AIC Submission No. 3:

to Productivity Commission - Public Support for Science and Innovation

Increasing Australia's Innovative Output

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Although it is generally recognised that innovation underpins future economic growth, Australia lags in most international comparisons on the exploitation of technological innovation[1]. The Chief Economist of the World Economic Forum (WEF) has observed "the highest returns [in Australia's measure on the WEF's Growth Competitiveness Index] will come from boosting Australia's high technology sector"[2].

Boosting this sector, and building new businesses to reap the rewards, requires three key elements: science-based research and know-how, entrepreneurial skills, and adequate capital.

Yet,

(i) Australia's publicly-funded research organisations achieve significant research outcomes. Universities, CRCs, and medical research institutes receive over $5 billion of public funding for research annually, much of it in science and technology related areas.

(ii) There are thousands of successful entrepreneurs operating businesses throughout Australia possessing the right skills and knowledge.

(iii) Australia's superannuation funds now manage capital approaching $1,000 billion. Recent budget announcements are resulting in a massive influx of funds that have benefited the industry greatly.

Why then, are there so few high growth, high technology businesses that have emerged in Australia from our science and technological research?

The issue lies in the different perspectives and interconnectedness among those with the right know-how, business skills, and capital. Catalysts are needed to generate new high growth businesses founded on technological innovation, and to bridge the gaps that lie between the right ideas, risk capital, and entrepreneurial skills.

The AIC proposes three key innovation enablers that it sees as currently lacking within the innovation system, and that would encourage the emergence of new, technologically innovative growth companies.

1. **Catalyse business – research collaboration**.
   Collaborations between business leaders and Australian researchers appear difficult to establish for a variety of reasons[3]. Yet such collaborations are often essential to either locally develop new know-how or to adapt existing technology, and for new technologically-based businesses to

[1] OECD, *Main Science and Technology Indicators Database*; OECD Publishing, 2005
[2] A. Lopez-Claros, speech at the Australian Industry Group *Economy 2005* forum, 4 March 2005
[3] See for example AIC submission no. 2, *Overcoming the Industry-Research Sector Divide*, AIC June 2006.

emerge. A catalyst is needed to improve access and information flow in order to achieve the desired outcomes. The AIC recommends support for market-led intermediary programs to assist Australian-based SMEs to:

- articulate their innovation and technology needs,
- identify appropriate Intellectual Property (IP) and know-how from across Australia's research system,
- manage the transfer of technology related skills and know-how into their business.

This will help create novel outcomes from the intellectual capital and assets that Australia already possesses. An example of such a program is described in the attached paper, "Creating New Industries by Increasing Business Involvement in R&D".

2. Push more investment funding into early stage innovation.

a) Australians have now invested nearly $1 trillion in superannuation[4]. Fund managers have reaped enormous benefits from recent legislative changes, given that they earn management fees of between 1 – 2 percent on a rapidly expanding asset base. A legislative directive that 0.1 percent of funds should be allocated to early stage venture capital would be roundly condemned by these managers as breaching their fiduciary duties to investors. However, such outcry seems hollow given that these same managers can increase their management fees by 0.1 percent with impunity and without reference to their investors. In any case, a mandatory allocation of that amount would be insignificant compared with the benefits that have resulted from the assets that have flowed into superannuation funds as a result of the recent budget changes. However, unlike a fee increase which would certainly yield no return to investors, the return from allocating an equivalent amount of the asset class to early stage venture capital could yield a median annual return of 16 percent (actual return in 2004-5) [5], and frequently higher. An early-stage capital base of $1 billion (equivalent to 0.1 percent of total assets) could build a pipeline of hundreds of new opportunities every year, and would significantly increase the capital available to start-up and early stage businesses.

b) The taxation system penalises the commercialisation of intellectual capital in four ways, and works contrary to the intent of other tax incentives intended to encourage research.

I. There is an immediate tax impost on unrealised gains associated with the transfer of IP assets to a company in exchange for shares;

II. There is an immediate income tax impost on unrealised gains associated with employee share option schemes;

III. There is practically no tax relief for company start-up losses which are retained within the company - they can be deducted against other income generated by the owners only in certain circumstances. Similarly, there is no rollover relief on capital gains if the gains are rolled over to fund new start-up companies.

