

Innovative Research Universities Australia

Submission to Productivity Commission Issues Paper: Public Support for Science and Innovation

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INNOVATIVE **R**ESearch **U**NIVERSITIES **AUSTRALIA**

Flinders University • Griffith University • La Trobe University
Macquarie University • Murdoch University • The University of Newcastle

Summary and recommendations

This submission relates to the role of universities in the production and transfer of scientific knowledge, as key players in the science research and innovation value chain, and more specifically to the position of the Innovative Research Universities Australia (IRU Australia) as a group of research-intensive universities that have adopted innovative approaches to research, research training, education, and community engagement since their establishment in the 1960s and early 1970s.¹

Views are provided about global trends in Research and Development (R&D) expenditure from the perspective of research-intensive universities. The submission assesses the implications of these trends for Australian science and innovation policy. Some comparisons are drawn with Canada with reasons provided as to why it might be seen as an appropriate country with which to compare scientific research and innovation policy and performance. Finally some observations from Australia and abroad are provided as possible leads for further research to be undertaken.

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Statistics from the Organisation for Economic Cooperation and Development (GERD, BERD, HERD and GOVERD) show a strong correlation between level of inputs, both public and private, into research and innovation and the economic and social benefits that follow. There is every indication that the global trend of increased public and private expenditure on research and innovation will continue – with many advanced economies revising GERD targets upwards to between two and three per cent of Gross Domestic Product by 2010. A higher proportion of research and development than ever before is being outsourced to universities to perform on behalf of governments and business reflecting the need for more knowledge intensive solutions. Achieving first-tier innovator nation status is a reasonable medium-term goal for Australia provided the enabling policies address the interface between universities, business, governments and communities in conjunction with international, national and regional research priorities. Policies need to be backed up by substantial funding which is required to align Australia with first-tier innovator nations such as Canada.

The IRU Australia recommends that total levels of public support for research and development in Australia should be increased to keep pace with global trends and that the attainment of first tier innovator nation status become a major policy objective.

The IRU Australia recommends that public funding for science and innovation take sufficient account of the diverse needs of Australian society and the trend for closer collaboration between universities, business, industry and community – without undermining the overall quality of university research, research education and the capability of universities to perform basic curiosity-driven research.

Australia is a large, thinly populated, regional, and resource rich nation with high concentrations of activity in mining, agriculture, the service sector and low to medium technology small and medium-sized enterprises. Although there are more high technology organisations than ever before, this basic industry mix will not change overnight. Science and innovation policy and funding in Australia must continue to recognise these unique national characteristics and the impact of this on the mix of scientific research undertaken in Australian universities.

The IRU Australia recommends that:

- ***Public support for science and innovation should fund excellence wherever it is found;***
- ***Governments continue to prioritise and plan research addressing national priorities and ensure universities are equipped to respond to the national agenda;***
- ***Universities retain the independence to plan research strategically and concentrate resources as they determine but with some alignment against national priorities; and***

¹ The six members of the IRU Australia are Flinders, Griffith, La Trobe, Macquarie, Murdoch and Newcastle universities. They were established from 1964-73, a time when the average enrolment at Australia's 10 universities was 5,360 students and the average department had fewer than 10 academic staff members. The scale and character of modern research called for a range of skills well beyond what the universities at that time could provide. Innovation was needed and the IRU Australia universities were established in each mainland state as the testing ground for a new interdisciplinary approach to education and research. Similar universities were also established in the UK and Canada around that time.

- **Private sector 'persuasion' be used as an integral tool in science and innovation policy with strong incentives for the sector to outsource more R&D and for high net worth individuals to provide more philanthropic support to universities.**

Innovation often results from the transfer of public good research pursued on a long-term basis by universities, often with little initial economic or commercial motive. Most of this research could not possibly have occurred had it not been for the existence of public funding. When such research is 'market ready' it is increasingly delivered to end-users on a commercial basis, but more often than not such knowledge is transferred through a process of engagement with communities (local, national and international), business and governments (both within Australia and overseas). Several IRU Australia case studies included in this submission illustrate the very long-term approach taken by our institutions and researchers – from the development of research parks, to building research capacity over many years to solve major research problems.

The IRU Australia strongly recommends that a major component of public support for science and innovation in Australia recognise the long-term nature of basic research by allowing certainty and stability in the allocation of research block grants to research-active universities.

