# Tech transfer

## Can the lucky country become the clever country?

DAN GAFFNEY AND JIM HENDERSON

**Australia's decline as a globally competitive economy could signal that the 'lucky country' should be looking more closely at technology transfer to commercialise its home grown discoveries.**

Despite its reputation as a sophisticated modern economy, Australia's economic growth over the past two decades has been underwritten by export earnings from minerals, natural gas, agriculture and tourism. In crude terms, Australia is a quarry, a farm and popular holiday destination.

Although education has emerged as the nation's third biggest export earner behind coal and iron ore, we are still laggards in the commercialisation of new ideas and technologies that are powering growth in more competitive nations such as Denmark, Sweden, Switzerland, Germany and The Netherlands.

### Technology transfer: room for improvement

Australian public research agencies such as CSIRO, leading universities, cooperative research centres and medical research institutes are major sources of research-derived ideas and technologies. All our leading research agencies, including the Group of Eight universities, have in-house technology transfer offices that provide advisory and commercialisation services to their researchers and inventors, which help bridge the gap between basic and applied research discoveries and their uptake as commercialised new products and services. Without them, many promising discoveries would never make it to market because few businesses would be aware of new discoveries or their commercial potential.

The latest national survey of commercialisation (2005–07) released by the Department of Innovation, Industry, Science and Research reveals that the 77 public institutions surveyed reported income from licenses, options and assignments totalling $214m, contracts and consultancies with end-users worth over $1.2b and equity holdings valued at over $196m. The estimated level of sales resulting from licensed intellectual property (IP) more than doubled from $3.8b in 2005 to $8.3b in 2007. In 2007, the total cost to institutions of conducting research commercialisation activities, including staffing and legal costs, was $76m.

The critical role of technology transfer offices in taking research from 'bench to business' is underscored by the fact that relatively few Australian companies are prepared to put time, money and resources into commercialising inventions. This isn't to say that universities and other research agencies can't improve how they approach the business and venture capital sectors seeking investment and research co-development.

The Productivity Commission summarised some of the challenges of commercialising Australian research in its 2007 report on Public Sector Support for Science and Innovation. The Commission said there was an excessive set of arrangements across the university sector for transferring IP to companies, which increases the costs for those seeking to commercialise university research.

Some universities have poor governance structures and incentives for commercialising IP, such as insufficient sharing of the benefit among the relevant parties.

The Commission also noted that commercialisation of research demands more than requisite commercialisation skills: it requires a sufficiently large pool of potential investment partners. This is a significant challenge. Australia is a geographically isolated continent with a small population and a business sector that invests comparatively little in research and development or the

commercialisation of novel inventions.

If Australian universities and research centres confined their technology transfer ambitions to the Australian business sector, their success rate would be tiny: only 2% of local companies collaborate with universities – the lowest rate in the OECD. Further, business research and development linkages in Australia are weak, with only around 9% of innovating firms cooperating with an external partner for their innovation activities.

This is why the Prime Minister has emphasised the crucial role of government in helping to raise Australia's global competitiveness and productivity growth. The Commonwealth Government shapes Australia's national innovation efforts through the design and governance of its institutions, by supporting the education and training of scientists and engineers, and by funding high-value research that would not otherwise be undertaken by businesses.

It also influences the research agendas of universities and other public sector research agencies by funding what it views as national priorities. The Commonwealth Department of Innovation, Industry, Science and Research uses an array of policy levers and funding mechanisms to boost the commercialisation of Australian research. These include direct funding of research and innovation, the Research and Development Tax Concession, and programs to stimulate and support linkages between industry and research agencies.

## Research commercialisation at the coal face

NewSouth Innovations Pty Ltd (NSi) is the technology transfer office of the University of New South Wales. It has a focus on pure technology transfer – moving inventions from the research bench into the hands of commercial partners. The company is actively commercialising more than 100 inventions in areas such as diagnostic and therapeutic drugs and biomedical devices, solar cell technology, waste recycling, novel materials, information technology and nanotechnology.

NSi employs a structured process for identifying, assessing and protecting new IP. Then it weighs the commercial potential of new IP to decide if there is a viable business case to commence commercialisation.