IV. Tax exempt shareholders (including PFROs) effectively lose tax free status as they have to pay company tax on income.

These imposts are not present in jurisdictions such as the US, and removing them would eliminate the preferential treatment of investment in real property over intellectual property.

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[4] Reserve Bank of Australia, *Assets and Liabilities of Financial Institutions and Non-financial Sectors (B Tables)*, 2005

[5] AVCAL, *Industry Statistics for the year ended 2005 Yearbook 2005*, 2005

3. Build Skills and Know-how

Innovative businesses require science and engineering graduates to improve the productivity and innovative capacity of their companies. They are needed to develop, adopt, and adapt new technological innovations, and for systems integration of external technologies. A pool of skilled engineers is also essential to build Australia's infrastructure and assume future leadership roles. A 2004 American study found that the most common undergraduate degree for the CEOs of the S&P 500 companies was engineering[6]. The AIC knows of no similar study for Australia, but would note anecdotally that lawyers and accountants appear to be over represented on Australia's company boards. There are no simple policy prescriptions to increase Australia's supply of graduate scientists and engineers, but the AIC adds its support to the efforts of those who attempt to rectify the looming shortage of skilled human capital.

In conclusion, Australia has many strengths and significant infrastructure - our innovation *drivers*. Our innovation *system*, like a biological system, is a complex ecosystem, and requires the right catalysts to achieve productive outcomes. Such catalysts can frequently add minor perturbations to the system and achieve great leverage. The AIC believes that actively encouraging collaboration, increasing the flow of capital to early stage ventures, and encouraging technological skills development, are levers that should be productively applied and used.

[6] Spencer and Stuart, *2004 CEO Study – A statistical snapshot of Leading CEOs*, 2004

Creating New Industries by Increasing Business Involvement in R&D

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Abstract

The creation of new businesses and ultimately industries around them requires new ideas, new skills, and plenty of capital. Although publicly-funded research produces many such ideas, the skills and capital needed to seed companies and grow new industries from this research are frequently lacking. Unlike business-sponsored research, the discovery process in universities and other publicly funded research institutions may not follow a business-driven agenda i.e. seeking a solution to a known problem. To achieve commercial outcomes from such research is frequently an afterthought, rather than the primary driver.

However commercialisation of such research is important, because business investment in research and development (R&D) in Australia lags well behind the OECD average, and as a nation we risk missing out on developing new industries and the opportunity to grow our own global giants. Public investment in research, while no substitute for business investment, can help to provide the new ideas and identify the opportunities that can be harvested to produce beneficial outcomes. This paper discusses how a new program that has been developed to catalyse the commercialisation of public research is helping to improve business involvement in R&D, and drive new opportunities.

Innovation and technology commercialisation

Those of us involved in innovation usually have a common objective: to create stronger economies, more vibrant companies, and to build wealth, jobs, and better social outcomes for the community. Myriads of economic development agencies, chambers of commerce, industry groups, businesses, research organisations, and technology transfer offices espouse the cause of innovation to help achieve such outcomes. The Australian Institute for Commercialisation (AIC) is among them.

One role of the AIC is to help increase the flow of R&D from Australia's publicly-funded research institutions into commercial outcomes. In doing so, it seeks to share leading practices in commercialisation among its stakeholders, and to build scale and increase interactivity among industry, the Australian states and territories, and research institutions. The AIC's core business is to help identify ideas, seize opportunities, and create innovation outcomes. By doing this, we will help generate high value jobs, exports, and wealth.

To some, 'commercialisation' is little more than the well understood task of product, service or process development followed by business development. In companies, these steps are usually well 'gated' to weed out failures early. However, ideas from public research institutions are usually at a very early concept stage and therefore generally lack capital, channels to market, and often, clear market application or customers. In such cases, the gates are usually uncontrolled and irrelevant, their existence and purpose generally not even recognised until too late in the development process.

Unlike industry-sponsored research, the discovery process in publicly-funded research organisations will frequently not follow a business-driven agenda i.e. seeking a solution to a known problem. To

achieve commercial outcomes from publicly-funded research is often an afterthought, rather than the primary driver. This is the classic problem of 'technology push'.