Global trends in R&D expenditure

The economic success of knowledge-based nations is increasingly dependent on the ability of world-class higher education institutions to produce new scientific knowledge that can be efficiently channelled through a well-functioning innovation system to meet the needs of commerce, industry, governments and the broader society. Evidence of this trend in Australia is seen in statistics for higher education expenditure on R&D (HERD), which rose from 0.29% of GDP in 1978-79 to 0.48% of GDP in 2003-04 (DEST, 2005, p.23 and ABS, 2006). The most recent increases in expenditure on R&D in universities were supported by the Backing Australia's Ability program which has committed an additional \$3.0 billion over five years (2001-06) and a further \$5.3 billion through to 2010-11. Even so, a continued increase in HERD as a percentage of GDP is by no means guaranteed in a strongly growing economy – reflecting a global reality where merely maintaining funding at levels of the past is insufficient if targets expressed as a percentage of GDP are to be met.

Australia's overall Gross Domestic Expenditure on R&D (GERD) ratio is however low compared with other OECD countries, which "reflects the low R&D expenditure to GDP ratio of the business sector, despite the Government and higher education sectors having comparatively high ratios" (ABS, 2004). As many commentators point out, a disproportionate amount of economic activity in Australia is driven by small business. This results in Australian innovation being weighted to smaller firms (Barlow, 2006, p.28), which do not have the capacity to undertake traditional forms of R&D, which are recognised by the OECD's *Frascati Manual*.² In spite of this, it must be acknowledged that business expenditure on R&D (BERD) in Australia has risen more dramatically than any other sector since the early 1980s as shown below in Table 1. Publicly funded programs designed to stimulate BERD in association with universities, such as Cooperative Research Centres and ARC Linkage can take some of the credit for this.

Table 1: Expenditure on R&D in Australia as a percentage of GDP

	1978-79 % GDP	1981-82 % GDP	2002-03 % GDP	2003-04 % GDP
BERD	na	0.24	0.87	0.89
GOVERD	0.41	na	0.33	na
HERD	0.29	na	0.45	0.48
GERD (a)	0.93	na	1.69	na

na: not available

(a) Also includes expenditure by the private non-profit sector

Australia lags most OECD countries in all sub-categories of GERD; however, the structure of a national innovation system is highly individual to each nation and the supporting levels of GERD vary

² The *Frascati Manual* excludes activities such as market research, testing of products or processes, commercial production of a new or improved material and other less technical business improvements along with the bulk of minerals exploration.

enormously as a result. Between developed industrialised nations in the OECD, GERD ranges from Italy (1.11% in 2002) to Sweden at 4.27% (2002) (DEST, 2004). It could therefore be argued there is no universal benchmark for success and that direct comparisons at any point in time are probably counter productive. Overall trend data is therefore more important as a tool for evaluation and to guide principles for future design of publicly funded research programs.

The overall trend that one can observe across the OECD during the last 20 years is:

- **BERD** has increased sharply as a result of global competition, privatisation of government-held corporations, improved protection of intellectual property, better enforcement of national competition policy, tax incentives, and other factors that affect the capacity of firms to innovate.
- **HERD** has increased significantly, though generally not as much as BERD, due to the availability of additional research funding, the willingness of universities to undertake more applied and experimental research, the creation of programs such as CRC and ARC linkage enabling them to do so, and a trend for both governments and industry to outsource elements of their R&D to universities.
- **GOVERD** has generally dropped off worldwide reflecting privatisation of government-held corporations and greater reliance on higher education to perform research of national significance.³
- **GERD** continues to increase reflecting the transfer in the developed world from manufacturing and commodities-based industries to high value-added service and knowledge-based industries.

Achieving First-Tier Innovator Nation status

A report, produced by Allen Consulting Group in 2004 on behalf of the Business Council of Australia and the Australian Vice-Chancellors' Committee, noted the recent improvement in Australia's international position as an innovative economy. "Over the two decades Australia has been transformed from a classical 'imitator' to a 'second-tier' innovation economy" (Allen Consulting Group, p.14).

