breakthrough technologies – through the convergence of IT and biotechnology for veterinary diagnosis, prognosis and the identification of drug targets for biopharmaceutical development. This case study proposes that the implementation of information and communication technologies (ICT) and its associated organisational restructuring has helped boost internal R&D capacity to accelerate product development.

7. Wedgetail Communications Pty Ltd

Wedgetail Communications was founded in 2000 at the security division of the Co-operative Research Centre (CRC) for Distributed Systems Technology in Brisbane, Australia. This case study is an example of a company spun-out from a CRC while addressing a business strategy for capital raising. The company is now based in the USA.

8. Vortex Insect Control Holding Ltd

Vortex Insect Control, a North Queensland company and inventor of the "Bug Bin" utilises a tried and true concept of light and water to attract flying insects in a very cost effective and innovative manner. Vortex has been selected as a pilot case for the AIC's TechFast Program. This program will assist Vortex in adding value to its initial invention and improve the benefits that the Bug Bin can deliver to the market.

9. Astracon

Astracon was originally spun-out from CiTR, a software start-up company, from the University of Queensland. The company developed and manufactured connectivity management software for the telecommunications industry. Launched in the US in late 1998, this case demonstrates importance of environmental scanning as illustrated in the various strategies used before and after the 'tech crash' in 2000.

10. Fultec Pty Ltd

Fultec is a start-up company commercialising a new device known as the Transient Blocking Unit (TBU), a highly effective surge-protector for telecommunications equipment. This case study addresses the funding issues faced through independent phases of the organization and product development pipeline. Moreover this case study highlights the importance of market research and industry assessment before product release. Fultec relocated to the US in 2005 in order to access larger capital markets there.

11. SAAB ITS

SAAB Intelligent Transport Systems (SAAB ITS) integrates currently available and emerging information, computer, communications and vehicle-sensing technologies

into transport infrastructure and vehicles to monitor and improve the safety, efficiency, management and operations of vehicles and transport systems. This case study describes how the SAAB ITS as a joint venture between SAAB Sweden and the Brisbane City Council developed and delivered the Coronation Drive Advanced Lane Control Project (ALCS) in Brisbane, acknowledged as one of the most complex tidal flow traffic systems in the world.

12. Ventracor Ltd

Ventracor is an international medical technology company based in Sydney. The company has developed a life-saving heart pump called the VentrAssist™ left ventricular assist system (LVAS). This case study explores key regulatory, IP and competitor issues Ventracor faced before they were able to market their key product in Europe and the United States.

CONCLUSION

Today there are approximately 1500 small, high-growth technology-based companies in Australia. Increasing this to 3300 by the year 2020 would represent strong and continuing commercialisation performance. If just 80 of these reach maturity (defined by sales over $50 million), the incremental total revenue is forecast to be over $20 billion. Therefore, the challenge for Australia, is to transform our national investment in research into economic outcomes.

Over the past two years, the AIC has engaged with the States and the Commonwealth, and a number of public research institutions, private service providers, and industry, particularly SMEs, to address the barriers to commercialisation. With the necessary support of government, we are contributing to building the 'soft infrastructure' described in this submission to improve Australia's research commercialisation performance, and in turn, bring benefits to industry. However, much still remains to be done, both by the AIC and by other stakeholders.

This document summarises some of the AIC's activities and recommendations. We believe commercialisation of publicly funded research in Australia requires a positive policy agenda, and support for the resources, people and soft infrastructure to create the environment in which innovation and commercialisation can thrive.

APPENDIX I
THE BARRIERS TO COMMERCIALISATION

The following contains a summary of the barriers to commercialisation that were identified at information sessions held throughout the country when the AIC was created in 2002. Many of the comments, by virtue of the complex interactions affecting innovation, will touch multiple categories. Other comments might appear 'naïve', but have been kept to capture the sentiments of stakeholders. Others are merely opinions. The solutions to each barrier will be wide ranging, since innovation and commercialisation form a complex ecosystem.

Many of the comments, by virtue of the complex interactions affecting innovation, will touch multiple categories. The solutions to each barrier will be wide ranging, since innovation and commercialisation form a complex system. Internationally, whole-of-government approaches to innovation policy have been found necessary to improve the commercialisation system.