**Road to recovery**

In his recent essay, 'Pain on the road to recovery,' Prime Minister Kevin Rudd acknowledged that this is an unsustainable growth strategy. In his view, Australia needs to prepare for a future 'beyond mining booms' by launching a new global competiveness strategy. The Prime Minister noted that productivity in the Australian economy has been flat over the past decade. The nation's annual labour productivity growth in the 1998–99 to 2003–04 productivity cycle fell to 2.2%. In the current cycle, labour productivity growth has slowed to an average annual rate of 1.1%.

In May this year it was revealed that Australia was ranked sixth on international competitiveness among 57 national economies, down from second in 2003 and third from 1999–2002. The ranking was published in the IMD World Competitiveness Yearbook 2009.

The Australian Institute for Commercialisation has said Australia's falling competitive ranking indicates that our economy needs greater efforts in innovation and commercialisation.

### Engagement

Researchers employed in publicly funded research agencies are obliged to notify their institution when they develop a new invention. This is done by notifying their institution's technology transfer office and filing a confidential Intellectual Property Notification (IPN) describing the novel and useful nature of their invention. This mechanism assists researchers to recognise when their discoveries may have commercial value and provides a means of identifying IP that can be protected and exploited.

At NSi, a team of business development managers are tasked with raising researchers' awareness about the process and benefits of completing an IPN. In addition to potential benefits such as research funding and income flowing to the researchers, increasing IPN submissions is a key goal for NSi, as they represent the pipeline of potentially commercialisable inventions.

### Assessment

This phase involves an assessment of the commercial potential of the invention. The analysis examines an exhaustive range of issues: whether the IP can be suitably protected and 'packaged' for commercial opportu-

**Turning used car tyres into steel**

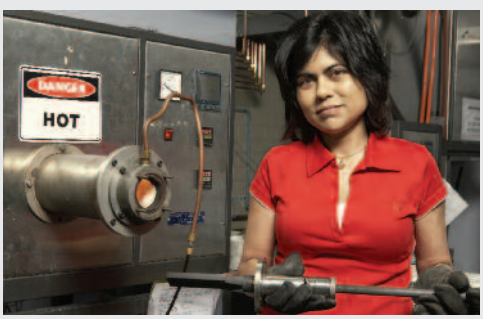
Hundreds of thousands of used car tyres could be recycled every year and turned into steel, thanks to a discovery that rubber can be partially substituted for coke in electric arc furnaces.

Invented by UNSW materials scientist Professor Veena Sahajwalla, the new technology not only removes used tyres from the waste stream but also cuts the energy demands, costs and gas emissions associated with steelmaking. Known as polymer injection technology, the process substitutes some of the coke used in steelmaking with other carbon-rich materials. Professor Sahajwalla had earlier shown that waste plastics could be diverted from landfill dumps and used in this way as well.

OneSteel, which has licensed the patented technology and has developed it in partnership with Professor Sahajwalla, has successfully trialled the process at both its Sydney and Melbourne-based electric arc furnace facilities.

At OneSteel's Sydney Steel Mill, which produces steel billets using mainly scrap steel, the trials showed the mill has potential to recycle more than 100 000 passenger car tyres a year. At its Laverton facility, near Melbourne, the mill has already been converted to the polymer injection process and has the potential to recycle more than 200 000 tyres a year.

At both mills, trials demonstrated that the process makes steelmaking cheaper, uses fewer natural resources and less electrical energy, and reduces emissions of nitrogen oxide, carbon monoxide and sulfur dioxide.




**Professor Sahajwalla heads the Centre for Sustainable Materials Research and Technology in the UNSW Science Faculty.**

nities; whether the invention really 'works' and can be scaled up to industry capacity; and market analysis, IP analyses and legal ownership due diligence.

The gap between scientific discovery and commercial proof of concept is often called the 'translational phase.' Notably, funding research to move a technology through this translational phase represents one of most significant challenges university technology transfer offices face worldwide and is a critical consideration in NSi's assessment process.

## Commercialisation

Commercialisation is a demanding process and regardless of their intellectual value, few innovations become major international successes. Data from the University of Queensland's commercialisation division Uniquest indicate that for every 3000 raw ideas generated, only 10% are disclosed to a commercialisation office. From these, about 125 or less are selected for commercialisation. Of these, nine progress to early-stage developments and only one becomes a successful business.