For Australia to climb to the 'first tier' it must possess a well-developed set of commercialisation intermediaries, appropriate people skills for growing technology-based businesses, and policies enabling the use of IP generated within universities. Particular attention needs to be paid to the pre-seed stage where proof of concept is not well established presenting a high-risk environment for prospective investors. With the necessary enabling conditions in place, the report points out a number of things we could expect to see including:

- Stronger growth in the number of small emerging technology-based businesses;
- An increasing number of these would be breaking through to become 'emerging globals' (e.g. Proteome Systems, Cochlear, ResMed);
- The performance of existing Australian companies will improve through the adoption of new products and processes developed in Australian universities;
- Recognition of Australia as providing the conditions of a 'first tier' innovator nation will act as a magnet for Australia to attract research-based operations of multi-national companies; and
- A virtuous cycle will be established which will lead to greater investment into knowledge generation creating better value jobs and economic conditions.

³ This can also include the co-location of government and university research as illustrated by the Western Australian State Agricultural Biotechnology Centre (SABC) which combines university, state government and industry researchers in one cost-effective centre at Murdoch University in Perth, with approximately 225 researchers and an annual research spend of almost \$10 million. Another recent example is the new \$20 million Victorian AgriBiosciences Centre (VABC), a consortium based at La Trobe University in Melbourne which comprises the Victorian Department of Primary Industries, La Trobe University, the Molecular Plant Breeding CRC, Florigene Ltd (a division of Suntory), Monash and RMIT Universities.

Broad implications for science and innovation policy

The above mentioned global trends are expected to continue, both internationally and domestically due to increases in knowledge-based economic activity, the massive transfer of manufacturing and IT outsourcing to developing economies such as China and India and the associated need for the developed world to create solutions to economic, social and environmental problems generated through higher consumption both in the developed and developing economies. The domestic implications of this are significant for firms, universities, and governments.

Australia however has some special characteristics to contend with, such as a higher proportion of Small and Medium-sized Enterprises (SMEs) than in other OECD countries and, due to geographical spread, a greater focus on regional issues and initiatives. The under-utilisation of university research and engagement services by SMEs and communities in Australia represents an imbalance in government policy and funding that should be addressed. The influential Lambert Review in the UK suggested a number of feasible ways in which links between universities and non-collaborating SMEs should be strengthened (Lambert, 2003, pp.26-30).

Despite all impediments there is evidence of recent growth in demand for university knowledge transfer from industry and other commercial users. This can be seen in the National Survey of Research Commercialisation, which reveals that staff (FTE) employed in university commercialisation companies grew from 57.5 in 2000 to 91 in 2001, and then to 104 in 2002. A recent Australian Vice-Chancellors' Committee (AVCC) paper on engagement points out that research income from non-government sources has increased from \$330 million in 2000 to \$452 million in 2003, an increase of 37 per cent – further evidence of demand-side growth.

The IRU Australia therefore supports policies and programs that:

- Facilitate greater knowledge-based R&D activity within small and medium-sized enterprises⁴;
- Encourage the co-location alongside universities of knowledge intensive businesses (especially SMEs) most in need of university knowledge services;
- Encourage further outsourcing to universities by the private sector (especially SMEs) of larger-scale research – sometimes on behalf of industry clusters and cooperatives which are not in a position to undertake such research and development; and
- Provide more incentive for the private sector to become involved in university research, teaching programs, and research training – allowing a two-way knowledge exchange.

Excellent programs designed to achieve such objectives currently exist including the CRC program, Australian Research Council (ARC) linkage, and R&D tax concessions. The **ARC Linkage program** is under increasing stress to maintain grant success rate and this should be boosted to enable more large scale university-industry collaborations such as the recent \$22 million Australian Mineral Science Research Institute – the largest ARC Linkage grant ever awarded. **International science linkages** are also crucial in today's competitive research environment and this is one area where Backing Australia's Ability could provide more funding to promote strong, long-term international research collaborations. Australian universities currently provide education to approximately 143,000 international students⁵ bringing in more that \$6.0 billion into the economy per year and more could be done to build **international knowledge transfer partnerships** through the international alumni of Australian universities who are destined to become future leaders in their home countries. Other areas requiring policy attention are those concerned with the **outsourcing of R&D from government and business to universities** and creation of a **strong culture of philanthropy in Australian society**. The nature of such programs should be the subject of future discussions and the IRU Australia would not wish to be prescriptive about their design at this stage.

Canada – a long-term and coherent R&D strategy

The Productivity Commission issues paper poses the question about which other countries are relevant for comparative analysis of Australian science and innovation policy. Due to Australia's unique mix of economic, demographic, geographic, historic, and other factors it is almost impossible to identify a reliable comparator nation to benchmark research and development performance against.