1. People and Culture

- There is a shortage of appropriate people and processes in the incubation process with the proper skills, including those at the Board level.

- There is not a widespread entrepreneurial culture in Australia that celebrates success and accepts the associated failure and risk. Australia has a lack of serial entrepreneurs.

- Training and skills are lacking at all organisational levels within the start-up milieu.

- The environmental factors impacting people, such as the tax system, the lack of venture capital, or a well-understood and well-trod commercialisation process are often not properly set or measured.

- There is a perceived gap between the ethos and timeframes of the academic research environment and the for-profit motive of the business world.

- There is frequently a lack of proper incentives for researchers to manage and commercialise the IP they create.

- Commercialisation is often seen as the last stage in a sequence of research, rather than research as part of a commercialisation process. Research is frequently performed for its own sake, rather than for a well identified or defined commercial outcome or market. Commercialisation needs to be identified as a key objective in the process (if it is a desired outcome), while still respecting the importance of pure science and academic excellence.

2. Taxation Issues

There are a number of impediments in the current taxation system that work against innovation.

2.1 R&D grant schemes and tax incentives

(i) 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.

(ii) The R&D cash rebate 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 3 year financial history to be eligible – start-up companies have cash flow issues.

(iii) Many research institutions are tax exempt, and thus ineligible to apply for tax exemptions, and for many other government grant schemes.

2.2 Employee Share Option Schemes

Employee Share Option Provision Schemes (ESOPs) are commonly utilized by investors to provide incentives and rewards for inventors/staff of start-up companies, which do not have the immediate financial resources to make cash incentives available. There is a tax penalty associated with these schemes as soon as the underlying IP is valued, for instance upon initial investment of start-up funds. When this occurs, a tax burden is immediately payable on ownership of company shares. In some cases, an FBT exposure is also incurred by the institution.

2.3 Stamp Duty

There are stamp duty consequences when IP is transferred or licensed from a research institute to a start-up company. From a stamp duty point of view, the transfer and license of IP is caught under the definition of asset transfer, thus dutiable.

2.4 Amortisation and IP Valuation

- Tax deductions are available for accelerated depreciation of capital equipment but there is no policy approach for amortisation of intangible capital items, such as patents in technology companies.

- There is a need to have guidelines on IP valuation and also to have continuity and security on IP valuation. A proposed solution could be to submit a

valuation to the Tax Commissioner seeking a once-and-for-all confirmation of the valuation of the IP, for instance, as at the date of creation of a start-up company.

2.5 Encouraging investment in new innovation

- R&D Tax concessions are not stimulating this sector enough. R&D expenditure in the private sector (individuals and corporations) needs to be stimulated to increase their activity.

- Investment needs to be encouraged for the longer term. Investment from private individuals (i.e. angel investors) should be allowable as an upfront tax deduction. Rollover relief of capital gains realised from a mature start-up company into new start-up companies is also provided in some overseas countries.

During July 2002, a number of tax concessions were set introduced in the Tax Act and VC Act. However, they are primarily directed towards attracting overseas capital into Australia.

2.6 Company transition

In the early stages of developing a concept, IP may be held in a company structure convenient for the research institution, while in later stages it is important that the company structure matches markets and channels. For instance, when a company lists on the US-based NASDAQ, the company realises a capital gain and is assessed tax in Australia. The result is that many companies are being lost offshore too early, along with economic and social benefits to Australia. Taxation incentives need to be structured to encourage companies to remain headquartered in Australia.

3. Education and Training

- There is often a negative public perception of researchers participating in the returns from commercialised research, particularly those on the government payroll.

- There is a shortage of start-up management skills and commercialisation skills in Australia.

- There appear to be 'disconnects' - be it in language, overall philosophy, time frames or priorities for key deliverables between many researchers and their institutions on the one hand, and venture capitalists and the market generally on the other.

4. Funds Availability

- There are many researchers who believe that there is a shortage of start-up resources in Australia. Surveys show there is an 'innovation progression gap' for funding for very early stage ideas.

