



**Australian Vice-Chancellors' Committee**  
*the council of Australia's university presidents*



# Building Effective Systems for the Commercialisation of University Research

August 2004





**Australian Vice-Chancellors' Committee**  
*the council of Australia's university presidents*



A report by The Allen Consulting Group

for the

Business Council of Australia & Australian Vice-Chancellors' Committee

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## Foreword

The Business Council of Australia and the Australian Vice-Chancellors' Committee jointly commissioned the Allen Consulting Group to undertake a research project to provide business and universities with a better understanding of the intellectual property policies and commercialisation management systems that would best facilitate the expansion of research commercialisation in Australian universities.

The higher education sector has a major role in creating both the leaders of the future and the research that underpins innovation and creative solutions. Business takes a lead role in developing these leaders and in the application of research in support of economic growth.

Australian universities are involved in a range of research activities bringing social and economic benefits to the country. This report considers an aspect of this research and development activity, namely the commercialisation of university owned intellectual property. This can be an important contributor to economic growth, and the high concentration of research effort in Australia's universities means that it is vital for higher education institutions, the private sector, and governments to ensure that the commercialisation framework is effective and appropriate.

Both the higher education sector and the business community are keen to identify ways to expand research commercialisation success. This report highlights three key areas for improvement:

- enhancing research commercialisation capabilities in universities;
- building effective partnerships between universities, business and financiers; and
- addressing areas of market failure requiring Government action.

This project has also been undertaken recognising that business research investment decisions are increasingly being made within a global context. This means that Australian universities will also look at business partnerships beyond our shores.

We commend this report to you. It provides a range of information and analysis that highlights the research success of Australian universities, and sets realistic expectations of revenue generation for universities through research commercialisation. The report includes examples of successful commercialisation ventures and a description of the factors supporting their development. Most importantly, this report explains the necessary preconditions for research commercialisation excellence and the factors that must be in place to sustain it and the benefits to Australia.

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## Executive summary

### ES1 Background

Innovation is a key contributor to productivity, economic growth and higher living standards. Nations and businesses that can achieve high levels of performance in innovation will be well placed to be leaders in the future.

Innovation is not just about invention, it also encompasses the process by which ideas are taken to markets. Fundamentally, innovation encompasses new products, processes and systems by which value can be created for customers, businesses and society more broadly.

In the knowledge economy which is now emerging, the universities, as major centres of learning and research, are becoming increasingly important as the sources of ideas that can be turned into new products, processes and systems. This is particularly so in the enabling technologies such as information and communications technologies, biotechnology and nanotechnology.

Reflecting this development, governments throughout the OECD countries are investing heavily in strengthening the research capacity of their universities. They are not doing this for its own sake, but in the expectation that this investment will show a return to the economy and the society through improved innovation performance and hence stronger economic growth.

While the universities are increasingly important as sources of ideas, those ideas will only show an economic return if they can be effectively applied by business. This means that an important element of an effectively operating national innovation system will be the quality of the linkages between the universities, business and finance providers.

It is recognised that the universities contribute to economic, social and environmental objectives in a variety of ways. The main benefit channel is associated with the education of people. But universities also generate benefits associated with the creation of ideas. Some of these ideas will flow freely into the community through publications and other processes, while others will be transacted to businesses who purchase ideas from universities through contract research or exploited directly by the universities through their control of IP. Universities also play other important roles which contribute to economic objectives such as through the development of new research tools and by providing access to international knowledge networks.

The purpose of this study is to contribute to increased success in university research commercialisation efforts by identifying the prerequisites for successful performance, in particular by creating excellence in IP policy and commercialisation management systems.

### ES2 Perspective

Our fundamental perspective is that commercialisation is primarily a market related process in which market forces play the dominant role. This study suggests a number of ways in which the market for research commercialisation can be made to work better. They can be grouped under three headings:

- building research commercialisation capabilities in the universities;
- building effective partnerships in research commercialisation between the universities, business and finance providers; and
- addressing areas of market failure where government action is appropriate.

This project, which has been supported by both university and business stakeholders, is focused upon identifying those structural arrangements and behavioural practices that will best support the achievement of successful commercialisation of university research in Australia.

### **ES3 The type of research commercialisation that is the focus of this study**

Commercialisation of research outcomes is the conversion of knowledge and inventions into products and services for the market. It is an important contributor to economic growth nationally and it also plays a role in university revenue generation.

Commercialisation can occur through a range of mechanisms including contract research, licensing, spin-off companies and joint ventures.

The defining feature of the commercialisation activity that is the focus of this study is that initially the IP that is to be commercialised is owned by the university (or universities in the case of collaborative projects occurring outside formal programs such as Co-operative Research Centres (CRCs)) within which the IP was generated. Therefore, the IP and commercialisation management systems in place within the university are important drivers of subsequent commercialisation outcomes. The university, due to its status as the IP owner, has responsibility for the commercialisation of the IP.

Against this background, commercialisation of university research, amongst other things, requires the universities to possess appropriate IP policies and commercialisation and management systems to support research commercialisation. These matters are central to this study.

It is important to note that for a significant proportion of research conducted within Australian universities, the research performing university will not be the owner of resulting IP and is therefore not the organisation that has responsibility for the commercialisation of the IP.

Examples of university research activities where the university does not have ownership of IP and therefore is not responsible for its commercialisation include:

- contract research activity where the company contracting for the research has ownership of the IP and responsibility its commercialisation;
- research conducted within CRCs, where it is the CRC (generally now as an incorporated entity) that has ownership of IP; and

- research conducted within major multi-institution research centres, such as the new ICT Centre of Excellence. National Information and Communication Technology Australia Ltd (a limited liability company whose shareholders are the Australian National University, the University of New South Wales, the NSW Government and the ACT Government) has been established as an incorporated entity with its own IP and commercialisation management policies and systems.

#### **ES4 Australian universities commercialisation performance**

A strongly held view in Australia is that while the universities have been effective performers of high quality research, there has been a shortfall in terms of converting research ideas into marketable products and processes. It must be said that Australia is not alone in this respect. Similar comments are commonplace in the United Kingdom and the UK government has introduced a number of measures in recent years to enhance the ability of universities to contribute to the commercialisation of innovation, their 'Third Stream' role. Funding is being provided for this purpose through the Higher Education Innovation Fund.

While on average licence revenue generation from research commercialisation in Australia is not too far behind the US university average (4.2 per cent), at the top end of performance the gap between leading US performers and leading Australian performers is in fact more significant. This lag in performance can perhaps be linked to the fact that most Australian universities have only begun to seriously focus on commercialisation activities over the past ten years whereas some US institutions have been active in this area for a much longer period. It is also likely influenced by early stage venture finance markets and the commercialisation skills base being more developed in the United States and the fact in the US there is a larger number of major companies in innovation intensive industries such as IT, biotechnology, pharmaceuticals, aerospace and automotive than is the case in Australia.

Since the mid 1990s there has been a growing focus by governments on creating conditions in which Australia's research commercialisation performance can be improved. For example, governments have sought to improve the situation in respect of early stage venture capital and the availability of the skills required to grow technology-based businesses.

Recent studies suggest that the research commercialisation performance of Australian universities, and for that matter the CSIRO, has been improving and is in fact not too far away from the performance levels demonstrated by the top 100 US universities. The challenge, however, is to create conditions in which Australian universities research commercialisation performance can expand and potentially reach levels seen in the top 20 US universities.

It is important to have realistic expectations about what can be achieved in relation to the levels of revenue that universities can generate through commercialisation activity. Even the leading US universities generally do not generate revenues from research commercialisation much in excess of 10 per cent of their total research revenues.

Given that even at world best practice levels, total returns to institutions from commercialisation (excluding contract research income) are unlikely to represent more than 5 or 10 per cent of total research revenue in the Australian higher education sector, it is therefore likely that the major economic impacts that Australia could realise in the future through the commercialisation of publicly funded R&D will be associated with the activities of companies that have successfully commercialised publicly funded R&D. The spin-out of research intensive companies and the licensing of IP to existing companies in turn creates a virtuous cycle as these companies grow and re-invest in collaborative research projects with publicly funded research institutions.

### **ES5 Receptor Industries**

The make up of the Australian industry base does most likely act as a constraint on the generation of returns from the commercialisation of university research.

As an economy, Australia has relatively high focus on resources, agriculture and services and a relatively low focus on manufacturing and in particular advanced manufacturing.

The 2003 OECD STI Scoreboard shows Australia ranked 19th in terms of business R&D expenditure as a percentage of industry value added.

The low overall level of business R&D expenditure in Australia, the relatively high share of this occurring in services and the relatively low level of spending on high technology manufacturing R&D is not particularly surprising given the make up of the Australian economy suggests Australia does not have the same depth of local business receptors for research in high technology fields such as ICT, aerospace and pharmaceuticals as in the other developed countries .

The relative lack of high technology industries in Australia, which do tend to be the drivers of commercialisation and university-business research collaboration in the US, is something that should be kept in mind when comparing Australian returns from the commercialisation of university research with those obtained in countries with bigger and deeper high technology industry bases.

Nevertheless, there are outstanding examples of both technology transfer and commercialisation of university generated IP relating to Australia's resource based industries and growing service industries.

### **ES6 Key drivers of commercialisation**

There is a threshold issue in relation to university engagement in commercialisation activity as well as six key drivers of university research commercialisation performance.

The threshold issue is that optimisation of university research commercialisation outcomes requires endorsement by universities and Governments of the commercialisation of research as a core activity alongside teaching and research. This necessitates Government funding models that recognise the risks and time it takes to be successful in research commercialisation, appropriate cultures, employment, recognition and reward systems in universities and capacity building, given the additional demands this places on universities and academics.

The key drivers of research commercialisation performance identified in the course of this study are:

1. the legal frameworks for IP in Australia and IP policies in place in universities – unless ownership of IP is clear and discoveries are disclosed and protected at the appropriate time, commercialisation opportunities are lost;
2. the commercialisation management structures and systems in place within universities – the presence, or lack of, structures and systems that ensure commercialisation opportunities associated with IP discoveries are progressed by appropriately resourced and skilled staff will impact commercialisation timelines and outcomes;
3. the quality of research being produced by universities – a considerable body of evidence highlights that it is excellent, ground breaking, research that is most likely to eventually generate significant commercial returns. The generation of high quality IP is a necessary condition for the generation of commercialisation outcomes;
4. the availability of early stage venture finance – development of a research breakthrough into a commercial product or service requires access to significant levels of risk capital. Early stage development finance can come from universities themselves, venture capital markets, angel investors or companies that wish to bring the product to a marketable stage. In the absence of access to development finance, research breakthroughs are unlikely to be commercialised in a timely fashion;
5. the presence of strong local receptor businesses – a significant avenue for the commercialisation of research is its adoption and further development by receptor companies. In the absence of local receptor companies with the knowledge and financial resources required to adopt and develop university research, research may instead be adopted and developed by overseas companies, resulting in the loss of significant economic activity offshore; and
6. the behaviour of participants within the research commercialisation system – if relationships between academics, university commercialisation staff, venture capital providers and receptor companies fall short of best practice standards, optimal commercialisation outcomes will not occur no matter what IP policies and legal frameworks are in place.

Each of these drivers can be thought of as a necessary condition for the generation of strong commercialisation outcomes. However, none of them in isolation should be seen as sufficient conditions for this to occur. All six drivers must be in place for optimal commercialisation outcomes to occur.

The current Australian situation with regard to these key performance drivers is considered in greater detail in Chapters 4 to 7 of this report.

## **ES7 Universities, business and finance providers — needs and contributions**

In conducting this report a clear understanding was established of the needs and contributions of the partners in the research commercialisation system, namely, universities, business and finance providers. The following three boxes set out, for each of the partners, the perspectives they provided to us on their needs and the contributions they believe they can make to each other.

Box ES1

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### **UNIVERSITIES — NEEDS AND CONTRIBUTIONS**

#### **Universities perspectives on business as partners in commercialisation**

##### *What universities want from business*

- ability to form long-term partnerships to develop and exploit IP
- knowledgeable buyers of IP
- the ability to add value to IP and take it to market in an appropriate form
- willingness to pay for IP

##### *What universities can provide to business*

- knowledge of what is going on at the cutting edge of research
- IP that can provide the basis for new or improved products and processes

#### **Universities perspectives on finance providers as partners in commercialisation**

##### *What universities want from finance providers*

- ability to assist the growth of new businesses
- willingness to invest at an early stage in spin-off companies
- capacity to provide advice, expertise and access to networks as well as capital

##### *What universities can provide to finance providers*

- knowledge of what is going on at the cutting edge of research
- IP that can provide the basis for the formation of companies

Box ES2

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### **BUSINESS — NEEDS AND CONTRIBUTIONS**

#### **Business perspectives on universities as partners in commercialisation**

##### *What business wants from universities*

- clarity and increased visibility of IP or research services that are being offered by the university, including clear ownership of IP
- reasonable pricing of IP
- ability to deal with universities at one point, with universities using a client management approach to business relationships
- a partner who has the authority to make decisions in a timely fashion and maintain confidentially
- a partner with an understanding of commercial realities

##### *What business can provide to universities*

- knowledge about what the market wants and values
- an ability to utilise and add value to university generated IP
- a capacity to give access to international markets where that is important to getting full value from university generated IP

Box ES3

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### FINANCE PROVIDERS — NEEDS AND CONTRIBUTIONS

#### **Finance providers perspectives on universities as partners in commercialisation**

##### *What finance providers want from universities*

- clarity about the IP or research service that is being offered, including clear ownership of IP
- IP that has been developed to an investment ready stage
- reasonable pricing of IP including reasonable expectations about the value of equity at an early stage of business development
- ability to deal with universities at one point
- a partner that understands and values what a venture capitalist can provide in addition to capital
- a partner who has the authority to make decisions in a timely fashion and maintain confidentiality
- a partner with an understanding of commercial realities

##### *What finance providers can provide to universities*

- knowledge about what the market wants and values
- an ability to utilise and add value to university generated IP
- a capacity to give access to international markets where that is important to getting full value from university generated IP
- ability to enhance the ability of spin-off companies to reach their full potential by providing capital, advice and access to networks

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### **ES7 Best practice in universities**

There is a wide range of approaches and performance in terms of research commercialisation among the Australian universities. While some universities have established commercialisation bodies with a corporate form, others have preferred to have the commercialisation function performed by elements within the university administration. Some of the bigger universities have created their own pre-seed capital funds, while others have not.

Based on our consultations and the consideration of published research commercialisation performance indicators, a strong case can be made that the leader in research commercialisation among the Australian universities at present has the following key features in its approach:

- a strong commitment by the Vice Chancellor to research commercialisation as an important function of the university;
- the university maintains ownership of IP generated by researchers employed by the university;
- the significant investment made in the university's research commercialisation arm (\$5 million was invested in 1995 over a ten year period to increase performance);

- the buy-in by the university faculties achieved by having business development officers located in each faculty that are jointly funded by the faculty and the university's research commercialisation arm;
- the joint establishment of a \$20 million early stage investment fund;
- the establishment of a business incubator at the University; and
- a culture in the university strongly supportive of research commercialisation.

### **ES8 The prerequisites for optimising university research commercialisation outcomes**

Based on our analysis of current practice among the Australian universities and leading universities in North America, we have developed a number of prerequisites for success in research commercialisation. While we have strongly emphasised that research commercialisation requires an effective partnership between the universities, business and finance providers, it is not surprising that many of the prerequisites relate directly to the universities themselves.

As we have argued, research commercialisation is primarily intermediated by the market and, of the three partners, it is the universities with their traditional focus on teaching and research who need to undergo the biggest changes in order for them to be fully effective partners in research commercialisation. Nevertheless, there are important contributions to be made by business and finance providers to the prerequisites for success.

Commonwealth and State governments also have a role to play in building capability, explicitly recognising and supporting a research commercialisation focus, understanding the nature of the risks in such a role and removing market impediments.

Pre-requisites for an effectively operating commercialisation market, including the role of government in the market, are described below.