⁴ Approximately 41% of BERD in Australia is carried out in firms with <250 employees.

⁵ Australian Education International statistics (April 2006)

Although several economies might warrant comparison, on balance, the most valid comparisons might be made with Canada – as a large, thinly populated, resource-rich nation, with a similar proportion of SMEs⁶, but with a slightly longer history of European settlement than Australia.

A 3,000 km border with the world's largest economy and the advantages that this proximity brings detracts somewhat from the validity of any observations. However, it could be argued that Australia has much superior access to the fast developing economies of East, Southeast, and South Asia. Also, despite an equivalent number of SMEs, a very high proportion of Canada's BERD is undertaken in the high technology sector (72.4% in 2003) against only 27.4% in Australia (DEST, 2005, p.29). One other ready example of the difference between the two countries is the endowment wealth enjoyed by the leading universities in Canada, which far out shadows most Australian universities (refer Table 2).

Table 2: Endowment wealth of Top 10 Canadian universities as at 2005

University	\$m (CAD)
Toronto	\$1,400.0
McGill	\$760.0
UBC	\$663.8
Alberta	\$541.4
Queen's	\$516.8
McMaster	\$365.0
Western	\$175.3
Laval	\$105.3
Montreal	\$89.5
Waterloo	\$79.8

Source: Group of Ten (Canadian universities), Wikipedia

The established culture of philanthropy in Canada combined with its world-leading technology intensity, and excellent mechanisms for university-industry knowledge exchange might explain why Canada's GERD was 1.96% in 2002 against Australia's 1.69%. It is especially worth noting that for HERD, Australia at 0.45% is well placed above the OECD average of 0.41% (which is distorted by the United States where more large-scale R&D is performed by industry) but well below Canada where HERD as a percentage of GDP was 0.65% in 2002. This indicates that private sector outsourcing of R&D or philanthropic support for university research is more prevalent in Canada than in Australia and suggests there might be public-private partnership models worth examining.

The Association of Universities and Colleges of Canada in its 2005 report *Momentum: The 2005 report on university research and knowledge transfer*, points out several programs established since 1997 that have contributed to spectacular growth in university R&D which is contributing to economic growth and social well-being in Canada. These are:

- Creation of the Canada Foundation for Innovation (1997);
- Canada Research Chairs Program (2000) which saw the creation of 2,000 research chairs supported for seven years at \$200,000 per annum;
- Partial reimbursement of indirect research costs (2001);
- Four consecutive annual increases in base funding for research (1997-2001); and
- Significant funding for world-class infrastructure.

Although Australia funds similar programs through Backing Australia's Ability, such as NCRIS and the Federation Fellowships, more analysis of the Canadian programs and how they function, and results to date, might provide future leads for Australian science and innovation policy. The Canada Foundation for Innovation serves as a salient example of a 'one-stop' approach to national innovation policy and programs while the Canada Research Chairs Program illustrates the massive scale of investment by the Canadian government for science and innovation.

⁶ The proportion of BERD undertaken in Canada by firms with <250 employees is 33%. The OECD range for this measure is from Germany (8%) to New Zealand (72%).

Other lessons from Australia and abroad

Given that direct country comparisons are notoriously difficult, we might best observe other lessons from the world's knowledge-based nations for pointers. Several observations are presented below supporting an IRU Australia case for:

- Research funding to be more widely dispersed amongst research-led universities;
- Avoidance of concentration of research funding to large groups;
- Governments to prioritise and plan research yet outsource more of this to universities;
- Ability for universities to retain the ability to plan research strategically and concentrate resources as they wish but with some alignment against national priorities; and
- Private sector persuasion as an integral tool in science and innovation policy with incentives for the sector to outsource more R&D and for high net worth individuals to provide more philanthropic support to universities.

The trends, observations, and lessons gained from recent experiences here and abroad that support such positions are:

1. **Establishing even one truly world-class university in Australia is simply not feasible** according to an analysis carried out by Griffith University⁷ in 2002. Harvard University alone employs 149 high citation scholars⁸ against 99 for the whole of Australia. It is worth noting that 14 Australian universities are listed on the Shanghai Jiao-Tong University (SJTU) Top 500 list of research universities (equivalent to the top 5 per cent of world universities) with another just ranked outside of the Top 500.⁹ This suggests that investment in a world-class system of higher education is a more sensible approach for Australia. A strategy of distributing university research funding more evenly across all research-intensive universities and research groupings is sounder option for Australia than concentrating resources on creating a single world-class institution. This is also an essential strategy for a nation such as Australia due to its regional nature and corresponding reliance on regional knowledge transfer.
2. **Diversity is of critical importance.** Universities must be able to plan research strategically, and to be backed up by a system that allows them to concentrate funding appropriately into areas of excellence. Diversity is a dominant theme in higher education at present, both in Australia and overseas, as governments appreciate the changing role of universities in society and their need to pursue distinctive missions. In recognition of this trend, the IRU Australia maintains that future science and innovation policy should enable each institution to choose its path to achieve maximum research potential for the benefit of the nation. Policies and programs that meet national priorities while enabling institutional diversity can be achieved in the Group's view and evidence indicates that institutions left to self-manage their own brand of research excellence will on the whole produce outcomes that are in the national interest provided the right incentives exist.

Scholarly individuals, usually within research groups, centres, institute, schools, and departments, perform research. Universities as such do not perform research, which is the major reason why IRU Australia has consistently supported the need for a research quality assessment exercise that identifies the best performing research groups and caters for a diverse range of sizes of such groups. The influential League of European Research Universities (LERU) supports the approach advocated by IRU Australia for a system that promotes vitality and innovation in the research and innovation system. In a 2002 paper on research areas and the role of research-intensive universities, LERU (2002) stated:

“A rigid institutionalised system of selectivity runs a severe danger of fossilising the system at a particular point in time. It is essential for research universities to be dynamic and to enable new centres of expertise to develop, possibly at the expense of more established ones that have lost their edge.”

⁷ The Griffith Model for Reform of Australian Higher Education, September 2002.

⁸ Thomson Scientific High-cited Scholars are the 250 pre-eminent scholars in each of 21 fields.

⁹ By comparison there are 23 Canadian universities represented in the SJTU Top 500 and four in the Top 100.

3. **Research performance of an institution does not necessarily relate to age or size.** The Science and Technology Policy Research (SPRU) unit at the University of Sussex (Von Tunzelmann, 2003), suggests that small, medium, and large institutions all play an important role in maintaining a vigorous research environment, not the least in providing a competitive environment for “potentially complacent larger units”. The SPRU research also points to empirical evidence supporting the notion of a critical mass of researchers at the group or team level – which varies in size according to discipline, but above which there is usually no extra gain per capita. The SPRU study shows that even successful large departments are usually composed of teams each of about the optimal size for the discipline concerned.

The Adams Report (2000), cited in the SPRU paper, strongly suggests that superior research performance on the part of larger institutions is often more closely associated with level of inputs than it is with performance. The policy implications of this are significant. The SPRU report advises:

“The evidence base for a government policy that will result in increasing the already high degree of concentration of research resources on large departments and large universities appears to be lacking.”

4. **The best functioning innovation systems facilitate knowledge exchange between academia and industry** – not a one-way knowledge transfer. Professor Craig Mudge, Director of the Macquarie University Institute for Innovation (Mudge, 2006, p.34) points out that there are benefits for both parties:

“For example, academics can inform business people about step function changes in a particular technology (for example, LEDS to replace incandescent lights). Meanwhile, the researchers begin to grasp the challenges involved with entrepreneurial marketing such as matching the right customer with the right product at the right time.”

5. **Location counts.** Close proximity to universities is a major factor influencing choice of research collaborators by small, medium, and even large businesses. This case is well supported by evidence from the UK’s Lambert review of business university collaboration (Lambert, 2003) that cited a community innovation survey that asked firms which universities they collaborated with. Results were analysed by type of the firm’s main market and location of their collaborating universities. The survey found that firms with local markets overwhelmingly collaborated with local universities, but even 37% of firms with national markets and 26% of firms with international markets collaborated with local universities.

Table 3: Location of UK firms’ collaborating universities, by type of firm’s largest market

Type of firm’s largest market	Location of collaborating university		
	Local	National	Overseas
Local	88%	12%	0%
Regional	47%	53%	0%
National	37%	47%	16%
International	26%	48%	26%
All	36%	46%	18%

This table is referred to again in the UK House of Commons, Science and Technology Committee Report *Strategic Science Provision in English Universities* (2005, p.73) to underline the importance of geography as a major consideration of firms in choosing where to locate. Close proximity to a ready supply of skills and knowledge transfer, often provided through a local university, is a particularly important consideration for small and medium-sized enterprises. Given the make-up of Australian industry and the importance of regional development, one could argue that such conclusions have even greater validity for Australia.