Business R&D drives profitability and economic growth

It is recognised and accepted in most developed nations that R&D is a key driver of technological innovation that results in the development of new products and services[7]. Businesses investing and engaging in R&D activities, whether established internally or sourced through external collaborations with research institutes, have a greater potential to develop new products and services that will stimulate growth for the business and result in the creation of new jobs, export dollars and wealth within the economy. This has been the case for economies, such as Sweden, Finland and the USA where business investment in R&D has been encouraged and supported. As a result these economies have been recognised as "first-tier innovator nations" having a comparatively high innovative capacity[8].

In Australia however, some representatives in industry have recently argued that international comparisons should not apply to Australia's laggard performance in business R&D investment because of structural differences in the make-up of business from country to country[9]. Even though this argument has recently been disproved[10], the case of Finland and Nokia is frequently cited i.e. Finland leads the world in business investment in R&D because its industry contains technologically based companies like Nokia.

How easy it is to confuse cause and effect! In 1989, Finland was at risk of becoming an economic basket case because it had lost its Soviet markets. Nokia was a mere rubber goods and forestry company. The Finnish Government's strategic decision that year to begin investing heavily in R&D, and Nokia's well-timed choice to invest in new product innovation, was to create the most robust of the European economies. Finland would still be in dire straits had it heeded such arguments! The Finnish R&D sector in fact provided a pool of new discoveries that were to become the foundations of successful industry restructuring.

Moving to first-tier innovator status is critical for Australia, if we as a nation want to remain competitive. Governments in Australia, on behalf of the taxpayer, invest over $5 billion in research at institutions throughout the country. This investment is frequently justified by the human capital and skills that are developed and the capabilities it infers, but direct commercialisation outcomes are also part of the equation. A study of the economic benefits to the nation of following a strong direct commercialisation path recently predicted that revenues from newly created spin-off companies could exceed $20 billion by 2020, most of it from exports[11].

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[7] As outlined for example in Working Group on Asia Report to PMSEIC, *Strengthening Australia's Position in the New World Order*, June 2006
[8] J. Gans and S. Stern, *Assessing Australia's Innovative Capacity in the 21st Century*, June 2003
[9] Business Council of Australia, *New Concepts in Innovation*, April 2006
[10] OECD, *Economic Policy Reforms: Going for Growth 2006*; Paris: OECD. 2006
[11] Allen Consulting, *The Economic Impact of the Commercialisation of Publicly Funded R&D in Australia*, 2003

Research and development can be of great benefit to individual companies as well: the 30 top R&D spenders in Australia had a five-year weighted average return on shareholders funds of 17.1 percent compared with 7.7 percent for the nation's Top 1000 enterprises, more than double[12]!

Benefits will also accrue at the local level. When a research-based university is fully integrated into its local community, the rewards can be enormous. Start-up companies created from Stanford University accounted for about 60 percent of total Silicon Valley revenues in both 1988 and 1996, and include companies such as HP, Sun Microsystems, Silicon Graphics, Adobe, and more recently, Yahoo![13]. The research organisations' role in developing human capital is also crucial. Companies formed by graduates and faculty of MIT would rank as the 24th largest economy in the world if measured among nations. MIT graduates have founded 4000 companies with 1.1 million employees[14].

But such outcomes cannot be achieved without the injection of business skills and investment capital. Unfortunately, as a nation, we lag seriously behind in business investment in R&D. Ironically, the task is not made easier by Australia's economic performance, which has been exceptional in the past decade-and-a-half, surpassing most other developed economies. But this performance was first driven by tremendous macro-economic reform and productivity improvements (often based on technology adoption), and more lately through the commodities boom, rather than through the growth of knowledge-based industries. And even in the best of economic times, Australia still imports more than it produces.

To strengthen economic performance into the future requires a concerted effort to raise business spending on R&D, and to greatly improve the efficiency with which publicly-funded R&D is converted into commercial and economic outcomes. As we will demonstrate later, business R&D can indeed build on publicly-funded R&D. 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.

Better exploiting publicly-funded research and development

In spite of the potential returns from Australian research, it is surprising how few incentives and resources are directed to its commercialisation. Less than one percent of the total public R&D spend is invested in direct commercialisation of that research[15]. This is of course the complete inverse of what it costs businesses to take a product to market, where multiples of ten to one hundred times the cost of the research itself are the normal expense for taking an idea to the marketplace.