#### ***Universities***

- Universities should have a clear mandate to engage in the commercialisation of research and this should be acknowledged as a legitimate third role for universities alongside teaching and research.
- Universities need to be producing excellent research, as it is excellent research that is most likely to generate the most significant commercialisation opportunities, and need to publicise their research capabilities.
- Universities need to be undertaking research in areas that fit with the interests of business.
- Universities should exercise their IP ownership rights, ensure IP ownership is clear and take appropriate steps to protect IP.
- Universities wishing to effectively commercialise should empower a central commercialisation entity to manage the commercialisation of university research. These commercialisation entities must be appropriately resourced to allow them to:

- identify and protect IP;
  - pro-actively identify commercialisation options;
  - disseminate information regarding research activities to business;
  - fund the further development of research to the point at which it is commercialisation ready;
  - negotiate deals; and
  - manage risk.
- University councils should not be involved in the micro-oversight of commercialisation activities.
  - University governing councils and senior management should be committed to developing a culture, and systems for the reward and recognition of staff, that encourages commercialisation activity.

### ***Business***

- Business should identify need for innovation and options to achieve this.
- Business should be able to engage with universities to pursue commercialisation opportunities where the university research is aligned to their product and service areas.
- Business should recognise that universities can access global markets for IP if local business is unable to use it.

### ***Finance providers***

- Venture capitalists must have both the capital and the expertise to allow them to add value to the formation and development of companies built around university generated IP.
- Venture capitalists should be able to provide soundly based judgements on the risk-return profile of business propositions.

### ***Government***

- Government research funding programs should provide incentives for universities to engage in commercialisation of research and support universities in establishing appropriate IP and commercialisation management systems, including where necessary to help build "critical mass" in commercialisation bodies shared between groups of universities where appropriate.
- State and/or Commonwealth Governments should not be involved in the micro- oversight of commercialisation activities.
- Commonwealth and State Governments should continue to address gaps in the market for early stage capital for growing technology-based businesses.
- Government policies and legislation should not impede university participation in commercialisation of research.

### **ES9 Best practice guidelines for optimising university research commercialisation outcomes**

There is no single best model IP policy and commercialisation management systems that will maximise research commercialisation outcomes in all circumstances.

However this research project has identified a series of best practice guidelines designed to achieve the following features of an effective university research commercialisation system:

- clarity about the control and ownership of IP;
- effective protection of IP;
- an organisational structure for commercialisation of IP allows for;
  - timely decision making within commercialisation activities – this may be influenced by both internal processes used within commercialisation entities and external processes imposed upon them through, for instance, Acts of Parliament establishing universities,
  - appropriate risk management being in place that fits the desired risk reward profile of institutions,
  - flexibility being available in the approach taken to commercialisation, with the choice of route to market (licensing, spin-off, joint venture, sale, etc) being determined on a case-by-case basis,
  - appropriate skills and other resources being in place to allow the commercialisation entity to conduct the full range of activities – which include identification and protecting of IP, negotiating deals, the education of researchers, risk management, providing funding to bring research to the investment-ready stage, building networks and market knowledge and buying in specialist skills as required for particular deals – necessary to encourage strong commercialisation outcomes,
  - necessary incentives and Government funding models being in place so that universities and researchers share a common commitment to achieving strong commercialisation outcomes, and
  - university governing councils and senior management should be committed to developing a culture and systems for the employment, reward and recognition of staff, that encourages commercialisation activity.

***Guideline 1: A clear mandate should be given for university involvement in commercialisation***

While there appears to now be a consensus emerging that universities should take an active role in ensuring that the potential commercial and other benefits from research are realised, there is currently no clear mandate in Australia stating that this should be a core function of universities activities alongside teaching and the conduct of research. In this respect Australia is different from the United States, where the Bayh-Dole Act establishes this principle, and now the United Kingdom where this 'Third Stream' role for universities, additional to teaching and research, has been explicitly outlined, and funding in support of it provided, in Government policy for the higher education sector .

The fact that universities should undertake this third role should be made clear in legislation that relates to the sector as well as within university constitutions.

***Guideline 2: Exercising IP ownership in universities***

As a direct consequence of acceptance of Universities having a role in ensuring that potential benefits from their research are realised, it is essential that IP should be owned, at least in the first instance, by the research organisation where it was generated.

Given the increasing significance of collaborative inter-university research projects in Australia, it is important that at the outset of such projects all parties agree upon how IP ownership should be assigned. Clarity on IP ownership is important to potential commercial partners, who are wary of having to negotiate with multiple owners. Therefore, where the results of cooperative research are to be shared between different institutions, a separate entity should be established, in which the participating institutions have an agreed ownership stake, to own the IP resulting from collaborative projects. Furthermore, one commercialisation entity should be charged with the responsibility of managing the commercialisation of the IP that is held within the new entity.

***Guideline 3: Ensuring IP protection within universities***

Ensuring appropriate IP protection measures are taken with respect to university owned IP, should be the responsibility of the commercialisation entity (irrespective of whether it is an incorporated entity or a division or office within the university) of the university. It should not be left to individual researchers or faculties to undertake this task. A fragmented approach runs the risk of IP 'falling through the cracks' or researchers with insufficient skills or support in this area adopting inappropriate IP protection strategies.

If a centralised IP protection system is to be introduced effectively, it is imperative that systems for the timely disclosure of IP to the university's commercialisation entity are implemented and enforced. Approaches to this are discussed within the context of organisational structures for commercialisation management and functions for commercialisation entities.

***Guideline 4: The functions and resourcing requirements for commercialisation entities and organisational structures for commercialisation management should reflect the complexity and risks associated with research commercialisation***

Currently, commercialisation functions are sometimes separated from the management of contract research, the identification of IP in faculties and the education of researchers. While the separation of these activities across multiple bodies will not necessarily cripple commercialisation outcomes, on balance, there are good reasons why these related activities should be undertaken by one entity.

For a commercialisation entity to undertake these activities, a significant annual operating budget and access to capital for proof of concept activity is required. It has been suggested that a minimum annual budget for commercialisation functions (not including the management of contract research) would be in excess of \$2 million per annum.

Such resourcing levels may be both unsustainable and inappropriate for some individual universities but one way for this to occur would be for incorporated commercialisation entities to be established jointly by two or more universities and for such commercialisation entities to handle commercialisation activity at each of the universities involved.

Experience both overseas and in Australia demonstrates, both commercialisation entities that operate as a division or office within universities and commercialisation entities that are established as separate incorporated entities can operate successfully. However, the incorporated structure does carry some advantages over the division or office approach.

Procedures for approval and monitoring of commercialisation activity should allow for timeliness within commercialisation activities and for appropriate risk management. Legislative reforms may be needed in the case of some states and universities before appropriate structures can be implemented in this area.

***Guideline 5: Provision of incentives for universities and researchers to engage in commercialisation activities***

Currently there is little direct incentive for universities and academics to actively engage in commercialisation activity. Commonwealth research block grant funding formulae reward universities that are successful in attracting contract research funding and in the publication of papers, but do not reward universities that achieve outstanding outcomes in the area of commercialisation.

It is important, however, that simplistic and inappropriate metrics for the measurement of commercialisation performance are not introduced into either block grant or specific research grant program criteria.

Promotion criteria for researchers are currently focused very heavily upon the production of peer recognised research publications and the attraction of competitive research grants. Promotion criteria should be broadened to also take into account the contribution that researchers make to the successful commercialisation or application of their research through other avenues

## Chapter 1

# Project overview

### 1.1 Context for this project

#### *The role of universities as drivers of innovation in the economy is growing*

The starting point for this study is the increasing importance of the research capabilities in the universities and the research they conduct. Research undertaken by the universities accounts for around one quarter of total research and development (R&D) in Australia<sup>1</sup>. The universities are also the major performers of basic research in Australia.

The importance of the universities in the research system has been increasing, not only in Australia, but also most OECD countries. There are a number of reasons why this has been happening.

The first reason is the emergence of major new areas of research in terms of the life sciences and nanotechnology which are increasingly fields where the research leaders are to be found in universities and, in the case of life sciences, in university associated medical institutes.

The second reason is the increasing importance of multidisciplinary research in high impact areas such the interface between information technology and the biosciences. This development makes it increasingly difficult for corporate research laboratories to marshal all the disciplines they need to stay at the cutting edge of product and process development in their areas. As a consequence, companies are tending to outsource research to the universities and other research institutions.

The third reason is that governments have recognised the trend towards university research and have been providing additional resources to enable universities to further develop their research capabilities. This trend has been particularly noticeable in the last decade in the United States and the United Kingdom and in Australia since the introduction of the *Backing Australia's Ability* innovation support package in 2001.

The fourth reason is the closure of a number of big corporate laboratories, such as the Bell Labs in the United States, which had made major contributions to basic research in the 20<sup>th</sup> century and especially in the decades following the end of the second World War. Companies have been tending to close their central corporate laboratories in favour of placing research more closely with the product divisions and also are increasingly outsourcing their R&D effort<sup>2</sup>.

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<sup>1</sup> Another quarter is performed by other publicly funded research organisations such as the CSIRO, DSTO and Medical Research Institutes. The other half of all R&D is performed by industry.

<sup>2</sup> The presence of this trend in Australia was highlighted recently in The Australian Financial Review, Education Liftout, *The Power of Partnerships*, February 23 2004.

*We should be seeking to generate optimal societal returns from investment in university research*

The increasing scale of the investment being made in research in Australian universities, with public funding for university research now exceeding \$2.7 billion per annum<sup>3</sup>, increases the desire of the community to ensure optimum returns are generated by this investment.

The processes by which society receives a return on the investment in research in universities are complex and, in many cases, difficult to estimate with a high degree of accuracy. This is a very different situation to the process by which research conducted in corporations is converted into new marketable products and processes which produce value for both the corporation and its customers.

Major channels by which university research produce benefits for society include:

- the creation of new knowledge that is eventually translated into new products, processes or improvements in public policy and societal structures;
- the education and training of research workers and also university graduates and the community more generally;
- increased ability to apply and integrate knowledge developed elsewhere in the world;
- participating in international research collaboration and getting access to cutting edge research findings at a very early stage;
- the creation of new and powerful research equipment; and
- the creation of intellectual property (IP) which can be directly commercialised either by the creation of spin-off companies or by licensing to existing companies.

The focus in this study is on the contribution the last of these channels, 'direct commercialisation', can make to universities, the economy and society as a whole. This is a channel of benefits that until relatively recently has not been a major area of focus in Australia. However, over the past five years, in particular, awareness of the potential societal benefits that can be generated by maximising 'commercialisation' performance has risen, and has consequently emerged as a major issue in Australia's ongoing innovation policy debate<sup>4</sup>.

*Maximising returns from commercialisation requires strong business-university relationships*

Commercialisation of university generated IP involves a lot more than the research itself. For value to be created and realised, it is necessary to mobilise development finance, further develop IP so that it can be embodied in products or processes, and access the management and marketing skills necessary for successful innovation in the market place.

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<sup>3</sup> Commonwealth Government Budget 2003-04, *Science and Innovation*, Table 1 (this includes both block grants and ARC and NHMRC grants made to universities.)

<sup>4</sup> The issue of commercialisation performance is also important for other publicly funded R&D such as that conducted by the CSIRO. Efforts to increase research commercialisation outcomes for such other publicly funded research institutions are also occurring.

Most university researchers understandably lack the skills and/or the motivation to become entrepreneurs. Successful commercialisation of university IP has therefore generally required the presence of an effectively functioning technology transfer agency in individual universities. Such agencies can act as a one-stop-shop both for business and researchers and add significant value by providing comprehensive advice, support and access to early stage venture capital.

As a result of Government policy measures, increased availability of early stage venture finance and commercialisation skills, and improvements in policies and practices within universities, the available evidence suggests that university research commercialisation performance has improved considerably in Australia in recent years<sup>5</sup>. However, if such improvement is to continue in the future, stronger and more effective relationships between the market and universities will be needed.

Whether the vehicle for commercialisation is by way of spin-off companies or by licensing, understanding of market needs is essential. This understanding will often be driven by close relationships between business and universities. A number of factors, a few of which are briefly mentioned below, impact upon the strengths of such relationships.

The United States, which is generally considered to be the best example of business–university relationships, is notable for the ability of people to move relatively easily between business and the universities. US academics are paid on a nine month in the year basis and are free to earn income from consultancies with business and other sources in the other three months of the year. Performing such consultancies gives the individual academics the chance to build up strong networks within the business community and to understand business drivers. There is also a willingness of US academics, who have been involved in the development of IP which is best exploited by the creation of a spin–off company, to leave the university and join a start–up company and perform ongoing research outside their university of origin. In summary, there appears to be little cultural gap between universities and business in the United States<sup>6</sup>.

A further strength of business–university relationships in the United States is the high proportion of turnover which major US businesses are prepared to invest in R&D. This reflects the structure of the US economy and the large number of major companies in innovation intensive industries such as IT, biotechnology, pharmaceuticals, aerospace and automotive that are headquartered in the United States. From the universities point of view, this increases the receptors in the business community for IP which they generate.

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<sup>5</sup> Allen Consulting Group, (2003), *The economic impact of the commercialisation of publicly funded R&D in Australia*, report for the Australian Institute for Commercialisation, sets out the upward trend in performance witnessed in Australia in recent years.

<sup>6</sup> It is important to note that terms of employment within US universities academics tend to be employed on the basis of a nine month year which provides an incentive for academics to actively build up commercial networks to generate income during the other three months. In the US there is also strong opportunity for academics to focus heavily on research rather than teaching activity. Employment of academics in Australian universities tends to be on a full year basis. There is also an expectation that most researchers will combine research and teaching activity. Current promotion, recognition and reward systems are focused on research publication performance.

A final important factor in the United States is the presence of a well developed venture capital market able to provide the complete range of funding from very early stage to later stage venture capital. Work done on important research-industry clusters in the United States such as Route 128 in Boston and Silicon Valley in California, but also elsewhere, have underlined the important role played by venture capital providers in the successful commercialisation of university-generated research and related IP.

## **1.2 Project objectives**

This project was commissioned by the Business Council of Australia and the Australian Vice-Chancellors' Committee with the aim of increasing understanding of the approaches to the commercialisation of university research that will be most successful in Australia.

Specifically, this project's aims are to:

- enhance understanding of the drivers of research commercialisation outcomes;
- provide a framework for the assessment of university IP policies and commercialisation management systems;
- identify those approaches that support effective commercialisation outcomes; and
- develop best practice guidelines for research commercialisation policy and practices in the Australian university sector.

What this study is *not* intended to provide is a comprehensive account of *all* the university research commercialisation policies and practices currently in place in Australia and overseas. Rather, in reviewing the extensive existing literature on these matters, we focus on those aspects of policy and practice that provide the most valuable lessons for further improvement of commercialisation performance in Australia.

## **1.3 Project methodology**

Meeting the objective's of this project required both an assessment of the extensive existing literature surrounding university research commercialisation systems and outcomes in Australia and overseas and the development of new insights into the behavioural practices that are associated with effective commercialisation of university research.

Therefore, in this study, in addition to conducting a review of the existing literature, we have gathered insights from a range of industry, venture capital and university stakeholders that have extensive experience in the commercialisation of university research in Australia. Through both general discussions and through the development of five specific contemporary commercialisation case studies, we have highlighted those policies and practices that are either supportive or obstructive of the generation of positive commercialisation outcomes.

## 1.4 Report structure

The report has been structured in the following way:

- Chapter 2:* defines 'commercialisation' as used in this study and discusses the contribution of university research commercialisation to economic and social development.
- Chapter 3:* considers the threshold issue of universities engagement in commercialisation activities and identifies six key drivers of university commercialisation performance.
- Chapter 4:* considers the first key driver of commercialisation performance, namely, Australian IP law and other legislation that has implications for university IP policies and commercialisation management systems.
- Chapter 5:* considers the second key driver of commercialisation performance, namely, current Australian university IP policies and management systems for research commercialisation.
- Chapter 6:* considers Australian performance in relation to three further drivers of commercialisation performance, namely, the quality of university research, the availability of venture finance and the presence of strong local receptor industries.
- Chapter 7:* considers the final key driver of commercialisation performance, setting out current perceptions of behaviour within the Australian university research commercialisation system.
- Chapter 8:* sets out the defining features of an effectively operating commercialisation system and considers best practice lessons from overseas.
- Chapter 9:* provides best practice guidelines for university research commercialisation in Australia are presented.
- Appendix A:* sets out five contemporary case studies of university research commercialisation.
- Appendix B:* provides a reference list of the relevant existing literature surrounding the commercialisation of university research and the knowledge-economy more broadly.