6. **Strong public funding of scientific research is closely connected to a university's ability to provide first-class science education.** Attention is drawn to the UK House of Commons, Science and Technology Committee Report, *Strategic Science Provision in English Universities*, Eighth Report of the Session 2004-05, 11 April 2005, for an account of the long-term impacts of the British RAE on the quality of provision of teaching and learning in science, technology, engineering, and mathematics (STEM) in English universities and also the negative impact upon research in the regions caused by the pursuit of an implicit policy of research concentration. The IRU Australia strongly cautions against Australia adopting a Research Quality Framework (RQF) that results in the same unintended consequences of the British RAE on the viability of national ranked science departments (grade 3 or 4). Following a House of Commons inquiry the UK has moved from a non-linear funding formula (which saw a 5* earn more than three times that of a 4) to a fairer, more linear system of funding profiles.

Case studies

Innovation is often the result of public good research that has been pursued on a long-term basis, sometimes with little initial economic or commercial motive. Much of this research would not have occurred had it not been for the existence of public funding. When such research is 'market ready' it is delivered to end-users on either a commercial basis or through a process of community engagement in cases where end-users lack the capacity to pay.

Public support for science and innovation is therefore critical to ensuring that Australian R&D does not take on a short-term and purely commercial focus. Several case studies are provided (refer attachment) which illustrate the need for long-term investment into public support for science and innovation.

1. International-scale economic, environmental and social returns on publicly funded research where users lack the ability to pay – International Centre for the Management of Pest Fruit Flies, Griffith University.
2. The evolution of a body of research over decades reaping unexpected success in areas in which the research was not originally intended – Jameson Cell, The University of Newcastle.
3. The importance of 'private sector persuasion' as a long-term strategy underpinning public support for science and innovation – Macquarie Research Park.
4. The difficulties faced by SMEs performing costly R&D – La Trobe University Alfa Laval Olive Cluster.

Conclusion

The evidence provided in this submission demonstrates that there is global trend for increased public and private support for science and innovation – both in terms of direct R&D funding as well as mechanisms to support the ever-increasing knowledge transfer from universities and other knowledge creators to business and industry required for Australia to achieve 'first tier' innovator nation status.

There is no universal formula for success and what works for one nation is almost certainly inappropriate when applied to a different set of economic and social conditions. In spite of these complexities there are preconditions that one should expect of a nation aspiring to achieve 'first tier' innovator nation status. There are lessons to be learned from comparator nations such as Canada pointing to the need for a nation such as Australia to pursue a path of diversity and avoid the temptation to concentrate resources on the potentially complacent larger institutions and research groupings.

This submission contends that the role of governments is to plan and prioritise research that is in the national interest and to increasingly seek ways to outsource this to universities. Private sector persuasion is also a vital ingredient in this interplay. The case studies provided show the importance of taking a long-term view with respect to public support for science and innovation while providing the market conditions for engagement by the private sector at an appropriate time.

The IRU Australia thanks the Productivity Commission for the opportunity to provide input to this significant study and is prepared to participate in future consultations as required.

Case Study 1 – International Centre for the Management of Pest Fruit Flies



In Southeast Asia, fruit flies are a major horticultural pest, accounting for crop losses of 40 to 100 per cent. As well as contributing to severe shortages of nutritious food, fruit flies are directly responsible for quarantine barriers that restrict or prevent international trade and hamper economic growth in the communities that need it most.

Professor Dick Drew and his research team at the International Centre for the Management of Pest Fruit Flies (ICMPFF), Griffith University, developed a protein bait manufactured inexpensively from brewery yeast waste. The ICMPFF has built a commercial production plant at Fosters Brewery in southern Vietnam, where beer waste is treated with heat and enzymes to convert it into a protein that is highly attractive to flies. The diluted protein, with miniscule amounts of insecticide added, is applied to fruit trees as a small spot that attracts the flies which feed on it and are rendered sterile for a period of several weeks. The bait eliminates the need for crops to be drenched with chemicals and offers major environmental benefits by reducing pesticide residues in food crops and the environment and preventing brewery waste being disposed of in the environment.