- There are many venture capitalists who believe that there is a great deal of commercially irrelevant research conducted in public institutions.

- Businesses and SMEs are often ignorant of the research directions of Australian universities and are frequently more focused on cutting costs than growing through innovation.

5. Intellectual Property

- The rights to ownership of patents need to be coupled with the assumption of responsibility for the effective identification, protection, management and commercialisation of the invention.

- Many commercialisation opportunities are lost because the ownership of IP cannot be established, or because there are so many encumbrances on the IP that its commercialisation can never be financially justified.

- At present, too much IP is lost through delay, dilution, ignorance of its potential, or through lack of knowledge of what IP exists within an organisation.

6. Company-research Links

- Commercialisation efforts are fragmented, with larger universities and CRCs having units dedicated to commercialisation while many have none or only one-man bands.

- A greater level of international networking and marketing of commercialisation needs to be fostered within Australia.

- There is an issue of scale with respect to the likely size a spin-off can reach in Australia compared to the US or Europe. Following from this is the need for any really successful spin-off to pursue both markets and funding offshore.

- There are high transaction costs in Australia partly attributable to reinventing the commercialisation process repeatedly. Rather than sharing of experiences in starting new ventures, each spin-off will frequently repeat the same mistakes of others. The associated cost drains significant financial resources at critical early stages. These costs often include expensive professional fees for advisors.

- Multinationals undertaking R&D in Australia will often do so only for reasons of subsidy, and will withdraw to their home base in difficult economic times.

7. Best Unbiased Advice

- There is a very real difficulty for researchers to obtain "hard nosed, accurate, confidential, unbiased advice and subsequent support" for commercialisation activities, especially in smaller institutions.

- There are problems for new companies in obtaining suitably qualified, competent and trusted advisors and directors.

8. Appropriate and Meaningful Benchmarking

- Commercialisation processes need to be assessed objectively against international "leading practice". Any blocking issues identified throughout the commercialisation processes need to be removed.

- There needs to be recognition that there is not a "one size fits all" solution to the commercialisation process – processes that are successful overseas need to be adapted for Australia, there will be differences in different industries.

- There is a lack of good news stories – the same stories are being retold repeatedly. There is a very real need to identify ways to promote a broader range and larger number of these stories through the media, especially television.

9. Co-ordinated Exposure to Markets (overseas links)

- There is currently too much fragmentation of research - be it because of the number of research institutions operating in similar fields or because of rivalries for available funding and difficulties in securing industry partners. Greater coordination is needed between them to allow bundling of related intellectual property to ensure marketable outcomes. Within Australia, there are 94 research institutions with research budgets under $20M.

- Closer links with overseas companies and distribution channels are required - as an access option to larger markets.

The AIC would be happy to provide detailed copies of its policy recommendations in these areas to the Committee, upon request.

APPENDIX II: AIC RECOMMENDATIONS

INNOVATION DRIVERS AND SOME INNOVATION POLICY SUGGESTIONS

Before suggesting some possible future directions and specific initiatives, it is helpful to first review some literature and recent AIC research on the key drivers of innovation, and therefore economic growth.

Referring to Porter's model of innovative capacity, Stern[3] states that the quality of linkages is a key driver for future competitiveness. He claims 'the quality of the connections between a nation's common innovation infrastructure and individual industrial clusters is crucial to innovation. Without strong linkages, upstream scientific and technical advances can actually diffuse to other countries more quickly than they can be exploited at home'. A variety of formal and informal organisations and networks – so-called 'institutions for collaboration' – are present in many nations and link the two areas. Formal and informal knowledge sharing between firms, and diffusion within them, are part of the network of feedback connections that constitute the innovation system.