## Chapter 2

# The role of university research commercialisation in Australian economic performance

This chapter defines the term 'commercialisation' as used in this study and discusses the contribution of university research commercialisation to economic performance.

### 2.1 Overview

University researchers throughout the developed countries have contributed significantly to the emergence of the information and communications technologies (ICT) and biotechnology/biomedical revolutions. This has focussed attention on the universities and other centres of leading edge research as major sources for the development of new businesses and jobs growth.

The power of a virtuous cycle associated with breakthrough research, growth of new technology-based businesses enabled by specialist financial intermediaries such as venture capital providers and the development of clusters of related businesses has led to greater policy attention being given to the process by which ideas are transformed into businesses (that is, the process of going from minds to markets).

Universities which have traditionally seen their role to be in research and teaching are taking on a 'third stream'<sup>7</sup> role in terms of the commercialisation of research findings and thereby are becoming even more important contributors to regional and national economies.

Universities are major sources of research activity within the Australian economy. Around half, of all Commonwealth Government support for R&D is directed towards universities<sup>8</sup>.

Governments in developed countries that have traditionally invested in the higher education system because of their role in the creation of knowledge and the education of young people, are now looking to obtain a clear return on their investments and one of the potential channels for obtaining a return for society is through the commercialisation of research results. In the United Kingdom this 'third stream' role for universities (beyond teaching and research) has been explicitly outlined in government policy for the higher education sector<sup>9</sup>. In Australia greater attention on commercialisation has also emerged in recent years.

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<sup>7</sup> The term 'third stream' was coined in the UK in the Lambert review of higher education. The identification of the 'third stream' role in the UK and the funding that has been allocated to support universities fill this role are discussed in Section 8.2.

<sup>8</sup> Commonwealth Government Budget 2003-04, *Science and Innovation*, Table 1 shows that funding for ARC and NHMRC grants, grants for CRCs and university research block grants total \$2.74 billion in 2003-04, representing 50.5 per cent of total commonwealth support for R&D.

<sup>9</sup> Department for Education and Skills (UK), (2003), *The Future of Higher Education*

As the Prime Minister said in 2001:

"Yet, as fine as our achievements have been, the fruits of our ingenuity and inventiveness must be realised here in Australia. In an extremely competitive world of highly mobile capital and labour, it is all the more important that Australia has the right incentives and opportunities to translate Australian ideas into income and jobs at home for Australians."

Prime Minister's 2001 Federation Address and Launch of Backing Australia's Ability

## **2.2 Defining commercialisation of university research**

Universities generate revenue from research activities in a number of ways, including contract research, participation in collaborative research projects that have commercial applications, the creation of spin-off companies and the licensing of IP to existing companies.

For the purposes of this report, when we refer to the 'commercialisation' of research we are referring only to the commercialisation of university R&D via:

- the formation of new spin-off companies based on the IP generated through university R&D; or
- the licensing (or outright purchase) of IP generated by university R&D by a company that then generates economic returns from the IP.

Other commercial activity resulting from contract R&D activities and through university participation in collaborative research projects with industry that occurs within structured programs such as the Co-operative Research Centre (CRC) program are not the major focus of this study. Reasons for this are set out below.

### ***The nature of commercialisation activity that is the focus of this study***

The defining feature of the commercialisation activity that is the focus of this study is that initially the IP that is to be commercialised is controlled by the university (or universities in the case of collaborative projects occurring outside formal programs such as CRCs) within which the IP was generated. Therefore, the IP and commercialisation management systems in place within the university are important drivers of subsequent commercialisation outcomes. The university, due to its status as the IP owner, has responsibility for the commercialisation of the IP.

It is important to note that for a significant proportion of research conducted within Australian universities, the research performing university will not be the owner of resulting IP and is therefore not the organisation that has responsibility for the commercialisation of the IP.

Examples of university research activities where the university does not have ownership of IP and therefore is not responsible for its commercialisation include:

- contract research activity where the company contracting for the research has ownership of the IP and responsibility its commercialisation;
- research conducted within CRCs, where it is the CRC (which may be an incorporated entity or a Board representing an unincorporated joint venture) that controls IP; and

- research conducted within major multi-institution research centres, such as the new ICT Centre of Excellence. National Information and Communication Technology Australia Ltd (a limited liability company whose shareholders are the Australian National University, the University of New South Wales, the NSW Government and the ACT Government) has been established as new incorporated entity with its own IP and commercialisation management policies and systems.

### ***The different nature of commercial activity related to contract R&D and collaborative R&D conducted within programs such as CRCs***

#### ***Contract R&D***

Issues surrounding contract R&D activities undertaken by universities tend to be quite different from those involved in the latter two types of commercialisation activity. With contract R&D, the ownership of IP generated through the contracted research is generally being purchased by the contractor who then carries forward the process of generating economic returns from this IP. Such arrangements are similar in nature to many other standard purchases of goods or services. The contractor pays the university a fee to undertake research and it is the contractor who then owns the IP generated through the research. The university in this case does not play an active role in the 'commercialisation' of the IP. Rather, it generates and sells the IP for a pre-agreed fee with the organisation that contracts for and subsequently owns the IP taking responsible for its commercialisation.

There are many examples of such contract research activity in Australia, such as the Commonwealth Bank contracting the University of New South Wales to undertake research into equity markets and provide the results of this research to the Commonwealth Bank. However, unlike the case where the university seeks to commercialise IP that the university owns, such contract research activity does not require the universities to engage in 'commercialisation' activity such as patenting, sourcing of buyers for IP, establishing companies, seeking investors and so on. Rather, the university simply needs to negotiate the initial research contract and then undertake the specified research task.

While acknowledging that contract research activity is a valuable income source for universities and that it also helps build industry-university relationships, it is not included as 'commercialisation' of research for the purposes of this study as the university that performs the research does not have responsibility for guiding the subsequent commercialisation of the research.

#### ***Collaborative R&D conducted in formal programs***

In Australia there are a number of formal programs for the collaborative research projects that involve public and private sector organisations participating in research projects where commercialisation of research subsequently occurs. Most notable of these programs is the CRC program.

The reason why such research commercialisation falls outside the scope of this study is that research conducted within CRCs (and through major multi-institution research centres) is commercialised in accordance with the specific IP commercialisation systems that have been established for each research centre. It is the responsibility of the research centre, rather than any one participating university, to carry out the commercialisation of research conducted within the centre. In most cases, CRCs now involve the establishment of an incorporated entity that holds the IP that is produced within the centre and that has responsibility for commercialisation of this IP. It is therefore the IP and commercialisation management systems in place within this incorporated entity that drive commercialisation outcomes rather than the IP and commercialisation management systems that are in place at those public and private sector organisations that are participants in the collaborative research projects conducted through the centre.

### **2.3 Channels for realisation of economic benefits from commercialisation**

Commercialisation, whether through licensing of IP to existing businesses or through the establishment of new spin-off companies, is now emerging as a potentially significant avenue through which benefits from public research funding can be accrued in Australia. The size of the economic benefit that could flow from a step change in Australia's performance in turning cutting edge research into commercial opportunities could be very large. For example, the June 2001 PMSEIC Report, *Commercialising Public Sector Research*, set out the goal of growing an extra 200 to 250 Australian research-based companies over the next five years. The prize was claimed to be around an extra \$20 billion in exports per annum<sup>10</sup>.

It is important to note that this prize relates to the benefits accrued to the wider economy *not* the financial returns that Universities themselves may be able to generate through research commercialisation activities.

The National Survey of Research Commercialisation<sup>11</sup> indicates that overall Australian performance regarding the generation of revenues from the commercialisation of university research may still lag somewhat behind international best practice. This may be due to a combination of university policies and practices, deficiencies in the wider supporting environment for commercialisation and cultural factors.

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<sup>10</sup> The linkage between intermediate outputs such as the formation of spin-off companies and the generation of final economic outcomes such as revenue, jobs and exports raises an important issue regarding how commercialisation outcomes are measured and reported. It is important that outcomes data focuses on measures that are as close as possible to final economic outcomes as possible. For instance, measuring employment and revenue of spin-off companies is a better outcome measure than simply measuring number of spin-off companies formed. The latter approach may simply encourage the formation of spin-off companies rather than encouraging the formation and fostering of growth of spin-off companies. Reflecting the importance of establishing appropriate performance measurement systems for research and research commercialisation, \$2.8 million has been recently allocated in *Backing Australia's Ability 2* for the development of improved outcomes assessment tools for publicly funded research in Australia.

<sup>11</sup> ARC, CSIRO, NHMRC, (2002), *National Survey of Research Commercialisation: Year 2000*

However, even if Australian institutions reached best practice levels, the total level of commercialisation revenue would remain small relative to research expenditures. While improving commercialisation practices could perhaps in total double revenues captured by the research performing organisations, it is unlikely that overall income to universities would be able to be increased much further.

The recent Lambert Review in the United Kingdom stresses that transferring technology from universities to business should not be viewed primarily as a revenue raising activity for universities.

“Transferring technology to business is not a way for universities to develop vast new sources of funding. Even the most successful US universities tend to get only a small part of their overall income from this activity. Public funding for university research is intended to support the generation and dissemination of new ideas; it should not be seen as a way for the universities to become rich.”

Lambert, R., (2003), *Review of Business-University Collaboration*, Report to the UK Government, December 2003, pg. 13

Given this, in assessing the commercialisation returns associated with publicly funded R&D, it would not appear that high overall economic impacts are likely to be found in the area of revenues accruing to research performing institutions. Even at world best practice levels, total commercialisation returns (excluding contract revenue) to institutions are unlikely to represent more than 5 to 10 per cent of total research revenue in the Australian higher education sector<sup>12</sup>. It is therefore likely that the major economic impacts that Australia could realise in the future through the commercialisation of publicly funded R&D will be associated with the activities of companies that have successfully commercialised publicly funded R&D. The spin-out of research intensive companies and the licensing of IP to existing companies in turn creates a virtuous cycle as these companies grow and re-invest in collaborative research projects with publicly funded research institutions.

#### **2.4 The scale of economic benefits available from commercialisation**

The level of economic returns accruing to universities from research commercialisation is relatively straightforward to measure. Holdings in spin-off companies and revenues from IP licenses can and have, particularly since the first National Survey of Research Commercialisation was conducted, been evaluated and results reported.

Determining the scale of economic returns accruing to the wider economy from the commercialisation of university research is a far more difficult task. Data is very hard to collect regarding the extent to which existing companies have derived economic returns from IP they have licensed from universities. It is also hard to determine the extent to which the economic activities of new spin-off companies based on university research can be attributed to research conducted in universities. This is because considerable inputs, such as venture finance, business development staff, and so on have also contributed to the performance of such spin-off companies.

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<sup>12</sup> Knowledge Commercialisation Australia (2003), *Forum and Fair of Ideas: Commercialisation Discussion Paper*, reported that the average licence revenue (as a percentage of research expenditure) by the 23 Australian universities that received license revenue in 2000 was 3.1 per cent.

### **Returns to universities**

Income to research institutions from licensing and start-up activity tend to be highly concentrated to a relatively small percentage of institution and to a small number of commercialisation events within these institutions. The license income generated by universities in 2000 for instance was dominated by one commercialisation event, namely the revenue generated by the University of Melbourne relating to the listing of Melbourne IT. The average licence revenue (as a percentage of research expenditure) by the 23 Australian universities that received license revenue in 2000 was 3.1 per cent. However, only 3 of these 23 universities – Melbourne (19.2), New England (14.0) and Flinders (7.3) – actually generated licence revenue (as a percentage of research expenditure) over this average level. The mean level of licensing revenue for the 23 universities was 0.4 per cent of research expenditure<sup>13</sup>.

As is the case in Australia, in the United States a relatively small number of research institutes account for the majority of all income generated from licensing and spin-off companies.

In 2000, the University of California system alone accounted for approximately 25 per cent of all university licensing income in the United States, generating US\$261 million in that year. The largest five generators of licensing income in turn account for \$571 million in revenue for that year, representing over 50 per cent of total licensing revenue received by all US Universities<sup>14</sup>.

As is the case in Australia, a very small number of licenses account for a significant share of total licensing revenue generated in the United States. Of the 781 licences generating income in the University of California system, only 10 generated over US\$1 million in revenue in 2000<sup>15</sup>.

However, unlike Australia, all but two of the 20 largest research universities in the United States generated license income (as a percentage of research expenditure) of over 3 per cent. Six universities generated income at a rate of over 10 per cent, while the average for the top twenty licence income generating research universities was 9.2 per cent<sup>16</sup>.

These figures suggest that while on average licence revenue generation in Australia is not too far behind the US university average (4.2 per cent), at the top end of performance the gap between leading US performers and leading Australian performers is in fact very significant. This lag in performance can perhaps be linked to the fact that most Australian universities have only begun to seriously focus on commercialisation activities over the past ten years whereas some US institutions have been active in this area for a longer period. It is also likely influenced by early stage venture finance markets and the commercialisation skills base being more developed in the United States and the fact in the US there is a larger number of major companies in innovation intensive industries such as IT, biotechnology, pharmaceuticals, aerospace and automotive than is the case in Australia.

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<sup>13</sup> Knowledge Commercialisation Australia (2003), *Forum and Fair of Ideas: Commercialisation Discussion Paper*

<sup>14</sup> Knowledge Commercialisation Australia (2003), op.cit

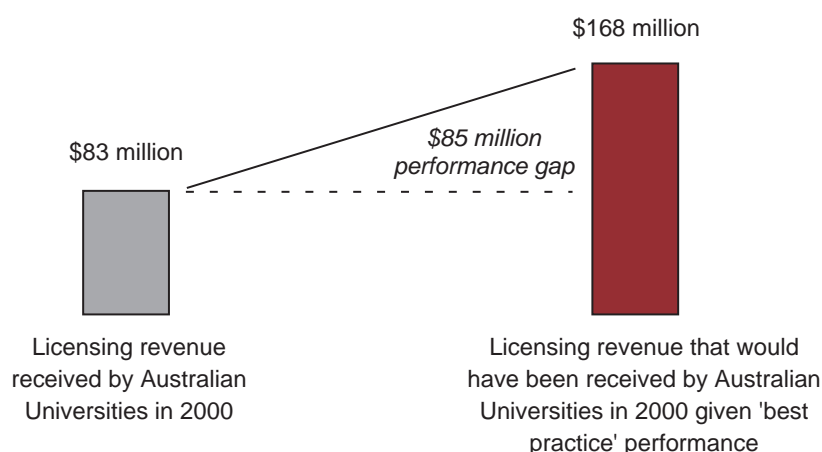
<sup>15</sup> Ibid

<sup>16</sup> Ibid

Figure 2.1 below shows that if Australian universities had been generating licensing revenues at the level of leading US universities in 2000, overall licensing revenues would have been around double those that actually were accrued in that year.

Figure 2.1

**REACHING 'BEST PRACTICE' INVOLVES A DOUBLING OF UNIVERSITY LICENSING REVENUE**



N.B. Figure assumes that 'best practice' would involve the top five performers in 2000 (in terms of licence revenue as a percentage of research expenditure) achieving a ratio of 15 per cent, the next five achieving a ratio of 5 per cent and the remaining 13 universities which generated licence income in 2000 achieving a ratio of 1.5 per cent.

Source: Allen Consulting Group analysis of data in: Knowledge Commercialisation Australia (2003), *Forum and Fair of Ideas: Commercialisation Discussion Paper*

**Returns to the wider economy**

While more data is available in relation to recent university commercialisation performance than was available for earlier periods, data relating to wider economic returns from commercialisation is still lacking. A key data problem is that while the National Survey of Research Commercialisation study tracked commercialisation performance from an institutional perspective, data regarding the performance of the companies that have commercialised publicly funded research has not been collected.

In our study for the Australian Institute for Commercialisation<sup>17</sup>, we attempted, via consideration of a number of information proxies, to estimate the total level of economic activity associated with companies that were formed based on publicly funded research. Our best estimate of the level of economic activity associated with such *new* companies was that their revenues totalled around \$2 to 3 billion per annum in 2002. Not all, or even most, of this activity can be attributed to the publicly funded research given the many other resources that have been allocated towards these companies from other sources. Also, this figure relates to companies based on *all* publicly funded research, not just research conducted in universities.