In what represents the first time an Australian organisation has worked with all 10 members of the Association of Southeast Asian Nations (ASEAN), the ICMPFF has established an international fruit fly centre in Kuala Lumpur, Malaysia, to host technical and scientific research projects. The regional centre will help increase food production by promoting field control strategies that prevent fruit fly attack, leading to improved financial stability for communities and alleviating poverty in rural areas. It also facilitates the export trade in fresh fruit and vegetables between Australia and south east Asia by working with national quarantine services to prevent new outbreaks of fruit flies and develop early warning systems.

A network of fruit fly experts is being established across south east Asia, with ICMPFF workshops in Malaysia and Thailand training government agricultural officers and plant quarantine personnel. The network will communicate where fruit flies are active, pool information on effective controls, and help determine where quarantine bans may or may not be effective.

For further information:

http://www.griffith.edu.au/research/stories/science_and_technology/

<http://www.griffith.edu.au/centre/icmpff/>

Case Study 2 – Jameson Cell

The Jameson Cell, named after its inventor, Professor Graeme Jameson from the University of Newcastle, was developed jointly with Xstrata Queensland Limited in 1985 initially for the mining industry for the recovery of valuable minerals such as copper, lead, zinc, nickel and gold in mineral processing plants. There are now over 250 cells in operation around the world, in twenty countries across 30 different applications. The coal industry is using the technology to recover fine coal from waste streams, which gives a clean coal product that is highly valued in the export market. This equates to a boost of approximately \$1.5 billion to Australia's exports each year.

While the process was developed initially for the mining industry, the technology has since been adapted by the Environmental Group Limited (EGL) for wastewater treatment in which the water becomes the valuable resource to be recovered for recycle and re-use. EGL has the worldwide rights for wastewater treatment using Jameson Cell technology and has established itself as a preferred technology for a variety of wastewater treatment applications within Australia. The unique characteristics of the Jameson Cell have shown particular advantages for tertiary treatment of sewage with 3 major installations currently operating.

The same unique characteristics, compact size, high throughput, rapid start-up and low chemical usage have been shown on a pilot scale to be able to produce a plant with significant commercial and technical advantages over existing technologies for a range of new applications. The range of new applications includes combined sewer/stormwater overflow (CSO), water re-use, sewer mining, sewage plant bypass treatment and high-rate primary sewage clarification.

This will create major markets for companies such as EGL that can treat stormwater, wastewater and sewage to standards that enable water to be reused or recycled for a variety of applications. Water re-use is expected to grow to be a A\$1 billion+ market in Australia within 5 years. World Bank estimates put the world market for CSO at over US\$1 trillion by 2015.



For further information:

http://www.environmental.com.au/p_water.flot.html

<http://www.newcastle.edu.au/school/engineering/chemicalengineering/engineerreceivesuniversityshighesthonour.html>

http://www.environmental.com.au/asx_announcements/040129%20Jaminson%20Cell.doc.pdf

Case Study 3 – Macquarie Research Park

Macquarie University, located in Sydney's North Ryde, is a key part of Australia's biggest high tech precinct – the knowledge-based growth corridor extending from the University in North Ryde, down to North Sydney. Macquarie University was set up with the express statutory charter of serving industry, commerce and other sections of the community and part of the rationale for establishing it on a large greenfields site in the northern suburbs of Sydney 40 years ago was to attract R & D-based high technology industry and government R & D bodies to this vicinity.



In 1989 the Macquarie University Research Park was conceived. Financial gain was not the primary motive, nor was the Park intended to be purely for research. It was designed to support any endeavour that is consistent with the University's mission – teaching, work for students, sharing of facilities. The University selected Baulderstone Hornibrook, a leading international development and construction company, to enter into a joint venture to develop the Park. Baulderstone Hornibrook accepted the financial risk and has invested substantial funds in planning, marketing and park infrastructure in return for the right to construct every building.



Planning took some years and in 1998 the first buildings were occupied. Five buildings have been completed, totalling over 45,000 square metres, with an investment by the private sector of more than \$130 million. The 13 tenants range from large companies such as Siemens, EMC Corporation, Cisco Systems, Goodman Fielder, Nortel Networks, BD (formerly Becton Dickinson) and Dow Corning, to smaller tenants such as Covance, OPSM and Eppendorf.