Erskine[4] refers to an OECD report that suggests 'the overall innovation performance of an economy depends not so much on how specific formal institutions perform, but on how they interact with each other as elements of a collective system of knowledge creation and use, and on their interplay with social institutions (culture, etc)'. He lists ten related OECD policy recommendations:

- *Giving greater priority to basic and long-term mission-oriented research in public programs*
- *Ensuring appropriate frameworks for intellectual property rights*
- *Matching the supply and demand of scientific knowledge*
- *Improving the governance of universities and public laboratories*
- *Safeguarding public knowledge*
- *Promoting the participation of smaller firms*
- *Attracting, retaining and mobilising human resources*
- *Improving the evaluation of research*
- *Responding to globalisation*
- *Building on existing innovative networks and clusters*

[3] J. Gans and S. Stern, "Assessing Australia's Innovative Capacity in the 21st Century", www.ausicom.com
[4] Erskinomics Consulting "Critical Factors in Successful R&D – An International Comparison", p. 17, www.ausicom.com

Erskine also notes that 'the technocratic, supply-driven nature of attempts to exploit academic output in Sweden has been markedly less successful than the demand-driven market institutions in the US'. ie. priorities that are set by the market lead to better commercialisation outputs. He also points to the success of Finnish policies in which 'the main benefits lie in the close cooperation between research institutes and industry, the widespread involvement of small and medium sized companies and the high level of international cooperation'. On Israel, he comments 'our analysis suggests that cluster effects have been particularly useful in overcoming difficulties that Israeli firms faced in accessing markets, because of distance from final markets'.

In a similar vein, the model of innovation used by UCSD Connect, an organisation instrumental in achieving local economic development in San Diego, contains five components:

- *Intellectual capital (research, patents and creation of ideas)*
- *Human capital (a talented workforce, skills)*
- *Financial capital (venture capital and funding)*
- *Clusters (concentration, critical mass)*
- *Creative capital (regional mindset, collaboration, connectivity).*

For innovation to occur, according to this model a community requires more than hard assets - people, science and technology, but also soft assets - the power of a network. Stakeholders recognise that *deal flow results from knowing people* and that *business is relational as well as transactional.* The Connect experience has shown that without such relationships, incubator schemes and grant schemes will never completely achieve their desired outcomes of (sustainably) facilitating investment and helping small companies create job growth and wealth. The premise for this is that the ***relational* component of economic development (i.e. trust) becomes much more important as the risk increases.** This is clearly the case in the growth of untested, hi-tech, start up companies.

The AIC believes that a future national strategy should bring greater focus to the 'soft assets' and to continue to build on the hard assets that exist to varying degrees already.

Our suggestions for possible initiatives include:

(i) Create a culture where industry and business recognise the value of innovation

Willingness to embrace new or 'smart' technology and to engage with the research community is not necessarily a function of size. Indeed, Australia's top 50 firms have minimal representation on the Intellectual Property Research Institute of Australia list of Australia's most innovative companies[5]. Rather, capability to embrace innovation is a reflection of the leadership and culture within an organisation, the sector in which the

[5] Intellectual Property Research Institute of Australia, "R&D and Intellectual Property Scoreboard 2004".

business resides and, importantly, the nature and integration of business planning within the organisation.

A business that does not undertake and apply real planning is in effect stating that it is accepting of its *status quo* position, or is a reactive organisation. Such an organisation typically sees little value in the need to engage with either the R&D community or others to accept and adopt new technologies to attain new goals.

The AIC believes that Australia's companies will become smart when they adopt methodologies for good business planning – particularly for high-growth companies in the contemporary global environment. This will lead to a more progressive attitude to engagement with the scientific and research communities.

The government can support such efforts at cultural change through various initiatives:

- Review the funding targeted at industry to ensure it promotes sustainable high technology companies and is sensibly targeted. There is an enormous plethora of schemes today across all tiers of government, some with mixed results. Targeted funding for the future should be based on a consideration of the effort to date: what works, what doesn't. Application of the State's research goals will help here.
- Celebrate innovation heroes and local firms. There are many excellent examples of industries engaging with the R&D community, and benefiting. These peer examples need to be better recognised, highlighted and celebrated, and the generic lessons documented and circulated.
- The AIC is particularly excited about the promise of its TechFast program, first piloted in Queensland and now in a national pilot. TechFast works with technologically receptive SMEs to identify publicly-funded R&D from across Australia and assists in its transfer, to help the SMEs become stronger and more innovative businesses.
- The importance of innovation can be highlighted and branded both within government itself and through government focus on the application of new technology. Government purchasing initiatives can be used as a tool.
- The need for 'balanced Boards' capable of exercising sound technological judgment is particularly acute in Australia compared with many US and European countries. Organizations such as the Australian Institute for Company Directors and the Business Council of Australia should be encouraged to focus on such activity.
- Work with the Australian universities to develop programs that grow the cadre of new technology commercialising executives, entrepreneurs and company directors, and encourage interaction of this group with science and engineering students.