<sup>17</sup> Allen Consulting Group (2003) *The economic impact of the commercialisation of publicly funded R&D in Australia*, report for the Australian Institute for Commercialisation

The economic activity associated with the returns from university research generated by *existing* companies that have licensed IP from universities is simply not possible to calculate. Companies do not report the portion of their earnings have been generated as a result of particular items of IP.

What is known is that R&D intensity of countries is positively linked to rates of economic growth<sup>18</sup> and that the value of companies is also positively linked to their innovation intensity<sup>19</sup>. To the extent then that university research is adopted and utilised by companies, thus raising their innovation intensity, the commercialisation of university research via licensing to existing companies will generate economic returns.

While it is not possible to give an estimate of the total economic returns generated from the commercialisation of university research, there are a number of reasons why the optimisation of the university research commercialisation system could be expected to generate significant benefits for Australia as it would help elevate Australia to the status of a first-tier innovator nation.

## **2.5 The benefits of achieving first-tier innovator nation status**

There has been recent improvement in Australia's position in the international league table as an innovative economy. A recent study by Gans and Stern<sup>20</sup> argues that over the last two decades Australia has been transformed from a classical 'imitator' to a 'second-tier' innovation economy. However, Australia has not yet lifted itself to the level of performance achieved by 'first-tier' innovator nations.

A notable characteristic of 'first-tier' innovator nations is that they possess a well developed set of commercialisation intermediaries, such as venture capital providers, people skilled in growing emerging, technology-based businesses and development oriented policies around the use of IP generated originally in the universities.

What then could we expect to gain by further increasing performance to 'first-tier' innovator levels? With the above enabling conditions in place, we would expect to see a number of things develop.

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<sup>18</sup> Within the economic growth literature, a number of studies in developed economies have attempted to measure the economy-wide productivity impacts of R&D investment. The elasticity between the R&D capital stock and the level of output refers to the percentage change in output associated with a 1 per cent change in the level of R&D. For instance, if a 1 per cent increase in R&D investment leads to a permanent increase of 0.1 per cent in output, then the elasticity of R&D investment is 0.1. In relation to the link between increases in R&D and increases in output, Griffith, Redding and Van Reenen report that studies typically indicate that a 1 per cent rise in the stock of R&D leads to a rise in output of 0.05 to 0.15 per cent (Griffith, R., Redding, S., Van Reenen, J., (1998), *Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Industries*, Institute for Fiscal Studies, Working Paper 02/00). Cameron reports a similar result from his review of the existing literature, suggesting that a 1 per cent rise in the stock of R&D leads to a rise in output of 0.05 to 0.10 per cent (Cameron, G., (1998), *Innovation and Growth: a survey of the empirical evidence*, Nuffield College, Oxford, Discussion Paper).

<sup>19</sup> A clear positive linkage between patent intensity of companies and the market valuation of companies is shown in Matolsy, Z.P. and Wyatt, A., (2003), *Using Patent-Based Metrics to Understand the Value of Companies*, Intellectual Property Research Institute of Australia, Working Paper No. 07/03. Also, CHI Research (reported in Forbes.com, 24th June 2002, *How to Find True Value in Companies*) has conducted a hypothetical stock portfolio experiment. Through choosing stocks on the basis of assessment of patent portfolio quality alone, CHI Research's hypothetical stock portfolio from 1989 to 1998 outperformed the S&P 500 by a factor of three times.

<sup>20</sup> Gans, J., Stern, S., (2003), *Assessing Australia's Innovative Capacity in the 21<sup>st</sup> Century*

First, we would expect to see strengthened growth in the population of small, emerging technology-based businesses. While growth in the population of such businesses has been growing over time in Australia the potential exists for this to be further strengthened.

Second, we would expect to observe an increasing proportion of the population of small, technology-based businesses breaking through to become 'emerging globals'. Australia has over the last two decades produced some companies that have achieved such a breakthrough, Cochlear and ResMed being the outstanding examples. These companies illustrate the potential upside in terms of value creation that such businesses can contribute to the economy.

Third, we would expect as a result of the increased population of technology-based businesses and the greater proportion of them that are able to become 'emerging globals' that the aggregate impact of technology-based companies emerging from the commercialisation process in terms of contribution to economic value, well paid jobs and exports will be highly significant. Such companies have the potential to be an important source of dynamism for the Australian economy in coming decades adding diversification to the Australian economic activity portfolio.

Fourth, the performance of existing Australian companies will be improved through the licensing and adoption of new products and processes that have been developed in Australian universities<sup>21</sup>.

Fifth, success in achieving recognition for Australia as becoming a "first-tier" innovator nation will assist the process of attracting innovation intensive activities of the leading research-based multinational companies to Australia. It will also assist the position of Australia in attracting and retaining highly qualified researchers and innovators in all areas of activity.

Finally, it is likely that a virtuous cycle will be established in which greater investment in the generation of ideas, will directly lead to the creation of greater value and jobs for the economy which in turn will increase Australia's capacity to invest in the generation of ideas. Achieving a self sustaining virtuous cycle like this will be vital to increasing living standards in Australia in the 21st Century.

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<sup>21</sup> Matolcsy, Z.P. and Wyatt, A., (2003), *Using Patent-Based Metrics to Understand the Value of Companies*, Intellectual Property Research Institute of Australia, Working Paper No. 07/03



## Chapter 3

# Key determinants of university research commercialisation performance

This chapter considers a threshold issue in relation to university engagement in commercialisation activity and then explores six key drivers of university research commercialisation performance.

### 3.1 A threshold issue – making research commercialisation a core activity for universities

Optimisation of university research commercialisation outcomes will require universities to make the commercialisation of research a core activity alongside teaching and research. While at a policy level, both within government and within universities<sup>22</sup>, the legitimacy of this 'third stream' role has been endorsed, whether it has been accepted into the culture and practice of universities is not clear.

Based on our discussions (both in this and prior studies) with university commercialisation offices, external groups involved in the commercialisation of university research and with university researchers<sup>23</sup>, it appears that a significant number of university researchers are either ambivalent about (viewing it simply as a potential avenue for raising research funding), or even hostile to (viewing it as a corrupting influence on research quality and impartiality), the commercialisation of research.

The existence of such attitudes is not particularly surprising. Cultural attitudes build up of long periods of time and it would be unrealistic to expect that they would change dramatically as soon as policy makers in both government and universities decide that commercialisation is now an important function for universities. It is also important to note that while policy makers are now stating the importance of commercialisation, both internal (promotion criteria) and external (funding formulas) incentive mechanisms still rely on traditional publication and research training performance indicators rather than commercialisation performance.

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<sup>22</sup> See for instance, *Backing Australia's Ability*, recent changes (promoting greater commercialisation outcomes) announced for the Co-operative Research Centres program and the presence of commercialisation policies and commercialisation offices/entities in almost all Australian Universities.

<sup>23</sup> Others have also commented on this issue. For instance in the KCA Media Release relating to the Commercialisation Forum & Fair of Ideas held in Sydney 26-28 March 2003, Mr Howard of Howard Partners suggests that "a cultural gap still exists in Australia between universities and business, which is holding back the knowledge economy."

Concerns over the potential conflicts of interest that commercialisation activities may create are legitimate and must be seriously addressed through the implementation of appropriate conflict of interest policies. Similarly, it may be hard for researchers to see the merits of commercialisation activities (beyond raising additional funding for research) if limited efforts are made to communicate these benefits to researchers and if the criteria for academic recognition and reward do not encourage engagement in such activity. Finally, if commercialisation structures and processes in place within universities are seen as time consuming, overly bureaucratic or confusing, researchers may be disinclined to engage with university commercialisation bodies.

Until the commercialisation of research is viewed by *most university researchers* as both a legitimate and worthwhile activity, and researchers have confidence in the systems in place for managing commercialisation activities within universities, performance will not be optimised. Therefore, while much of the discussion in this paper focuses on the policies, practices and external environmental factors that influence commercialisation outcomes, a sustained focus on educating researchers as to the importance and merit of pursuing commercialisation opportunities is also needed before university research commercialisation outcomes will meet their full potential.

### 3.2 Key drivers of performance

Once this threshold decision has been taken by universities to commit to the active commercialisation of research, university research commercialisation performance is determined by a range of factors, many of which are not within the control of universities themselves.

Based on assessment of the existing literature<sup>24</sup> and discussions undertaken during this study with a range of stakeholders, we have identified the following six key drivers of commercialisation performance:

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<sup>24</sup> A number of recent reports provide insight into the drivers of commercialisation performance. For instance, a report undertaken for the Australian Government Department of Education, Science and Technology (ACIIC, Howard Partners, Carisgold, 2002, *Best Practice Processes for University Research Commercialisation*, report to DEST, Canberra) detailed a number of success factors for commercialisation of university IP. Some factors included:

- the importance of scale — effective research communication depends first on access to a large enough portfolio of research and second on a breadth and depth of research commercialisation capacity;
- the need for a strong ‘receptor’ capacity in industry (that is, the availability of firms with a capacity to develop IP into new products and services);
- effective commercialisation requires non-disclosure, however, effective research requires sharing of knowledge. A balance between these two objectives needs to be achieved; and
- IP identification is most effectively carried out through decentralised processes close to the researcher, but with effective partnership with the research commercialisation office.

Another source of information in identifying commercialisation drivers is to consider the most commonly cited key impediments to performance. Five commonly cited impediments in the literature are:

- Lack of clear IP ownership (especially in relation to collaborative R&D).
- The tendency of researchers to undervalue returns from commercialising IP in favour of obtaining ongoing research grants.
- The variable quality of university commercialisation agencies.
- Inadequate provision of early stage financing.
- Weak business–university linkages.

These factors are commonly cited in both Australian (for instance in Industry Advisory Group of the University of Melbourne (2003), *Research Collaboration Between Industry and Universities*) and international (for instance in Lambert, R., (2003), *Review of Business-University Collaboration*, Report to the UK Government, December 2003) studies of university research commercialisation.

- the legal frameworks for IP in Australia and IP policies in place in universities – unless ownership of IP is clear and discoveries are disclosed and protected at the appropriate time, commercialisation opportunities are lost;
- the commercialisation management structures and systems in place within universities – the presence, or lack of, structures and systems that ensure commercialisation opportunities associated with IP discoveries are progressed by appropriately resourced and skilled staff will impact commercialisation timelines and outcomes;
- the quality of research being produced by universities – a considerable body of evidence highlights that it is excellent, ground breaking, research that is most likely to eventually generate significant commercial returns. The generation of high quality IP is a necessary condition for the generation of commercialisation outcomes;
- the availability of early stage venture finance – development of a research breakthrough into a commercial product or service requires access to significant levels of risk capital. Early stage development finance can come from universities themselves, venture capital markets, angel investors or companies that wish to bring the product to a marketable stage. In the absence of access to development finance, research breakthroughs are unlikely to be commercialised in a timely fashion;
- the presence of strong local receptor businesses – a significant avenue for the commercialisation of research is its adoption and further development by receptor companies. In the absence of local receptor companies with the knowledge and financial resources required to adopt and develop university research, research may instead be adopted and developed by overseas companies, resulting in the loss of significant economic activity offshore; and
- the behaviour of participants within the research commercialisation system– if relationships between academics, university commercialisation staff, venture capital providers and receptor companies fall short of best practice standards, optimal commercialisation outcomes will not occur no matter what IP policies and legal frameworks are in place.

Each of these drivers can be thought of as a *necessary* condition for the generation of strong commercialisation outcomes. However, none of them in isolation should be seen as *sufficient* conditions for this to occur. All six drivers must be in place for optimal commercialisation outcomes to occur.

The current Australian situation with regard to these key performance drivers is considered in greater detail in Chapters 4 to 7 of this report.



## *Chapter 4*

# Australian IP law and other legislative frameworks that impact university research commercialisation

This chapter examines a key driver of commercialisation performance, namely, Australian IP law and other legislation that has implications for university IP policies and commercialisation management systems. Matters addressed are:

- provisions for IP protection in Australia;
- overseas protection for Australian IP;
- ownership of IP generated in Australian universities;
- record keeping and disclosure of IP;
- identification, protection and management of university IP;
- sharing of profits from commercialisation of IP; and
- four current issues in IP and commercialisation legislation.

### **4.1 Provision for IP protection in Australia**

The Australian Government provides protection for a variety of types of intellectual property.

- Patents provide protection for technological innovations. Standard patents generally provide a temporary monopoly for 20 years with the possibility of an extension for pharmaceuticals. Details of the patent are made public not more than 18 months after lodgement. The innovations must have been new and non-obvious at the "priority date". Lodging a provisional application with the Patent Office describing the new invention usually sets the priority date. Within 12 months of this, a complete application must be lodged. The novel aspects of claims are examined.
- Innovation patents provide protection for eight years, involve a less demanding innovation test and are not examined before being granted.
- Plant breeder's rights provide an alternative or additional means of protecting plant varieties. These rights last for 25 years. For plant breeders' rights to be granted, varieties must meet three criteria: distinctiveness, uniformity and stability. Applications are subject to examination.
- Copyright is available for original literary, artistic and musical works. Copyright is not registered in Australia.
- Trademarks distinguish the provider of particular goods and services and are registered.
- Designs may be registered and provide exclusive use for up to 16 years.

- Circuit layout rights protect the three-dimensional configuration of electronic circuit products or layout designs.
- Trade secrets (keeping an invention confidential) may also be used to protect valuable information. These rely on common law protection of property. Trade secrets may be appropriate in circumstances where the subject is not likely to be discovered by someone else.

Thus Australia offers a full range of measures to protect intellectual property and supports these measures through IP Australia. IP Australia is the federal government agency responsible for granting rights in patents, trade marks and designs. IP Australia incorporates the Patent, Designs and Trade Marks Offices. It is a division of the Department of Industry, Tourism and Resources (ITR) but operates independently and reports directly to the Minister.

#### **4.2 Overseas protection for Australian IP**

Outside Australia, patent protection may be obtained through various treaties and agreements to which Australia is a signatory:

- The Paris Convention, which provides for nationals of one country to be accorded the same treatment in other countries as nationals of those other countries, as well as priority filing rights in those other countries within 12 months of the original filing.
- The Patent Cooperation Treaty (PCT) provides a simple means of simultaneously commencing a patent application in a number of PCT countries. Once a PCT application is lodged in Australia, the Australia Patent Office undertakes a search, which results in a report, usually within 16 months. Subsequently, the World Intellectual Property Organisation publishes the PCT application and individual applications can then be lodged in each country.
- The Budapest Treaty facilitates the protection of micro-organisms by permitting samples to be deposited with recognised authorities. This overcomes the difficulty of describing inventions involving micro-organisms.
- Agreement on Trade Related Aspects of Intellectual Property (TRIPS) requires signatory countries to make patents available for any invention, subject to the usual tests, without discrimination.

#### **4.3 Ownership of IP generated in Australian universities**

Most universities in Australia assert their ownership of IP generated by the researchers who they employ. This is based on employers' entitlements, which arise through:

- terms in employment contracts/agreements or in policies to which the contract/agreement refers;
- by operation of a duty of fidelity that an employee has to an employer; or
- by operation of legislation/regulations.

Other factors which support a university's claim to ownership of IP include the use of university resources to generate the IP, the use of pre-existing IP owned by or licensed to the university, management of staff and students involved in the generation of the IP, the use of university funding or funding obtained by the university and agreements with external funding bodies.

Because students and visiting researchers are not usually university employees, special arrangements need to be made for these individuals, usually by asking to assign their rights to IP, in return for a consideration (this must be done in writing).

As Sydney University notes<sup>25</sup>, students cannot be required to assign their intellectual property in order to qualify for or remain enrolled in a course, or in circumstances where students are involved in activities which are subject to an agreement with a party from outside the University (such as the Australian Research Council (ARC) or a company), unless that student does so freely and with consent. If students wish to participate in any activity that may create intellectual property, then appropriate arrangements must be put in place in advance of that activity commencing. Legal advice for students may be arranged through the student organisations.