The Park's objective is to attract a mix of companies from a range of industries who enjoy the benefits offered by the University and the Park and through their relationship with other Park companies. Participating companies will also benefit from the University's extensive teaching, research and social facilities. Examples of collaboration between the University and its tenants include:

- All of the larger companies have contracted with MGSM to deliver management development programs and many staff have enrolled in MGSM postgraduate courses.
- The University has collaborated with one Tenant Company in a major government-funded Generic Technology Grant, which has provided opportunities for graduate students to work with that company.
- Several senior staff of tenant companies are serving on University company boards and advisory boards.
- Tenants have lent the University valuable scientific equipment.
- Several tenants have offered scholarships to postgraduate students.
- The University research company provides information technology services to two of the smaller tenant companies.
- The University is exploring with an international tenant the possibility of overseas students in business and marketing spending time with that company in the Park and, after graduation, returning to their home countries to work for them.

In January this year, the University was formally declared a Site of State Significance. The University believes that over the next few decades, that being recognised as a State Significant Site will support it in its goal of pursuing successful academic and research initiatives alongside commercial success as a key stakeholder in the Macquarie Corridor.

For further information:

<http://www.pr.mq.edu.au/events/archive.asp?ItemID=2265>

<http://www.murp.mq.edu.au/>

Case Study 4 – La Trobe University Alfa Laval Olive Cluster

Through its independent relationships with three separate companies and groups, La Trobe University has made a significant contribution to the development of a local olive oil processing cluster that has established an R&D fund to seed further business-university collaborative research.

The three major groups partnering with La Trobe University are:

- **Alfa Laval** – one of the world's largest suppliers of separation equipment for milk, vegetable oils, starch, wine, beer, chemicals, vaccines, latex, mineral oils, industrial fluids, and waste water.
- **OlivOz** – OlivOz Limited was formed to service the processing requirements for the members of the CVOGA (Central Victorian Olive Growers Association), numbering approximately 160 local olive growers, and to locally produce high quality extra virgin olive oil under the common brand name of Latitude 37.
- **Corporazione Dei Mastri Oleari**, International School of Oil Masters (ISOM), which is collaborating with La Trobe University in education and research.

The partnership won a Business Higher Education Round Table award in 2005 for the best collaboration with a regional focus.

Australia imports \$148 million of olive oil per year, \$34 million of which is extra virgin olive oil (Australian Olive Association, 2004). Olives are currently grown in central Victoria and exported from the region for value adding in Melbourne and Wagga Wagga, New South Wales. While OlivOz Limited saw the potential to enhance and grow the local industry through the development of a processing capability, it was concerned about exposing itself to initial financial risk, particularly given the small business profile in the local olive industry.

Through its ongoing relationship with Alfa Laval, La Trobe University was offered, for R&D purposes, an olive oil processing plant valued at \$180,000. In keeping with its commitment to support the economic development of the region, the University looked for opportunities to place the machine in Bendigo to optimise its potential value to the local industry and to foster mutually beneficial partnerships.

Partnership negotiations culminated in the formation of a partnership between OlivOz and Alfa Laval. At no capital cost to the growers, Alfa Laval has now provided an olive processing machine on a one-year lease to OlivOz (with the option of renewal/upgrades). The partnership has provided OlivOz a low-risk entry into the oil processing business, with key partners available to share expertise and R&D capacity. It provides growers with access to a state of the art olive oil processing machine located on site for their use and the development of a competitive olive oil industry in the region.



This collaboration has resulted in both synergies and operational relationships between stakeholders at all levels. These include Government agencies, education providers, research bodies and industry players. Proceeds from the lease agreement are contributed to research, development and training programmes.

In addition, the partnership is anticipated to provide teaching and student placement opportunities in: marketing; cooperative business models; supply chain; food technology; and, agribusiness management. The University's connections through Mastri Oleari have also provided access to

international experts in the olive industry and links to international oil buyers. They also provide university academic staff with links to international universities for research and development purposes. Linkages have been brokered between growers, leading international experts and practitioners.



Since the negotiation and implementation stages of this project, participants in the group have recognised the potential for opportunities not only in processing but also the marketing of product, export potential and linkages of value between different industry players. Through working together, all partners are able to access a wider range of expertise than would otherwise have been available to them. The project to establish the partnership was undertaken without any direct Government funding, and, like most community engagement projects, this could not have progressed without significant input and commitment of resources from a publicly funded university.

For further information:

<http://www.olivoz.com.au/news.asp>

http://www.latrobe.edu.au/bulletin/assets/downloads/2005/bulletin_jul05.pdf

http://www.latrobe.edu.au/bulletin/assets/downloads/2006/bulletin_janfeb06.pdf

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