Commercialisation involves selecting an appropriate commercial pathway for an invention and sourcing financing to grow the business. The commercialisation pathway may include filing patent applications, identifying possible licensees and forming a limited liability company or some other vehicle to exploit the IP.

NSi markets its technologies actively and passively. Active marketing includes directly contacting companies working in the field, initiating media coverage and giving conference presentations. Significantly, technology transfer industry data suggest that about 60% of university technologies that are successfully commercialised go to companies that had a pre-existing relationship with the inventor.

If a company or investor expresses an interest in a technology, a technology transfer office will execute a confidentiality agreement that is signed to facilitate more detailed discussions. This allows the company to speak with the inventors, review background information and patent applications, and perform due diligence as appropriate.

Most evaluations don't lead to successful commercialisation. Many factors may contribute: the technology is too early stage, it doesn't fit within a company's focus, it doesn't solve a company's problem, or it isn't commercially viable. In some cases, a partner may be sufficiently interested in a

technology to financially support further proof-of-concept or product development work. These are opportunities that NSi readily encourages.

Universities and research agencies typically pursue a licensing model of technology commercialisation. This allows the research agency to maintain ownership and control of the IP, while transferring financial risk and product development requirements to the partner.

Licenses may be non-exclusive or exclusive in nature. A non-exclusive licensing strategy is pursued when the best commercialisation option available is to move the technology into the hands of as many commercial partners – or end users – as possible. An exclusive license is typically requested by commercial partners when product development requires significant time and financial investments. This is often the case with inventions in the medical diagnostics and therapeutics areas: it can take 10 years or more, and many millions of dollars, to take a technology to market. Companies are simply unwilling to take such risks without exclusivity and strong patent protection.

Under the right circumstances, NSi may also establish a spin-off to commercialise an opportunity. To facilitate this path UNSW is a member of the pre-seed investment fund Uniseed, which grants the fund a right of 'first-look' at new spin-off opportunities.

Uniseed is a $61m fund that typically makes small, milestone investments of $250 000–500 000 in the first investment round, with the capacity to follow on. Uniseed's preference is to partner with other investors at any given round, thereby increasing a company's potential funding. To date, Uniseed portfolio companies have raised in excess of $200m from other investors and grant funding, leveraging Uniseed's investment by over eight-fold.

In most instances, completion of any commercial agreement represents the beginning of a potentially very long relationship with a business partner. As an example, a patent's life extends to 20 years, and with follow-on patent filings a product can be on the market significantly longer. Therefore, it is critical that technology offices establish strong working relationships with investors. Anecdotal industry figures from the biotech/pharma industry suggest that of the industry–industry partnerships that fail, 60% do so because of poor relationship management.

## Thriving in tough times?

Australia's leading research agencies and universities are hothouses of research and innovation. Its scientific publications are well above average: 780 scientific articles per million head of population – over 2% of world publications – and 16th worldwide for publication impact.

The nation has a strong literacy and skills base, and human resources for science and technology represent 38% of the labour force. Until now, Australia has made the most of its luck: it has a strong tradition of invention and investment-led growth derived from its abundant natural assets and resources such as minerals, agriculture and a unique and beautiful geography and landscape.

But we face significant looming challenges. In the midst of the largest financial crisis since the Great Depression, the Commonwealth Government has seen tax receipts shrink by some $210b and has borrowed significantly to stimulate the economy, job creation and investment.

The global economy is rapidly shifting towards a carbon emissions trading scheme that will constrain the economies of carbon-exporting nations such as Australia. The nation has an ageing population and workforce, and will face funding and environmental challenges in areas such as healthcare, retirement income, infrastructure, water scarcity and energy security.

Australia's political leadership is intent on reform to deliver a new path of innovation-led productivity and growth, rather than risk being at the mercy of cyclical windfalls from mining booms and global factors beyond the nation's control. We have the brains, resources and institutions to transform ourselves into the clever country. So what are we waiting for?

**Dan Gaffney** <headlines.news@gmail.com> runs News and Headlines, a communications and public relations consultancy. He provides communications advice to NewSouth Innovations Pty Ltd, the technology transfer division of the University of NSW. **Jim Henderson** <J.Henderson@nsinnovations.com.au> is General Manager Commercialisation – Life Sciences for NewSouth Innovations Pty Ltd. The views expressed here are personal.