#### **4.4 Disclosure of IP**

Australian universities usually require the disclosure of new IP as part of their IP policies. Best practice would make this disclosure requirement part of the terms of employment contracts/agreements. However, there are issues about who the disclosure should be made to and whether the disclosure is subject to a time limit. Disclosure to a Head of Department or Dean is useful only to the extent that the university has in place arrangements to ensure that timely action is taken to assess and, if appropriate, protect the IP.

Most Australian university IP policies contain a requirement not to publicly disclose potentially valuable IP until arrangements to protect it have been made. Some also have a requirement to maintain laboratory notebooks that can be important in establishing precedence dates.

Effective protection of university IP requires employment terms and conditions that require disclosure of IP within defined time limits, mechanisms to ensure action on disclosures and provisions forbidding unauthorised public disclosure of IP.

#### **4.5 Identification, protection and management of university IP**

The rules and procedures for protecting IP are complex and subject to a variety of different timing requirements. Managing IP therefore requires a detailed professional knowledge of the various provisions. This will generally require inputs from patent attorneys and members of the Licensing Executives Society.

While the staff of university technology commercialisation companies and offices are generally aware of the relevant requirements, they usually rely on patent attorneys to ensure that existing patents in the field are checked ('prior art'), claims are appropriately drafted and applications lodged at the appropriate times.

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<sup>25</sup> The University of Sydney, 2002, *University of Sydney (Intellectual Property) Rule 2002*, accessed on 1<sup>st</sup> April 2004 at <http://www.policy.rms.usyd.edu.au/0000031.pdf>

Managing the protection of IP for any new innovation requires a strategy to maximise benefits while minimising risks and costs. Such a strategy needs to:

- take into account the likely countries in which the product or service may be sold;
- ensure that circumvention is made difficult and infringement discouraged; and
- coordinate the timing of applications with licensing discussions and, in the case of pharmaceuticals, testing of the product.

Most university IP policies designate their commercial arm or technology office as responsible for assessing, protecting and managing their IP. While some university policies are specific, in some cases giving the commercial arm or technology office first right of refusal, others leave it open to the Head of Department, Dean or even the researchers themselves as to what they do to protect valuable IP.

#### **4.6 Sharing of profits from commercialisation of IP**

Arrangements for sharing the returns on IP are generally set out in university IP policies. Most of these policies address a situation where IP is licensed and are therefore not easily adapted to spin-off companies. Profits are commonly allocated one third to each of the university, the researchers and their department. Some policies place thresholds and limits on the payments to researchers.

The point at which profits become payable under some of these policies is not well defined. Some university IP policies are not clear on what costs should be deducted from revenues to arrive at a profit. In addition, IP policies are frequently silent on the allocation of part of the profit to the university's commercial arm or technology transfer office. In addition to receiving a share of the profits, the universities' commercial arms need to recover costs, including costs incurred in protecting innovations that have not yet (and may never) yielded a profit.

#### **4.7 Current issues in IP and commercialisation legislation**

Three issues currently causing concern in relation to the management of IP in Australia are discussed below.

##### ***Recent US Court rulings on the experimental use provisions of patent law***

Patent law in the United States and elsewhere commonly contains provisions protecting researchers who make 'experimental use' of patents and patented materials from claims of patent infringement. Recently the US Courts have taken a narrow view of this experimental use exemption.<sup>26</sup>

In relation to US-owned patents, unless the patent use is "solely for amusement, to satisfy idle curiosity, or strictly philosophical inquiry" the experimental use exemption is not available to university researchers.

This outcome has caused concern on the part of university researchers, who may now need to check the patent literature before undertaking a research project and may need to obtain licences from the holders for US patents that they wish to use in their research.

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<sup>26</sup> Madey versus Duke University, 307 F.3d 1351 (Fed. Cir. 2002), cert. denied 156 L.Ed2d 656 (2003).

Other countries' patent legislation (including Japan and EU countries – particularly Germany) has much broader experimental use provisions and it has been suggested that the result may be a diversion of research from the United States to these countries.<sup>27</sup>

The Australian Council on Intellectual Property (ACIP)<sup>28</sup> is examining whether some types of patents are inhibiting research and development in Australia and whether Australian researchers and business would benefit from introducing an experimental use exception provision (or some other provision) into the Australian patent legislation. ACIP has released a discussion paper<sup>29</sup> which examines this issue in more detail.

### ***New South Wales legislation applying to university commercial activities***

The NSW Parliament passed the University Legislation Amendment (Financial and Other Powers) Act in 2001, which updated and clarified university powers in relation to commercial activities and addressed issues of commercial risk. The Act requires NSW universities to develop guidelines to apply to the development of commercial proposals and to maintain a register of commercial activities in order to be granted exemption from the Public Authorities (Financial Arrangements) Act in New South Wales. An exemption from this Act frees universities from the need to obtain the approval of the Treasurer of New South Wales to incorporate a spin-out or to enter into a joint venture arrangement.

This legislation was introduced following expressions of concern by the New South Wales Auditor General about how New South Wales universities control the formation of new business ventures. The Auditor General<sup>30</sup> believes that he should audit such entities.

Most New South Wales universities have submitted draft guidelines for Ministerial approval. However, the Auditor General has criticised aspects of some guidelines, including:

- requiring registration only when an activity exceeds a threshold (\$50,000 at the University of Western Sydney, \$1 million at the University of Sydney);
- avoiding the need for University Senate approval of commercial activities; and
- omitting from the register, the commercial activities of university controlled entities.

Due to the time delays and administrative burdens involved, commercialising intellectual property is obviously going to be much more difficult for New South Wales universities if they have to seek approval from their respective Senates every time they want to licence technology or start up a company. The loss of confidentiality in such reporting will also discourage commercial partners.

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<sup>27</sup> Maebius, S B and Wegner, H C, 2002, *Ruling on research exemption roils universities*, National Law Journal 25, C3.

<sup>28</sup> The Advisory Council on Intellectual Property is an independent body appointed by the government, and advises the Federal Minister for Industry, Tourism and Resources on intellectual property matters and the strategic administration of IP Australia. The Council was established in 1994. The Council's membership reflects a cross section of industry involved with the intellectual property system, and includes individuals from both large and small businesses, the legal and attorney professions and academia.

<sup>29</sup> Available at <http://www.acip.gov.au>

<sup>30</sup> NSW Auditor-General's Report to Parliament, 2003, vol 2.

Other jurisdictions in Australia have been considering legislation similar to that adopted by New South Wales. While the legislation itself is not necessarily problematic, if the State Government, at the prompting of State's Auditor General, insists on universities introducing inappropriate and cumbersome administrative processes for commercialisation activities, effects on commercialisation outcomes would be highly negative.

### ***Effects of the State Acts that Universities are established under***

Raising similar concerns as those outlined above in the context of the recent New South Wales legislation, some universities, due to clauses in their original foundation legislation, may face material constraints on commercial activity. For instance, at the Royal Melbourne Institute of Technology, under the terms of their foundation Act, to set up a spin-off company, the articles of incorporation for the spin-off company must also be approved by the University Council, as must any subsequent amendments to the company's articles of incorporation. They are also currently required to notify the State Education Minister of the company formation and the reasons for it<sup>31</sup>.

Such clauses in the foundation Act of a university may deter investors from entering into commercialisation activities with the university due to both the time delays involved and the potential loss of commercial confidentiality.

Legislative action may be necessary to address the problems currently facing some universities in this area.

It is important to note that University Councils do have an important role to play in overseeing commercialisation activities within the universities. The University Council in should provide general oversight of the overall strategic direction, as opposed to the day to day operations, of commercialisation entities and should establish overall parameters for their operations.

### ***Effects of the actions and attitudes of Auditor Generals***

In addition to the burdens that may be imposed under their foundation Acts, the attitude and actions of the Commonwealth, States and Territories Auditor Generals may also constrain commercialisation opportunities for universities. Auditor Generals, whose role is focussed on overseeing the 'proper' spending of public money, have wide ranging powers to audit all entities related to a university. If the Auditor General holds the belief that universities should not be engaged in commercial activities (as some have suggested is the case in Victoria for instance), the Auditor General will submit consistently negative reports (that are tabled in Parliament) regarding universities risk profiles and exert pressure on Government to introduce inappropriate and cumbersome administrative arrangements for approval of commercialisation activities. Also, potential investors in a spin-off company may be deterred from investing given the loss of confidentiality that the attention of the Auditor General will result in.

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<sup>31</sup> Royal Melbourne Institute of Technology Act 1992, Act No. 45/1992. Section 39 (5)(ba) requires the university to notify the Minister within 30 days after the formation, participation or membership, of the name of the company and the reasons the Council decided that the formation, participation or membership was in the interests of the management or conduct of the affairs of the university. Section 39 (4)(b)(i) requires that the constitution of the limited company provide that the company must not alter the constitution of the limited company unless the council has by resolution authorised the alteration.

## Chapter 5

# Current Australian university IP policies and commercialisation management systems

This chapter examines a second key driver of commercialisation performance, namely, current Australia university IP policies and management systems for research commercialisation. Matters addressed are:

- the general approach taken to commercialisation of Australian university IP;
- the structure of IP commercialisation entities;
- approaches to IP ownership; and
- the approach taken to building commercialisation skills.

### 5.1 General approach to commercialisation of Australian university IP

A number of Australian universities have for many years had technology transfer companies and offices with responsibility, amongst other things, for commercialisation of IP. Nevertheless, until recently there was a tendency for university administrators and government policy makers to see the commercialisation of IP as something that needed to be provided for, but was not necessarily of central importance to the mission of the universities.

The University of New South Wales is notable for having established its commercial arm (Unisearch) in 1959. During the 1970s other Australian universities and (then) Institutes of Technology also established commercialisation arms. In 1978 representatives of seven tertiary education institutions decided to form the Australian Tertiary Institutions Commercial Companies Association (ATICCA).

The commercialisation arms generally had responsibility for technology transfer and technology commercialisation. They often took on other commercial functions including:

- consultancy;
- testing and analysis;
- provision of expert witnesses;
- management of contract R&D;
- management of aid projects;
- provision of education and training services (for example, English language and preparatory course for university); and
- other university-related business activities.

Further progress was made in the late 1990s when some universities (most notably the Universities of Queensland, New South Wales and Sydney) provided their commercial arms (Business Liaison Office in Sydney's case) with the resources necessary to facilitate successful commercialisation of IP on a scale that started to match the opportunities<sup>32</sup>.

Professor Ron Johnson, Director of the Australian Centre for International Innovation and Competitiveness, explains the establishment and operations role of UniQuest as follows:

"...the University invested in UniQuest in 1995 for the purpose of building a professional team and implementing a research commercialisation strategy with a 10-year horizon. In making this investment the University accepted that positive returns were unlikely inside 5 years....A particular feature of the UniQuest approach is the decentralisation of IP identification and refinement to the Faculties. Managers, Innovation and Commercial Development have been appointed to each Faculty to work closely with the Dean on business development, sourcing deals and interfacing with UniQuest's headquarters specialist staff."

Ron Johnson as quoted in Australian Centre for Innovation, Howard Partners, Carisgold (2002), *Best Practice Processes for University Research Commercialisation, Final Report*. A study undertaken for the Department of Education, Science & Training, pages 44-45

In 2001, ATICCA was renamed Knowledge Commercialisation Australasia (KCA). Membership of KCA, which now stands at 46, includes universities, government research organisations and departments, medical research institutes, rural research and development corporations and TAFEs. There are also affiliate members from CRCs and industry. The objectives of KCA are to assist in the development and maintenance of skills associated with knowledge transfer from public sector organisations and to promote the activities of its members in government, industry and commercial forums.

The creation of the Uniseed fund in September 2000 marked a further significant development in the commercialisation of university IP. UQ Holdings/UniQuest Pty Ltd and Melbourne Ventures Pty Ltd (formerly Melbourne University Private) created Uniseed Pty Ltd as a \$20 million "pre-seed and seed venture fund bridging the gap between the research in Australian universities and research organisation and the commercial community of venture capital and investment"<sup>33</sup>.

Flinders Technologies Pty Ltd has also been able to build up a pool of funds used to provide pre-seed funding to bring technology to an investment ready stage. However, unlike the case of the Uniseed fund, this funding pool has been established through reinvestment by Flinders Technologies Pty Ltd of returns from successful past commercialisation activity rather than through new investment from the university itself.

## 5.2 IP Commercialisation entities

The choice of the form of university IP commercialisation entities has a number of dimensions to it including:

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<sup>32</sup> Recent work done in the United Kingdom (reported in the Lambert Report) suggests that before individual universities can achieve the critical mass necessary to support an effectively operating commercialisation arm, a research budget of £20 million (~A\$50 million) per annum (1999 dollars) is required. Interestingly, only 17 Universities in Australia recorded this level of total research expenditure in 2001. One of the recommendations of the Lambert Report is for universities in particular regions to share resources in order to bring about an adequately resourced commercialisation operation.

<sup>33</sup> [www.uniseed.com](http://www.uniseed.com) accessed on 3 March 2004.

- functions to be carried out by the entity;
- its relationship to the university; and
- the level of resources that are available.

The two main choices in terms of the form of university IP commercialisation entities are:

- (1) an internal division which exists within the university administration; and
- (2) an entity which is constituted as a separate, corporate entity but with the university as the majority owner of shares.

Amongst the largest eight research performing universities<sup>34</sup>, six have established (or are in the process of establishing) commercialisation companies while two retain the commercialisation function as an internal division of the university. Amongst the smaller research performing universities however, it appears that the balance between incorporated and internal structures is more even.

The logic for establishing an incorporated entity is that as the entity's purpose is to carry out a commercial function it is appropriate that it has a corporate form with all that implies for governance and the applications of corporations law. Arguments supporting this approach are:

- the board of a company can be so constituted to comprise people external to the university who have the required expertise in licensing of IP and establishing new companies;
- the chief executive of the company can be paid at commercial rates to attract people with the right capabilities;
- external business entities find it easier to deal with a university IP commercialisation company;
- decisions can be taken more quickly;
- risk can be shifted away from the university; and
- resourcing of the company and accounting for it can be clearly defined.

To be effective university IP commercialisation companies need to be:

- well supported by senior university management;
- well resourced; and
- given sufficient time horizons to get established and demonstrate performance.

Nevertheless, some Australian universities – and indeed some well known universities in the United States and Canada – have chosen to adopt the first approach and establish an IP commercialisation unit based inside the university administration. Some advantages of this approach are:

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<sup>34</sup> In Australia there is a significant gap in research expenditure between the eighth and ninth largest research performing universities. The gap in 2000 was \$119m versus \$75 million according to DEST's most recent (2002) publication of *Research Expenditure: Selected Higher Education Statistics*.

- lower establishment and compliance costs. Establishing a company involves considerable costs relating to establishment of a board, registration of the company and filing of corporate statements; and
- the strong and visible support such entities receive from senior university management.

Two of the most highly regarded<sup>35</sup> commercialisation entities in Australia – UniQuest at the University of Queensland and the Business Liaison Unit at the University of Sydney – provide examples of these two alternate structures.

Box 5.1

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#### TWO CONTRASTING EXAMPLES OF UNIVERSITY COMMERCIALISATION ENTITIES

##### **UniQuest Pty Ltd – University of Queensland**

UniQuest was established in 1983 as the technology and consulting company of the University of Queensland.

Its function is to identify and package commercially valuable technologies and expertise from the university and bring them to the market via licensing, venture capital funded start-up companies and consulting activities.

The University of Queensland invested \$5 million equity in UniQuest in 1995 to build an effective team and implement a research commercialisation strategy with a 10 year horizon.

UniQuest is the gateway to venture capital funding through its association with Uniseed a joint venture between the University of Queensland and the University of Melbourne established with a capital base of \$20 million.

##### **Business Liaison Office – University of Sydney**

The Business Liaison Office (BLO) is the commercialisation arm of the University of Sydney. The BLO reports to the Deputy Vice Chancellor (Research)

The BLO is well positioned to establish new ventures. It is seeking "investment ready" opportunities to present to the many investment groups who approach the BLO.

The BLO is the university's single point of contact for discussions relating to IP commercialisation.

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### 5.3 IP ownership in Australian Universities

Almost all Australian Universities assert ownership of IP created by University employed researchers in the course of their work.