(ii) Ensure that all Australia's universities and research institutions recognise 'industry' as a customer

Successful commercialisation requires both the supply of ideas and talent, and demand from markets, through industry, to deliver useful products and services. 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.

One key to success in regional development is developing a world-class people climate. Universities are very effective talent-attractors. Richard Florida[6] opines that for universities to be effective contributors to regional growth, a university must play roles that reflect the three 'T's' of creative places – technology, talent and tolerance. The Irish 'miracle' was premised upon the three Ts; today, 60 percent of Ireland's university students major in engineering, science, or business studies. In Ireland, the recruiting of technology companies and entrepreneurs was extended to the artistic and cultural creative scene of writers and musicians (U2, Van Morrison, etc). Place is becoming an important source of status. Australia could be such a 'place'.

A range of supply side initiatives could include:

- Task and appropriately fund universities to adopt an explicit 'third' stream – support for industry – in their mission statement. The UK's 'third stream' of funding accompanied a requirement for universities to adopt a third mission – that of serving industry. This has been considered in the UK's Lambert review of university commercialisation and is a legislative recommendation in the recent AVCC-BCA review of research commercialisation[7]. Entrenching a commitment to collaboration with industry in the charter of the nation's universities and providing access to a pool of funding, would give them the official mandate to enable them to even more vigorously pursue outcomes from their research.
- Anchor a 'creative class' around universities. The Creative Industries Precinct in Brisbane is an excellent initiative that leads the way in its sector. We note that part of the reason for the success of San Diego in attracting high-growth, high wage jobs has been the success of UCSD (the local university) in 'anchoring' creative activity around the university. Attracting venture capital and industry to the university's talent pool has created a plethora of businesses, particularly in the biotech and wireless areas. Their growth was sparked by one or two iconic leaders in these fields. Australia's universities also have iconic researchers in a number of fields, but these potential leaders are often lost within the research community. Their talents could be better utilised if cross-coupled with entrepreneurs.

[6] R. Florida, 'The Rise of the Creative Class', Basic Books, New York, 2002
[7] Australian Vice-Chancellors' Committee and Business Council of Australia, "Building Effective Systems for the Commercialisation of University Research", August 2004, p70

- Implement metrics for government supported research institutions around the supply of ideas and their support for industry that can help benchmark their outcomes and improve the transfer of R&D and its conversion process. There is too much emphasis placed on the number of spin-out companies created from commercialisation activity. Whilst this is indicative of short-term activity, it does not necessarily reflect longer term wealth generation and value creation, attraction of capital, or job creation. Outcome indicators have considerable lag with respect to inputs, so must be considered over time. The metrics should report on:
  - *Their positive impact on business and industry (probably flowing through to community benefits as well)*
  - *The effective management and use of their intellectual property.*

(iii) Continue support for local clusters, be specific about sectors and promote interaction

In deciding how to develop communities of interest, the AIC believes that, as with clusters and supply chains of any sort, the best are developed with true commonality of interest and with physical immediacy. 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, identifying opportunities that mean something to both those research institutions and to local businesses and, in effect, put a leading edge to comparative advantages that already exist in those regions.

Rowen and Toyoda have identified six major enabling factors that would have improved the emergence of high technology start-up companies in Japan[8], especially when compared with the US and Taiwan:

- Appropriate 'rules' of the game that help establish the background for entrepreneurial activity (labour mobility, compensation, regulatory constraints, etc.)
- Creation of high knowledge intensity and *knowledge-sharing* environments
- High value placed on merit
- A social climate that rewards rather than punishes risk taking
- Cooperative institutional relations among business, academe and government that encourage knowledge transfer
- An infrastructure and environment that nurtures newly emerging firms, especially in finance.