It has proven stubbornly difficult to commercialise research from publicly-funded institutions. In attempting to find a buyer for its technology, an institution is most likely engaging in **'technology-push'**. Those working in a business environment readily admit that **'market-pull'** should instead be the initiator for product development. Yet technology transfer and commercialisation offices around the world are 'pushing' their technologies out, hoping to find customers or venture capitalists to create a

[12] IP Research Institute of Australia (IPRIA), *R&D and Intellectual Property Scoreboard 2005*
[13] C. M. Lee et al, *The Silicon Valley Edge*, Stanford University Press, pg 204, 2000
[14] MIT Website [on-line], http://web.mit.edu/newsoffice/1997/jobs.html
[15] Based on total 2002 employment of 361 staff in the nation's technology transfer offices.

new business opportunity. Some will succeed with blockbusters; others will have discovered the better mousetrap that has customers knocking at their door; but the statistics prove that more generally, start up companies created through technology-push will fail.

Furthermore, the commercialisation process itself is typically only a secondary or tertiary goal of most research organisations. The principal mission of most universities and many other research institutions is not to create ideas with immediate business application, and even if it were, it is rarely to set the technology transfer process in motion on their own. Developing businesses and products out of research done for the sake of science, rather than commercial outcomes, is just plain hard! A national, independent, not-for-profit body such as the AIC can help highlight what needs to be done, and implement programs to catalyse the right sorts of activities to restore the equilibrium.

The AIC's activities are therefore focused on reducing the key barriers to commercialisation. Effective commercialisation requires:

- good management of intellectual property (IP);
- incentivised researchers and business people skilled in taking the IP to an investible proposition and willing to collaborate;
- an understanding of the marketplace; and of course,
- the liquidity of capital
- a conducive environment (tax, governance, skills etc)

To realise these, we believe one of the biggest innovation challenge Australia faces is to establish stronger collaboration between its research sector and business. Links need to be strong in both directions: 'IP push' from the research agencies on the supply side, and 'demand pull' from business. These activities and linkages need strong encouragement by the relevant boards of Directors, many of whom appear to focus more on achieving profits through cutting costs rather than via growth through innovation.

The policy response

Policy-makers are increasingly recognising the importance of high technology and innovative industries to the economic well-being of nations and regions and are adjusting policy accordingly. In this context there are two critical policy trends.

First is an increased emphasis on small firms and entrepreneurial activity. In many countries small businesses have played a prominent economic role over the past decade. Some countries are highly reliant on SMEs for their economic and social well-being. Public policy has placed a greater emphasis on small firms because of their perceived link to competitiveness in the knowledge economy. The growing emphasis on entrepreneurial activities and small business is a response to the critical role of innovation and knowledge creation in modern economies. The generation and use of new ideas has become increasingly important, as has the capacity to test those high-risk and uncertain ideas in a commercial setting.

Second, the view that knowledge has become the foundation of economic competitiveness has given rise to a re-conceptualisation of the role of research organisations as key knowledge institutions in

contemporary economies. The importance of research organisations to the knowledge economy is explained in terms of their contribution to economic development through intellectual property output, new products, R&D infrastructure, knowledge generation, new firm spin-offs and incubator facilities. The three-node model of government-university-industry relations has emphasised the blurring of the role of research organisations in contemporary economies, as they take on the functions of both government and industry in coordinating activities and engaging in commercial ventures.

There are already several policy initiatives within Backing Australia's Ability I and II to stimulate research commercialisation. In Australia, governments have emphasised the need to enhance university-industry engagement as a basis for innovation and economic competitiveness. Public policy initiatives in this area have sought to enhance the social and economic benefits of research investment by encouraging commercialisation, entrepreneurial activity and technology transfer of publicly funded research. A recent paper[16] by the Department of Industry, Tourism, and Resources has shown that firms that engage in collaboration, and have diverse collaborations, are up to 70% more likely to have new-to-the-world innovations than firms that do not. However, apart from the CRC program and early-stage ARC Linkage Grants, government initiatives have rarely involved both the research community and industry together. Such programs have tended to be exploited by larger businesses as a proxy for performing their own R&D, or by research organisations trying to bolster their R&D funding.