The University of Technology Sydney (UTS) has recently formally adopted a policy for ownership of IP where returns are to be equally shared between the inventor, the commercialisation company and the university<sup>36</sup>. It is this one-third, one-third, one-third model for distribution of returns from the successful commercialisation of IP that has emerged as the most common policy position within Australian universities.

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<sup>35</sup> Based on the feedback received from university, business and commercialisation entity stakeholders during the conduct of this study.

<sup>36</sup> Christie, A F, D'Aloisio, S, Gaita, K, Howlett, M J and Webster, E M, 2003, *Analysis of the Legal Framework for Patent Ownership in Publicly Funded Research Institutions*, report to DEST, Canberra.

A recent exception to the approach, of asserting IP ownership and then distributing returns to the university, inventor and commercialisation body, has been the University of Melbourne.

In 2000 the University of Melbourne changed its policy of asserting university ownership of IP and instead decided to assign ownership of all IP to the researchers. In practice, however, much of the IP created by university researchers has occurred within the framework of collaborative projects which often establishes prior claims to IP ownership. Even where IP ownership is not at issue, most researchers lack the time, expertise and funds to commercialise their research and the universities are increasingly seen as responsible for ensuring commercialisation of government funded research carried on in their institution.

The University of Melbourne approach also has accountability problems as institutional oversight of the commercialisation of publicly funded research is weak. The University does not provide any oversight of the commercialisation activities of staff to whom ownership of IP has been transferred.

*National Principles of Intellectual Property Management for Publicly Funded Research Guidelines* issued in September 2001 by a number of Commonwealth Government agencies including the ARC and NHMRC make the position of the Commonwealth granting bodies on IP ownership and commercialisation very clear, placing the responsibility on grant recipients and their institutions.

The role of the researchers in determining commercialisation pathways is often quite significant. Many researchers are not interested in setting up spin-off companies. They often see royalties as a distant second best to arrangements that provide immediate additional funding for their research and are prepared to give up IP at low price to get this additional funding. This makes the task of the university commercial arms more difficult.

The growth in university involvement in collaborative research, especially since the creation of the Cooperative Research Centres Program in the early 1990s, has provided new challenges in relation to attribution of IP ownership. CRCs are required to address the issue of IP in their legal and governance arrangements. Some CRCs, particularly those that are unincorporated, have IP policies that, in essence, state that they rely on the IP policies of their member institutions. This creates uncertainties that make IP commercialisation much more difficult.

The CRC Review reported that:

The (CRC) joint venture structure also creates extraordinary problems and tensions in relation to intellectual property, where universities especially tend to jealously defend their 'right' to patents, and the 'cultural' rights that university staff have in this regard. Invariably, there are disagreements in relation to the value of Intellectual Property when it comes to commercialisation negotiations.

Howard Partners, 2003, *Evaluation of the Cooperative Research Centres Programme*.

However, some CRCs, such as the Photonics CRC, have been successful in commercialising research through a range of different mechanisms.

#### **5.4 Approach taken to building commercialisation skills**

The skills of staff entrusted with research commercialisation are of critical importance. In Australia, Knowledge Commercialisation Australasia (KCA) is one of the main sources of this training. KCA provides professional training at its meetings twice per annum and via its newsletter. Following a recent decision, KCA will be providing training materials on its website.<sup>37</sup>

In addition, universities are seeking to improve the entrepreneurial and commercial awareness of both PhD students and research staff through use of study modules, courses and seminars.

The Australian Institute for Commercialisation (AIC) also plays an active role raising researchers commercialisation awareness and skills. Its 'Commercialisation Workshop' program (Box 5.2), developed jointly by the AIC and UniQuest Pty Ltd, the commercialisation company of the University of Queensland, is a leading example of such activity.

The Workshop has been run twice at the University of Queensland with PhD students and early career researchers from all faculty units and in New South Wales by the Warren Centre at the Australian Technology Park as a cross institutional program between the Universities of Sydney and NSW Engineering Faculties. The AIC is increasing resources to deliver this program in 2004 to universities and public sector research agencies for their students and researchers.

The Intellectual Property Research Institute of Australia, a national centre for multi-disciplinary research on the law, economics and management of intellectual property, also runs regular seminars and disseminates research publications relating to intellectual property management.

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<sup>37</sup> See <http://www.kca.asn.au/>

Box 5.2

**COMMERCIALISATION WORKSHOP STRUCTURE, GOALS AND OUTCOMES**

Structure

Each workshop had 40-45 participants, selected from double the number of applicants through a competitive process to attend the workshop. The workshops have been delivered as both a 2 day residential program at a conference centre or as a day delivery program with associated social events. All the workshops to date have been sponsored by the AIC and other stakeholders.

The Chief Scientist opened the first workshop and others presenters have included experienced CEOs of start-up companies, research scientists who have left the traditional academic environment and moved to more commercial careers, experienced lawyers and patent attorneys, investors and industry representatives.

Goals

The goals of the workshops are to:

- Inform researchers about the basic principals of research commercialisation.
- To provide researchers with opportunities to network within and across disciplines, and with research commercialisation professionals.
- To promote the hosting institution's technology commercialisation policies, practices and objectives.

Outcomes

Measurable outcomes from the workshops held to date (detailed follow up surveys were completed by attendees) include:

- Market demand for such a program has been confirmed with double the number applications to attend received but limited to 40-45 based on a competitive selection process. Around 40 is considered to be ideal for networking.
- Overall extremely positive response rate determined through detailed questionnaire and follow up with a selection of participants. An average of >88% of attendees would recommend the workshop to others.
- One third of participants have indicated the workshop had changed the direction of their future career with over 60% believing it helped them focus their career direction.
- Over 90 per cent of attendees felt the workshop enabled them to understand commercial realities more clearly and felt the workshop has increased the knowledge and skills they needed to acquire in order to commercialise their research.
- 100 per cent of participants understood that commercialisation is a team effort and felt that the workshop had helped them understand the complexity of the commercialisation process.
- After attending the workshop, over 90 per cent of attendees felt they understood where they need to go to get assistance to commercialise their research.
- The participants at the University of Queensland have formed an alumni group to meet on a regular basis for further seminars to enable further networking.

Source: Australian Institute for Commercialisation and Uniquist Pty Ltd, (2003), *Commercialisation Workshop Evaluation Report*

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## Chapter 6

# Assessment of the quality of university research, the availability of early stage venture finance and the status of local receptor industries

This chapter explores three more drivers of commercialisation performance, namely:

- the quality of research produced by Australia's universities;
- the availability of early stage venture finance; and
- the presence of strong local receptor industries.

### 6.1 Quality of research being produced by universities

The quality of research produced by Australia's universities fundamentally underpins the prospects for commercialisation of this research.

This is because not all publicly funded research is equally likely to play a role in the development of applied technological innovation. Research conducted by CHI Research<sup>38</sup> indicates that the publicly funded research papers most cited in US patents are preferentially drawn from the most highly cited, high-quality research. A US research paper in the most highly cited 1 per cent of scientific papers is 9 times as likely to be cited in a patent as a randomly chosen US paper.

Furthermore, in The Allen Consulting Group (2003) report for the Australian Institute for Commercialisation, some of the most significant commercialisation events involving publicly funded research in Australia over the past two decades were considered. What this analysis showed was that the two true 'star' performers over this period (Cochlear and ResMed) were companies that were built upon truly groundbreaking research rather than on the development of incremental improvements to existing knowledge. The research upon which these companies were based actually created new markets for categories of products that did not previously exist.

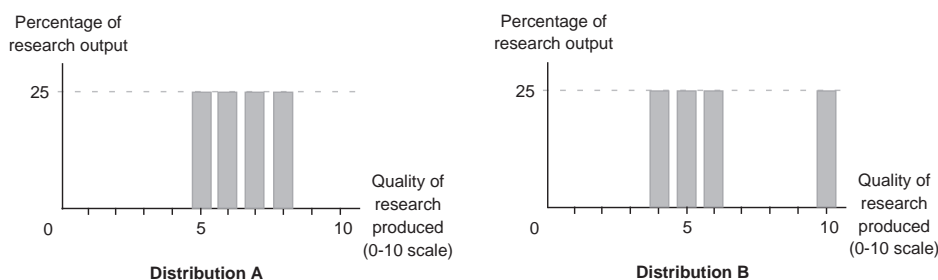
In terms of impacts upon commercialisation prospects, it therefore appears that it is the level of production of research at the top end of the quality spectrum, rather than the average quality level of research, that is most likely to impact upon commercialisation prospects. For instance, as shown in Figure 6.1, the distribution of research across the quality spectrum presented in Distribution B would probably be more supportive of commercialisation prospects than the distribution of research across the quality spectrum presented in Distribution A, despite the fact the average quality of research in Distribution B is lower (average of 6.25) than in Distribution A (average of 6.5).

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<sup>38</sup> CHI Research, (2000), *Periodic Newsletter*, Vol. VIII, No.1, July 2000

Figure 6.1

**THE DISTRIBUTION OF RESEARCH ACROSS THE QUALITY SPECTRUM**



What then is the current status of research being produced by Australian universities?

The answer to this question is, of course, highly complex with a great variety of performance existing across different fields of research and across different universities. While it is not within the scope of this paper to make a detailed assessment of research quality within Australian universities, some overall measures of research quality are included below.

Reflecting the diversity in performance across research fields, an investigation into the link between patenting and basic science in Australia<sup>39</sup>, for instance, found that while Australia appeared strong in biotechnology and biomedical research it appears to be relatively weaker in areas such as IT research.

In terms of assessing the overall quality research produced in universities, the most common measure used to is citation rates for published research papers. While citation rates are by no means perfect indicators for research quality, they do provide perhaps the best widely available and internationally comparable proxy data for assessing a university's research quality<sup>40</sup>.

A number of submissions to the recent Commonwealth Evaluation of Knowledge and Innovation Reforms have noted that while the Australia's share of global scientific papers increased over the 1990s the relative impact of these papers has declined to levels below those of most OECD countries<sup>41</sup>.

<sup>39</sup> Narin, F., Albert, M., Kroll, P., Hicks, D., (2000), *Inventing Our future: The Link Between Australian Patenting and Basic Science*

<sup>40</sup> Evans, D.J. and White, J.W., (2002), *Australian Universities Classification by Research Quality: A Question of Concentration and Quality*

<sup>41</sup> See for instance the Australian Academy of Science's submission to the review.

A number of respondents supported the hypothesis, proffered by Butler in her 2000 study that provides the empirical evidence underpinning this observation<sup>42</sup>, that this decline in impact has been driven by university research funding formulas rewarding the publication of papers without accounting for the quality and impact of these papers<sup>43</sup>.

Evans and White, in a submission to the Nelson Review of Higher Education in Australia, have conducted some interesting analysis of international citation data in order to assess the quality of Australian university research against leading international universities<sup>44</sup>.

They have used a one-hundred point ranking scale across 21 research fields, where a score of 100 goes to the university with the highest number of citations in the field and a score of 1 goes to the university with the one-hundredth highest number of citations in the fields (universities not in the top one-hundred receive a 0 score). Scores received for each of the 21 research fields are added to provide an overall research score for universities (a score of 2100 would indicate that a university is the top rated globally in every research field while a score of 0 would indicate it is not in the top one-hundred globally in any research field).

They found that the United Kingdom had six universities with a higher rating than any Australian university, Canada and Japan had four, the Netherlands and France two each, Switzerland and Sweden one each and Germany and Israel none.

Given that total citations will be heavily influenced by institution size, they then repeated the ranking process using citations per published paper, rather than the absolute number of citations, as the criteria – thus removing to an extent the bias towards larger institutions in the rankings<sup>45</sup>.

They found that the United Kingdom on this measure had seven universities with a higher rating than any Australian university, Canada, Switzerland, Germany and the Netherlands four each, Sweden two, France and Israel one and Japan none.

When adjusting for population and GDP, they conclude that Canada, Switzerland, the Netherlands and Sweden are outperforming Australia in terms of overall university research quality. Their results also support the contention that the relative impact of Australian papers (as measured by citations per paper) is lower than in many other OECD countries.

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<sup>42</sup> Butler, L., (2000), *Monitoring Australia's Scientific Research*

<sup>43</sup> Another possible explanation for the relatively low impact of Australian university research papers could be that research funding per researcher is relatively low in Australian higher education – which in turn may reduce the quality of research produced. The OECD STI Scoreboard 2003 shows that Australia ranked 13<sup>th</sup> in the OECD in relation to the share of GDP allocated to higher education sector research whereas Australia had the 2<sup>nd</sup> highest number of number of higher education researchers as a percentage of the labour force for all OECD countries – suggesting that higher education research funding is spread relatively thinly in Australia compared to most OECD countries (only three countries: Poland, Spain and the Slovak Republic had a higher ranking difference on these metrics than Australia).

<sup>44</sup> Evans and White, *op.cit.*

<sup>45</sup> Of course larger institutions are still likely to feature more prominently as they are more likely to have strengths across a wider range of the 21 research fields considered.

If citations per paper are indeed a reasonable proxy for research quality, the declining impact of Australian scientific papers would carry negative implications for future commercialisation prospects in Australia. However, as was shown in a recent bibliometric study released by the Australian Research Council<sup>46</sup>, the quality of research performed across universities and within each university varies considerably. It is not clear, based on the available analysis of average quality/impact figures, how Australia's production of research at the highest end of the quality/impact spectrum compares to that of other OECD countries. As illustrated in Figure 6.1, it is the extent to which highest quality research is being produced that is likely to be a bigger driver of commercialisation prospects than the average quality of research. It is therefore unclear the extent to which the current quality of university research in Australia is placing us at an advantage or disadvantage regarding commercialisation of research when compared to other OECD countries.

It is not within the scope of this study to consider mechanisms for maintaining and where possible improving the quality of research conducted in Australian universities. However, it should be acknowledged that research quality is, and will remain, a key driver of commercialisation outcomes and therefore must remain a fundamental priority for our universities. This is an important point for policy makers to keep in mind when making decisions regarding both the quantum and distributive mechanisms for public funding of university research.

## **6.2 The availability of early stage venture capital**

During the late 1990s the lack of access to early stage venture capital was identified as a major problem in Australia. This was a major issue covered at the 2000 Innovation Summit.

Australia was identified to be in the lower half of OECD countries in relation to the availability of venture capital. Over the 1998-2001 period, Australia ranked 15<sup>th</sup> in the OECD in relation to investment in venture capital as a percentage of GDP<sup>47</sup>. When only early stage venture capital is considered, Australia was ranked equal 18<sup>th</sup> in the OECD (tied with Spain and Poland). Perhaps of even greater concern than these rankings, is the fact that Australia ranked 26<sup>th</sup> (ahead of only the Slovak Republic) in terms of the percentage of total venture capital that is allocated to high technology industry sectors<sup>48</sup>.

A key exception to the relatively low levels of venture capital investment as a percentage of GDP in Australia is in the biotechnology sector. In 2001, Australia ranked 6<sup>th</sup> in the OECD (Australia is significantly lower than Canada and the US but only slightly lower than Belgium, Germany and Denmark) in terms of biotechnology venture capital as a percentage of GDP. On this measure, Australia records levels of relative investment more than triple that in countries such as the United Kingdom, Norway, the Netherlands, France, Finland and Korea – all countries that we trail in terms of overall investment in venture capital as a percentage of GDP.

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<sup>46</sup> Butler, L., (2004), *ARC-supported research: the impact of journal publication output 1996-2000*

<sup>47</sup> OECD, (2003), *Science, Technology and Industry Scoreboard 2003*

<sup>48</sup> Ibid

However, since 2000, a number of government programs, at both the Commonwealth and State level, and several university initiatives (outlined below) have been introduced with the aim of improving access to early stage finance. As a result of such initiatives, it does appear that the situation in relation to availability of early stage venture finance is now improving considerably.

### **Recent programs introduced to improve access to early stage finance**

#### **Commonwealth Government programs**

The Commonwealth Government as part of its set of policies to enhance the prospects for the development of the Australian ICT sector put in place a significant program aimed at strengthening the prospects for the successful incubation of ICT technology-based start-ups. The Building on IT Strengths (BITS) incubator program provided over \$70 million to establish an ICT incubator in each capital city. The \$40 million Intelligent Island program subsequently provided \$40 million for a range of measures to enhance the Tasmanian ICT sector, including establishment of an ICT incubator.