Seline[9] from New Economy Strategies Inc. gives the example of San Diego and the greater Philadelphia area. San Diego receives about US$1 billion of Federal R&D funding each year, Philadelphia US$1.8 billion. Both have world-class universities (the latter including Princeton)

[8] H. S. Rowen and A. Toyoda 'From Keiretsu to Startups: Japan's Push for High tech Entrepreneurship, Stanford University, October 2002

[9] R. Seline, Private communication, Dec 2003

and research institutions. Philadelphia has much more 'old capital' than San Diego. Both cities have enormous assets, yet San Diego produces over 100 new biotechnology companies each year against Philadelphia's ten.

Numerous other examples abound.[10] Both Pittsburgh (home to arguably the world's best university for software engineering, Carnegie-Mellon) and New Jersey (Bell Labs) are similar locations unable to create more than handfuls of new start-ups each year.

The difference lies very much in the 'soft infrastructure' and the resultant emergence of clusters. In numerous interviews into the direction of research and the membership of boards and peer review committees, leaders in Philadelphia did not understand their role in innovation and researchers were unaware of what others in their city were doing. The *creative capital*[11] and *proximity* in Philadelphia were significantly less than in San Diego, whose environment facilitated business creation. Philadelphia lacked a creative class.[12] As Richard Florida points out in 'The Rise of Creative Class', the key to success today in regional development lies in developing a world-class 'people climate'. Cultural inertia can be a real barrier in older, better established, industrial regions. Social capital – regional mindset, collaboration and connectivity have thrived in San Diego where they are distinctly lacking in Philadelphia.

(iv) Promote mobility and enable exchanges of staff between government labs, universities and industry

A common observation is that very often industry and science fail to truly understand the drivers, imperatives, time frames and even the language of the other group. Initiatives might include:

- Break down these barriers by trialing a robust system of industry/research exchanges that are of value to the business, the research institution and the individual involved. Government research personnel could show the way. Develop appropriate incentive schemes, protect tenure (where applicable) and ensure pension rights are unaffected in order to enable such exchanges.
- As a policy direction, facilitate discussions that enable the transfer of knowledge across the states and regions in a creative and non-threatening way.

[10] C. Lee et al, "The Silicon Valley Edge", Stanford Business Books, 2000

[11] The role of social capital in economic development is also of interest. For instance, the Vietnamese community in Houston represents a $1.8 billion 'banking system'; Indonesia's Chinese population is just 3% of the total but represents 83% of GDP; and the first generation Asian network in the US has become critical to new wealth creation.

[12] R. Seline points out that other supposed creative centres, such as Seattle and Austin, have not recovered from the dot.com collapse to the extent of San Diego. For instance, Seattle spawned 138 millionaires from Immunex, not one of whom has started a new startup. Their largest medical centre has a commercialisation intensity only one-half that of its San Diego equivalent. The head of Austin's Chamber of Commerce 'does not know' the economic future of Austin.

(v) Nurture the growth of investment capital in innovation

The capital markets in Australia are small and the venture capital markets smaller still. The bulk of venture capital funds are not invested in early-stage commercialisation, but in mergers and acquisitions when companies are at the mature stage, risks lower and the short-term returns higher.

Specific initiatives to narrow this early-stage funding gap could include:

- Encourage, through legislation or rebates, investment of a small component of superannuation funds into private equity and local innovative companies.
- Encourage the growth of local angel investor networks.
- Facilitate investments in Australian high growth, high technology business by business immigrants to Australia (anecdotal evidence suggests that many immigrants invest instead in local retail outlets because a ready market exists for trading and exiting such investments).
- Facilitate successful small businesses created through such initiatives to remain in Australia and to attract follow on capital so they can remain local companies. Anecdotes, including some in the AIC case studies mentioned earlier, exist of local high-technology companies ready for growth having to become US-based entities simply to attract a later round of venture capital funding. By selling offshore too early in the development cycle, higher value is not realised locally and the benefits of local jobs lost.
- Utilise Australian expatriates and alumni to assist Australian firms in market entry and capital raising. The AIC's ExpatriateConnect is an initiative based on this model (but one that currently lacks a sustainable revenue model).