Translating policy into program

The AIC TechFast Program addresses these market gaps by using a market-pull approach to create and accelerate knowledge and technology transfer and adoption into SMEs from publicly funded research organisations. It turns the traditional model of commercialisation of publicly-funded research on its head. Rather than starting with the IP and pushing it to market, it starts with small existing technologically-receptive companies that already have existing sales channels, and a track record in product and business development. After identifying and analysing their needs, TechFast farms new IP for them from Australian universities and CRCs to extend or enhance their product line, thus accelerating their growth. With its industrial incubation of R&D, this program is helping to build linkages and skills, and to help remedy low industry involvement in R&D. It is unique in several respects.

First, business involvement in public R&D commercialisation is encouraged because the program focuses on market-pull technology transfer and R&D that is relevant to the business. Market-pull technology transfer is critical as it provides the opportunity for more rapid diffusion of innovations because there is an existing demand from technology ready partners for the new technology. The significance of TechFast is that by facilitating market-pull technology transfer, it is expected to have a more significant economic impact.

Second, business involvement in R&D is encouraged because the program focuses on engaging existing Australian SMEs as business partners. As noted above, SMEs make an important contribution to innovation in the knowledge economy, because of their small size,

[16] D. Brunker, Department of Industry, Tourism, and Resources, *Collaboration and Other Factors Influencing Innovation Novelty*, 2006

decentralised organisational structures and capacity to radically change strategic direction in response to changes in markets and technologies. SMEs involved in the program have leveraged the public investment in R&D into their own.

Third, the program has been successful because it enables third party facilitation of the technology transfer process. Imperfect knowledge on the part of potential exchange partners (universities and firms) necessitates the intervention of an intermediary as match-maker because those with intellectual property and innovative products in their research and development pipelines, and those in need of products to improve their market standing, remain unaware of each others existence. In the case of market-pull technology transfer, there is often a problem of information asymmetry, or imperfect knowledge between the technology supplier and the recipient. The intermediary is truly independent of any vested interests, and can also provide an additional project resource when needed to ensure knowledge transfer does not stall. The intermediary can also help each party understand and navigate the differing and non-aligned cultures within the parties.

The changes induced by the program are behavioural and endemic to the national innovation system. During the TechFast pilot program, we have already observed:

- Creation of new long-term collaborative interactions between SMEs and research organisations;
- Cultural change in research organisations, and in SMEs that for a variety of reasons had previously been unable to collaborate independently with them;
- Increased commercial relevance of research activities as a result of researcher exposure to real life business problems brought by TechFast;
- Broadening of commercialisation avenues for many research organisations;
- Previously unidentified new market applications for researchers' know-how and intellectual property;
- Assistance to smaller, regional research organisations, which currently perform at a lower level of productivity than the larger, well-funded organisations that are close to a critical mass of deal flow and expert competencies;
- Attraction of private sector investment to the SME innovation sector;
- Secondary benefits, including the establishment of new business to business links, identification of off-the-shelf solutions, and referrals to other assistance programs and organisations;
- Demonstration effect – the concept of market-pull is becoming widely accepted as an essential approach for commercialisation.

In its first year alone and for a tiny fraction of the cost of the research itself, the program has achieved 28 technology transfers on behalf of Australian SMEs, a significant increase in the volume of interactions between the entire Australian research sector and small companies. 47 Australian research organisations and 29 SMEs have been involved in the national pilot, half of them in regional locations. Business investment in R&D is increased because the firms involved are developing new products (at the 'D' end) from the research obtained (at the 'R' end). From such collaborations will new industries emerge.

Conclusion

Innovation is the wellspring of economic growth. Australia cannot continue to live on the fruits of its natural endowments. Increasingly in the twenty-first century, a nation's prosperity and competitiveness will be derived from its ability to create new products and services, adapting continually to remain ahead of its competitors.

Establishing Australia as a "first-tier innovator nation" requires a systematic upgrade to the national innovation and commercialisation environment. Such an environment is a result of a combination of factors such as well-trained people, an innovation-oriented corporate investment climate and greatly improved collaboration between research organisations and businesses.

Fortunately, Australia's research capability is often world class. Where it performs less well is in the process of converting its excellent research into social and economic capital, new businesses and new jobs. The AIC is working to improve the skills required to better commercialise intellectual property, along with developing programs and policy recommendations to change the culture to embrace outcome-based research, collaboration with business, and sensible calculated risk-taking behaviour.