As part of its Biotechnology Strategy, the Commonwealth Government also established a Biotechnology Innovation Fund (BIF) to provide seed capital to biotechnology-based start-ups.

In 2000 the Commonwealth Government in order to improve the prospects for commercialisation introduced the Commercialisation of Emerging Technologies (COMET) scheme.

A further boost to the commercialisation process was contained in Backing Australia's Ability. As well as providing additional funding for COMET and BIF, the Commonwealth Government also introduced a new Competitive Pre-Seed Fund for universities and public sector research agencies. Under the program, four fund managers have been selected to invest more than \$100 million in projects or companies spinning out from university or public sector research agencies. The Commonwealth Government contributed \$72.7 million to these funds. The lack of pre-seed capital was a gap identified by a number of participants in the February 2000 Innovation Summit.

More recently actions have been taken through the taxation provisions to attract venture capital investments to Australia by the tax exempt US superannuation funds.

In the recently announced extension to the Backing Australia's Ability statement, *Backing Australia's Ability - Building Our Future through Science and Innovation*, funding was extended through to 2011 for a number of key innovation support programs such as COMET and the Pre-seed funds while the new Commercial Ready program will draw together and extend the R&D Start program, Biotechnology Innovation Fund and parts of the Innovation Access Program.

Taken together, these actions have improved the prospects for the successful commercialisation of university R&D.

Also influencing the potential for commercialising publicly-funded research is greater focus on ensuring that publicly funded research institutions have appropriate IP management practices in place – the ARC for instance has supported the development of best practice guidelines for management of IP.

### *State and Territory Government programs*

Since the mid 1990s State and Territory governments, reflecting the judgement that innovation is central to future growth and employment in the emerging knowledge economy, have become strategic investors in their science and innovation systems. This represents a step change beyond their longstanding practice of investing in elements of the research base necessary to support State and Territory government direct responsibilities in the areas of resource development, public health and the environment.

As State and Territory government investments in science and innovation programs are designed ultimately to contribute to economic development, these government investments in science and innovation have had a significant focus on improving pathways and support for the commercialisation of research. This has been done by way of business incubation support, technology commercialisation skills support and the provision of start-up grants and venture capital funding.

Recent examples of a number of State Governments' willingness to invest in elements of the commercialisation process include:

- the Victorian Government in its Science Technology and Innovation first generation initiative, which had an allocation of \$310 million, provided \$20 million for a Technology Commercialisation Program. Its second generation STI initiative provides \$30 million for Building Innovative Businesses;
- the Queensland Government established BioStart, a \$6 million investment, designed to assist young start up companies by providing early stage financing to get to the proof of concept stage. A \$100 million BioCapital fund, administered by the Queensland Investment Corporation, has also been established to provide venture capital for biotechnology companies. Queensland also has The Innovation Start Up Scheme, which provides grants of up to \$80,000, to promote innovation and commercialisation for early stage companies. Thus far, \$2.7 million has been granted through this program;
- the South Australian Government has recently established a Bio Innovation SA Pre-seed Fund (with funding of \$4.5 million over four years) administered by Bio Innovation SA (South Australia's key body for public/private partnerships in innovation). In the 2003-4 budget, the State Government allocated new funding towards a number of new initiatives to enhance science and innovation capabilities, these included the establishment of a Venture Capital Fund (\$11.4 million over four years), to be managed by a Venture Capital Board;
- the New South Wales Government, as part of its BioFirst Strategy, has introduced the BioBusiness program. This program provides funds and support to assist the growth of companies and the commercialisation of research outcomes for the global market. Support includes marketing, information forums, conferences and financial support for proof of concept. In 2003, the New South Wales Government provided \$659,850 to seven NSW biotechnology companies under its Proof of Concept Program;
- the Australian Capital Territory Government, in its Economic Whitepaper released in late 2003, announced that an investment fund will be established to better leverage commercial outcomes from the ANU.

### *University initiatives*

Some relatively recent developments within the Universities themselves have also focused on increasing the supply of early stage finance. A notable example is Uniseed Pty Ltd which was established in 2000 as a joint venture pre-seed and seed fund between UQ Holdings Ltd/UniQuest Pty Ltd and Melbourne University Ventures Ltd, the commercial arms of the University of Queensland and the University of Melbourne respectively. The fund was established with capital of \$20 million. Similarly, the University of New South Wales, over 1999 and 2000, provided \$10 million in capital to Unisearch, the university's commercialisation arm, for use in such very early stage IP development activity.

### **6.3 The presence of strong local receptor industries**

Despite a very recent upturn in business R&D, with business expenditure on R&D as a percentage of GDP rising from 0.73 per cent in 2001 to 0.78 per cent in 2002<sup>49</sup>, based on a wide range of measures it is clear that Australian business spends relatively less on R&D than business in most other OECD countries.

The 2003 OECD STI Scoreboard shows Australia ranked 19<sup>th</sup> in terms of business R&D expenditure as a percentage of industry value added. Australia's business R&D intensity is less than a third that of Sweden, Finland, Japan and Switzerland and is less than half that of the United States, Korea, Iceland, Germany, Belgium and France. Also, all but one (the Slovak Republic) of the countries ranked lower than Australia recorded higher rates of business R&D growth than Australia between 1995 and 2001.

When business R&D is broken down by broad industry sector, several interesting points emerge. Australia ranks 2<sup>nd</sup> (of 19 countries for which data is available) in relation to the share of services in business R&D (40 per cent share compared to OECD average of around 23 per cent). In relation to manufacturing sector R&D, Australia ranks 2<sup>nd</sup> in proportionate spending on medium-low and low technology, 5<sup>th</sup> in proportionate spending on medium-high technology and 14<sup>th</sup> in terms of proportionate spending on high technology.

The low overall level of business R&D expenditure in Australia, the relatively high share of this occurring in services and the relatively low level of spending on high technology manufacturing R&D is not particularly surprising given the make up of the Australian economy. As an economy, Australia has relatively high focus on resources, agriculture and services and a relatively low focus on manufacturing and in particular advanced manufacturing.

Given that many of the largest returns from direct commercialisation of research have been realised in advanced manufacturing industries, the make up of the Australian industry base does most likely act as a constraint on the generation of returns from the commercialisation of university research.

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<sup>49</sup> Intellectual Property Research Institute of Australia (2003), *R&D and IP Scoreboard 2003*

Australia simply does not have the same depth of local business receptors for research in high technology fields such as ICT, aerospace and pharmaceuticals as in the leading developed countries<sup>50</sup>. This is not necessarily a surprising situation as Australia, when compared to many developed countries, has a comparative advantage in resources and agriculture. However, the relative lack of high technology industries in Australia, which do tend to be the drivers of commercialisation and university-business research collaboration in the US, is something that should be kept in mind when comparing Australian returns from the commercialisation of university research with those obtained in countries with bigger and deeper high technology industry bases. Nevertheless, there are outstanding examples of both technology transfer and commercialisation of university generated IP relating to Australia's resource based industries and growing service industries.

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<sup>50</sup> Highlighting the key role played by ICT and advanced manufacturing in business R&D, even in Australia, where these sectors make up a smaller share of economic activity than in many developed countries, 14 of the 20 largest business spenders on R&D in 2002 were in the ICT or manufacturing sectors. (IPRIA, 2003, *R&D and IP Scoreboard 2003*). Also, a report by the Industry Advisory Group of the University of Melbourne (IAG, 2003, *Research Collaboration Between Industry and Universities*) notes that researchers in engineering, biosciences and physical sciences tend to undertake more collaborative projects with industry.

## *Chapter 7*

# **Perspectives of the current behavioural features within the Australian university research commercialisation system**

This chapter explores a final key driver of university research commercialisation performance, namely the behavioural features evident within the commercialisation system.

The existing literature on the behavioural features of the Australian university research commercialisation system is quite limited. In order to fill this gap, we conducted a number of interviews with university research commercialisation practitioners, university management, researchers, industry stakeholders, and venture finance providers. We then developed a number of case studies (set out in full in Appendix A) focused on the behaviours exhibited by those practitioners involved in the case studies.

### **7.1 Perspectives from universities**

#### ***Internal university issues***

A number of internal difficulties encountered in commercialisation activities were raised by research commercialisation staff, researchers and university administrators. These issues can be categorised under the broad headings of culture, skills, resourcing and administrative processes.

#### ***Culture***

A starting point for a number of interviews was the proposition that the culture of universities and business is different. The drivers for the universities are education and research, while the driver for business is 'the bottom line'.

The key cultural issue raised was, while the profile and acceptance of commercialisation activity amongst researchers has increased in recent years, some researchers are still either are not interested in commercialisation<sup>51</sup> or believe that the university should not be claiming IP rights over their research.

This issue directly impacts upon the IP disclosure process. The level and timeliness of IP disclosure by researchers tends to vary significantly within institutions and appears to be heavily influenced by the attitudes of the individual head of faculty.

Researchers were categorised into three groups by one research commercialisation manager:

- informed about commercialisation issues and diligent in disclosure of IP;
- not informed about commercialisation and simply focused on the need to publish; and

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<sup>51</sup> Internal university issues, such as the lack of reward and recognition for involvement in commercialisation activity, and external issues, such as government performance indicators (for determining allocation of research funding) being focused on publication rather than commercialisation activity, where seen as contributors to this lack of researcher interest in commercialisation.

- actively resistant to the idea that they should be disclosing IP to the university commercialisation arm.

Furthermore, it appears that what group the head of a faculty falls into largely drives the behaviour of researchers within the faculty. A frustration expressed by commercialisation staff was that while employment contracts clearly state an obligation for researchers to disclose IP discoveries to the university, in reality, failure to do so does not result in any censure.

A negative consequence of some researchers falling into the 'not informed' or 'actively resistant' categories, is that such researchers are highly unlikely to be willing to become actively involved in the commercialisation process. The lack of researchers willing to become the chief technology officers of a new company that is established to commercialise their research is a constraint on the number of start-up companies that can either be formed, or if formed, expected to succeed.

By contrast, the powerful positive role that an actively engaged researcher can play in the development of a spin-off company is illustrated in the example of ACYTE Biotech (Box 7.1).

Box 7.1

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#### **ACYTE BIOTECH**

ACYTE is a biotechnology based company formed by Unisearch to commercialise IP developed by leading researchers Professor Peter Gray and Associate Professor Noelle Sunstrom from the University of New South Wales, in the area of mammalian cell expression of recombinant DNA derived proteins.

While looking to become an early stage producer of purified cell lines for large pharmaceutical groups its initial strategy has been to work with large international pharmaceutical and biotechnology companies to prove the technology. This provides ACYTE with the cashflow to complete its development programme whilst obtaining acceptance of this new approach from leading industry players.

The commercialisation phase commenced in July 2001 and over the past two years the company has generated gross income in excess of \$1.8 million. Of this approximately 50 per cent has been derived from international pharmaceutical and biotechnology companies, 25 per cent from local biotechnology companies and 25 per cent from government grants.

To date the company has been self-funding, although it is recognised that as it moves into a marketing phase that additional capital will need to be raised, most likely through partnerships with leading industry players.

Based on discussions with Unisearch and Professor Gray, perhaps the key lesson to emerge emerged from the ACYTE experience is that, while it took some time to reach, the adoption of a true partnership approach between Unisearch and the researchers involved was crucial to the development of the company. For the company to succeed, the commercialisation staff and the researchers needed a shared goal of creating a sustainable long-term business rather than a goal of maximising short-run financial returns.

Both Unisearch and the researchers have provided capabilities essential to the development of ACYTE. The researchers have entrée to the key industry forums that has allowed the technology to be brought to the attention of potential contract research customers. Also, without the continued involvement of the lead researchers, the company would not have the technical capabilities required for it to operate. Unisearch has provided required high quality accounting, company structuring and license/contract negotiation skills.

Promotion criteria for research academics also influence the behaviour and culture of researchers. Promotion criteria currently tend to focus heavily on traditional research performance measures such as publications and citation rates while measures of commercialisation activity – such as licensing revenue generated from IP discovered or the establishment (and subsequent level of success) of spin-off companies based on an academics research – are rarely looked at. This clearly results in 'career' academics having little personal incentive to devote time to commercialisation activities.

On a positive note, the attitudes of researchers do not appear to be fixed and a number of relatively straightforward actions could enhance awareness of the merits of commercialisation and improve attitudes towards engagement with commercialisation activity. Key actions that can generate positive changes in culture include:

- university commercialisation arm staff having an active presence in the faculties, regularly giving presentations to researchers and talking to heads of faculty; and
- conducting formal training sessions such as the commercialisation workshops developed by UniQuest and the Australian Institute for Commercialisation.

However, unless employment, promotion and recognition systems also provide incentives for researchers to engage in commercialisation activity, cultural change will be hard to achieve.

Unfortunately, it appears that not all university commercialisation arms have the resource levels required for them to engage in such culture change initiatives.

Culture is also an issue in relation to the attitude to commercialisation adopted by senior university managers. A number of university commercialisation staff pointed to pressure they receive from senior university management to focus on maximising short run financial returns to the university rather than on developing university IP with a view to maximising long-run benefits for the university and Australia more broadly.

### *Skills*

Skills issues arise both in relation to the skills needs of commercialisation arms of universities and the level of commercial skills amongst researchers.

University commercialisation arms need access to a wide range of skills. These include both generic skills – such as contract preparation, deal negotiation, IP valuation and IP protection skills – and technology specific skills – such as technical knowledge, access to market specific networks and knowledge of particular product markets. It is often hard to source all of these skills amongst a relatively small number of professional staff, so it is important that commercialisation arms have the resources to allow them to outsource certain activities to specialists as the need arises. A lack of critical mass is cited as a constraint upon many commercialisation arms building an appropriate skills base.

In relation to the ability to attract staff, one of the benefits cited for the incorporated entity structure for university commercialisation arms is the flexibility this provides them to offer competitive salary packages to key staff. While it is acknowledged that salaries offered may still trail market rates, with new staff often having to take a pay cut to join, the ability to offer staff a share of future commercialisation returns is one tool that assists commercialisation companies in attracting and retaining staff.

Amongst researchers, a difficulty that may arise due to a lack of skills and experience, is a tendency to take an overly optimistic view of technology that is in its early stages of development and to consequently over-promise to industry or investors in relation to likely outcomes from research being undertaken. This optimistic outlook, combined with a limited understanding of the high costs associated with developing an idea into a marketable product, may also explain why some researchers tend to have unrealistically high expectations regarding the market value of their early stage research.

### *Resourcing*

To operate optimally, a commercialisation entity must have the resources that allow it to:

- effectively manage the level of deal activity being generated by university research activities – a general rule of thumb is that one professional manager can handle up to four or five projects at any given time;
- maintain networks with industry and finance providers – networks need to be built and maintained across an often wide range of discrete technology areas;
- maintain an up-to-date knowledge of technology and market developments – this also needs to occur across a range of technology and market areas;
- meet costs associated with the protection of IP – such as costs associated with taking out and defending patents;
- access specialist service providers as necessary – such as IP attorney services;
- maintain an active presence within the University research faculties – in order to ensure early identification of potentially valuable IP and to support culture change amongst researchers; and
- access capital to support the development of IP to an investment or customer ready stage – for instance, amounts of between \$50,000 and \$300,000 may commonly be required to further develop an initial piece of IP to the point where it's value can be demonstrated to potential investors or buyers/licensors.

It appears that currently only a small number of university commercialisation entities have the resources required to undertake these activities. Fewer still have the resources required to undertake further value adding activities such as offering incubator services.

An example provided by Flinders Technologies Pty Ltd of perhaps the most common form of industry-university commercialisation interaction, namely the licensing of technology, illustrates that licensing arrangements require considerable commitment of time and effort if successful outcomes are to be obtained (see Box 7.2).

Box 7.2

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#### LICENSING ENZYMATICS METHODS FOR MEASURING IONS

In 1987 (the late) Professor Michael Berry (Professor Medical Biochemistry Flinders University) advised Flinders Technologies Pty Ltd of his invention for measuring ions such as sodium and potassium.

The rights to manage the intellectual property were transferred to Flinders Technologies. Clinical chemistry assays for sodium and potassium are the most commonly ordered throughout the world. However, our technology had competition from alternative technologies and the medical diagnostics market is dominated by large trans-national companies. We added technical and commercial value to the invention through clinical trials, patent applications and market studies.

A licensing strategy was devised, targeting large diagnostic companies, that would secure funds for further R&D on the invention and optimise market penetration. Discussions were held with several companies under confidentiality agreements.

An exclusive License and R&D agreement was negotiated with a large European company. This provided significant license fees and minimum royalty payments. The agreement was terminated in December 2000 with a large payment and all of the intellectual property rights reverted to Flinders Technologies (about 30 patents & manufacturing know-how).

Flinders Technologies subsequently negotiated non-exclusive licenses with other 5 companies in different geographic regions of the world. One of these companies was NASDAQ listed and the technology was crucial for their business. During 2003, Flinders Technologies had negotiations to sell the patents and the other non-exclusive licenses to the NASDAQ company. The final stage was the sale in December 2003 of a portfolio of 29 patents and 4 non-exclusive licenses for a 7 figure sum to a NASDAQ listed company. This was the culmination of about 16 years technical and commercial effort.

Over the years, large sums have been provided to Flinders University from commercialisation of the enzymatic methods invention to the benefit of the inventor, the university, the medical school and hospital.

Some lessons learnt by those involved in this process have been that:

- Long term strategies may be required to optimise research commercialisation.
- Professional management of intellectual property is crucial.
- Adding value to intellectual property arises through both technical and commercial activities.
- Understanding markets and the needs of target companies is crucial for successful deal-making.
- Things never go exactly as expected: it is prudent to have a professional IP manager like Flinders Technologies to carry the risk.

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UniQuest, the commercialisation arm of the University of Queensland, which was uniformly nominated in discussions with university, business and commercialisation stakeholders as representing current best practice amongst Australian university commercialisation entities<sup>52</sup>, illustrates the outcomes that can be achieved with appropriately resourced technology commercialisation activities.

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<sup>52</sup> This accords with findings from the ARC funded study (1999), *University Research: Technology Transfer and Commercialisation Practices*, which found that overall the university of Queensland model comes very close to best practice for research commercialisation in a well-established institution.

In 2002, UniQuest's technology commercialisation division had a full-time equivalent of 9 staff<sup>53</sup> (in addition to a network of innovation and commercial development managers located in University of Queensland faculties) and in 2002 it spent almost \$1.5 million on external patent fees. In 2002, UniQuest's technology commercialisation division generated commercialisation revenues of \$39 million.

Based on the tasks that a commercialisation entity needs to undertake to operate effectively, an annual operating budget of at least \$2 to \$3 million per annum (including seed funds used to develop IP) would appear necessary for performance of their technology commercialisation function<sup>54</sup>. For the majority of Australian universities with research budgets of less than \$100 million per annum, such a commitment of funds to commercialisation activity may not be justifiable.

For smaller research performing institutions, sharing of commercialisation resources across multiple institutions may be necessary for an appropriate scale of activity to be reached and sustainably funded.

The actions of universities have a significant impact on the ability of their commercialisation entities to operate effectively. Some universities have demonstrated a strong commitment to building an effectively scaled commercialisation operation<sup>55</sup>. However, many universities have not made such commitments and indeed one has been mentioned as consistently removing any capital that their commercialisation entity manages to build up through their operations (the commercialisation entity uses such capital to seed fund the further development of university generated IP) as 'special dividend' payments to the University.

#### *Administrative processes*

Commercialisation is a time sensitive process. Administrative delays imposed on the process negatively impact on the prospects for successful outcomes being achieved. Therefore, the administrative processes that a commercialisation entity must follow in order to finalise a deal are an important issue in the university commercialisation management system.

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<sup>53</sup> A number of administrative and senior management staff work across multiple Uniquet divisions, which, in addition to the Technology Commercialisation Division, include the Consulting and Research Unit and the International Projects Division.

<sup>54</sup> University technology entities are also often responsible for managing the contract research activities of the university and the provision of expert advice (on contract) by academics. These functions are to an extent quite different in nature to the commercialisation activities that are the focus of this report. The significance of contract research and expert advice activities is illustrated well through the example of Unisearch, where in 2002 \$5.3 million of their \$19 million in operating income was generated through technology commercialisation compared to \$9 million raised from expert legal services provision and \$4 million from other consulting activities that they broker. Of the \$6.2 million in operating expenses not incurred as cost of sales (\$3.4, \$5.4 and \$3.5 million in cost of sales were reported for technology commercialisation, expert legal services and other consulting respectively), perhaps \$3-4 million can be linked to the 'commercialisation' activities of Unisearch.

<sup>55</sup> For example, the University of Queensland which made a large investment in UniQuest in the mid-1990s and then in 2000 invested (with the University of Melbourne) in the formation of Uniseed, and the University of New South Wales which has provided \$10 million in capital for a seed stage investment fund that is managed by Unisearch.

It appears that the administrative processes in place differ significantly across universities. This is true of both the degree of internal university administrative processes that must be followed and of the administrative processes placed on universities by State Governments. A comparison of the administrative processes involved in signing-off a deal at RMIT and Unisearch (UNSW) illustrates the extent of such divergence of administrative processes across universities.

In order to establish a spin-off company RMIT, under the terms of their foundation Act, the Articles of Incorporation for the spin-off company must be approved by the University Council, as must any subsequent amendments. The State Education Minister must also be notified (with reasons for action given) when a company is established. The imposition of such administrative burdens makes it very hard to conduct commercialisation activities in a timely manner and to guarantee commercial-in-confidence treatment<sup>56</sup>.

The University of New South Wales provides an example of a different structural approach being implemented to facilitate more streamlined sign-off processes for commercialisation activity. Unisearch is excluded from Public Authorities (Financial Arrangements) Act in New South Wales, so it does not need to obtain the approval of the Treasurer of New South Wales to incorporate a spin-out or to enter into a joint venture arrangement. Unisearch was specifically exempted from this requirement when it was initially set up in 1959.

Under its Constitution established by the Council of the University of New South Wales the Unisearch Board can approve the commercialisation of new technologies through licensing or the establishment of spin-out companies.

The internal process followed within Unisearch is for a proposal for investment/spin-out to be submitted to a Commercialisation Panel comprised of General Managers for review and recommendation to the Director: Finance & Operations and then to the Managing Director. Upon those sign-offs such proposals are submitted to the Unisearch Board for discussion and final approval.

In general similar reviews are undertaken prior to entering a major licence, although delegated authority lies with the Managing Director to enter into such licences. However, as mentioned above, in nearly all such cases the intended strategy and approach is outlined to the Board and Investment Panel to obtain feedback and strategic input although the Board's formal sign-off is not needed.

All investments are then updated in reports to each Board meeting and formally reviewed by the Board and Audit Committee for potential write-offs each year. The University Council in turn oversees the overall operations of Unisearch, regularly receiving reports on its overall operational performance and it also sets overall parameters for its operations.

The process in place at Unisearch illustrates that proper accountability and risk management can be achieved without the imposition of external administrative processes such as Ministerial notification and University Council sign-off of all commercialisation activity.

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<sup>56</sup> Royal Melbourne Institute of Technology Act 1992, Act No. 45/1992. Section 39 (5)(ba) requires the University to notify the Minister within 30 days after the formation, participation or membership, of the name of the company and the reasons the Council decided that the formation, participation or membership was in the interests of the management or conduct of the affairs of the university. Section 39 (4)(b)(i) requires that the constitution of the limited company provide that the company must not alter the constitution of the limited company unless the council has by resolution authorised the alteration.

### ***Issues in dealing with business***

#### **Universities perspectives on business as partners in commercialisation**

##### *What universities want from business*

- ability to form long-term partnerships to develop and exploit IP
- knowledgeable buyers of IP
- the ability to add value to IP and take it to market in an appropriate form
- willingness to pay for IP

##### *What universities can provide to business*

- knowledge of what is going on at the cutting edge of research
- IP that can provide the basis for new products and processes

University research commercialisation staff and researchers who have been involved in commercialisation activities also provided their perspectives on their interaction with industry partners. These interactions included licensing arrangements and the formation of companies to jointly progress promising research activities.

The most commonly raised concerns regarding interacting with industry were that:

- it is very hard to form long term relationships with companies as their R&D budgets, research priorities and key staff tend to regularly change;
- companies often approach the relationship not knowing exactly what they want out of it. To cover their bases they then tend to seek very broad and exclusive IP rights that they may not actually need or use; and
- companies tend not to want to become involved in longer term projects where a sustained commitment is required before pay-offs will be realised.

There were a number of exceptions to these criticisms raised. Two positive examples of industry and universities interaction are presented below.

The relationship being formed between Intel and the Australian National University (ANU) (Box 7.3) provides an example of the joint (in conjunction with the Allen & Buckeridge Emerging Technology Fund) establishment of a new company to carry forward the development of an area of research at ANU that is of high potential interest to Intel.

Box 7.3

**INTEL – AUSTRALIAN NATIONAL UNIVERSITY RELATIONSHIP**

The Australian National University has discovered a physical property of a material that makes the material very attractive to Intel for use in a particular type of electronic product. More work is required to fully understand the physical property and to design products exploiting this property. Together with Allen and Buckeridge's Emerging Technology Fund (A&B ETF), Intel and ANU are forming a company to carry out this work and commercialise the products.

From the perspective of the senior ANU researcher involved in this project, this experience has provided a number of important lessons, namely:

- that getting a major industry partner, Intel, involved very early on in the development of the technology – at the stage when a provisional patent application was being prepared – has added real value to the provisional patent subsequently received;
- that Intel and A&B ETF (via a technical consultant) both bringing people to the negotiations that could understand and talk to the researchers about the technology helped build trust and confidence from the researchers perspective;
- that the adoption by all parties of a constructive (amicable and flexible) approach to negotiations is essential to getting a positive outcome as inevitably there are always be points of difference that need to be worked through during the negotiation process. The fact that all parties in this case have had past experience in the area of university research commercialisation helped; and
- the researchers and the ANUTECH staff member attached to the faculty took a proactive role in briefing the ANU finance committee, who must sign off on any commercialisation deals within ANU, on the progress of the negotiations which is important if fast internal ANU sign off is to be obtained.

The formation of a RABiT (Box 7.4), a joint venture between the University of Melbourne, Swinburne University, PBR and Bishop Technologies, highlights that it is possible for companies and universities to jointly initiate and progress a long term research program addressing a major technological challenge facing the industry.

Box 7.4

**RABiT**

RABiT is a cooperative facility for vehicle dynamics research and the development of by-wire (BW) technology. BW technology is likely to replace mechanical hydraulic systems and become highly influential in the automotive industry.

The uptake of BW technology is expected to accelerate at the start of the new decade. In response, industry, educational and research groups in Victoria have formed RABiT, which is a collaborative venture aimed at bringing cohesion and focus to the development and commercialisation of BW technology in Australia. Not responding to the challenge to get on top of the technology could put at risk significant parts of the Victorian automotive supplier base.

RABiT represents the combined efforts of Pacifica Group Technologies Pty Ltd, the University of Melbourne, Bishop Innovation Limited, Swinburne University of Technology and the Victorian Government. The Victorian Government, through its Science, Technology and Innovation (STI) Initiative provided funding of \$4.7 million to RABiT, while the four industry and university partners together contributed \$5.6 million in initial funding to the project. RABiT has used the combined funding to secure the first BW facility in the Asia Pacific region. Comparable facilities are located in North America and Western Europe, and mostly owned by multinational companies.

The industry partners involved in RABiT ensure that the venture is viable and sustainable in the long run. They provide a commercial focus for the initial research efforts, along with established networks for the early commercialisation of intellectual property generated by RABiT.

Limiting the number of core partners has ensured a common purpose and better coordination during RABiT's start-up. Further into development, however, the intention is to allow additional partners. It is anticipated that RABiT will be largely self-sufficient at the end of the three-year STI grant period.

The four partners envisage that total commitments to research from 2003 to 2006 will gradually build up from \$1.991 million in 2003, to \$2.815 million in 2004, \$3.45 million in 2005 and \$3.978 million in 2006.

By June 2005, revenue generated from RABiT, together with additional grants and private funding, is anticipated to fund the ongoing running of the facility.

**Issues in dealing with venture capital providers**

**Universities perspectives on finance providers as partners in commercialisation**

*What universities want from finance providers*

- ability to assist the growth of new businesses
- willingness to invest at an early stage in spin-off companies
- capacity to provide advice, expertise and access to networks as well as capital

*What universities can provide to finance providers*

- knowledge of what is going on at the cutting edge of research
- IP that can provide the basis for the formation of companies

Perspectives on their interaction with external venture capital providers were sought from university research commercialisation staff and researchers who have been involved in commercialisation activities.

Attractive venture capitalist attributes were seen to include:

- the ability to provide advice, expertise and networks in addition to capital;
- strong technical expertise in relation to the research in question; and

- the capacity to take decisions quickly in relation to whether they are seriously interested in pursuing an opportunity.

The case of Fultec (Box 7.5), a company spun-out of the University of Queensland, provides a good example of a positive outcome being obtained when the university commercialisation arm and an external early stage capital provider work well together.

Box 7.5

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#### **FULTEC**

Fultec was formed in 2001 to commercialise the Transient Blocking Device (TBU), a technology developed by a PhD student at the University of Queensland. The TBU is a patented device specifically designed for use in the over voltage protection of telecommunication and data systems.

In the mid-1990s UniQuest identified the underpinning research being undertaken in this area at the University of Queensland as having potential commercial value. A patent for the technology was lodged by UniQuest and a number of commercialisation avenues then pursued.

Following the failure of a number of attempts to secure research contracts to further develop the technology (for reasons unrelated to the technology), UniQuest decided to set up a company, Fultec, with early stage finance sourced through Uniseed – the early stage venture capital fund jointly established by the University of Melbourne and the University of Queensland in 2000. Subsequently, once the technology had been developed to proof of concept, successfully tested in the field, and had elicited commercial interest, additional and more substantial investment was raised from the Allen and Buckeridge Emerging Technologies Fund (A&B ETF). The pre-seed funding and supporting activity provided by A&B ETF enabled Fultec to develop to the stage that it was ready to secure first round Venture Capital investment.

Fultec moved its operations into UniQuest's incubator facility and is now establishing a presence in the US market. Through A&B ETF's networks in the US, further capital has been secured from leading US venture capital firms and a US based management team has been assembled.

From the perspective of UniQuest, keys to this successful expansion of Fultec have been:

- that UniQuest has the systems in place to identify promising technology being developed at the University of Queensland;
- the fact that UniQuest was able to source, through Uniseed, the very early stage capital required to develop and demonstrate the effectiveness of the technology;
- the subsequent choice of a venture capitalist, A&B ETF, that could provide not only capital but expertise and networks in the US have considerably accelerated Fultec's development; and
- the positive and constructive nature of the working relationship that UniQuest established with A&B EFT made the process much smoother.

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Two criticisms raised regarding venture capitalists were:

- a view that venture capitalists were too risk averse due to a limited ability to assess the risk/reward profile of early stage research, and that they therefore either will not invest or seek a very high share of deals to offset the perceived risk; and

- a concern that the timelines venture capitalists work to, with venture capital providers generally having an exit strategy horizon of only a few years, mean that the venture capital model may not work well with projects where the research will require many years further development before it leads to revenue generating products.

## **7.2 Perspectives from industry**

Industry stakeholders, that have had direct experience in dealing with universities in relation to the commercialisation of research, were asked to provide their views on both:

- issues internal to industry that effect industry's ability to enter into commercialisation relationships with universities; and
- issues relating to university behaviour.

For the greater part industry stakeholders are those who have research relationships with university researchers and research teams through:

- contract research
- direct involvement with SPIRT (now Linkage) grants projects; and
- membership of Co-operative Research Centres.

### ***Internal industry issues***

Generally speaking, the companies that are most likely to have strong links to universities are those which themselves have significant R&D resources and programs and possess the internal capability to commercialise their own research.

There is a higher likelihood that companies which spend over 1 per cent of their turnover on local R&D will have relationships with university researchers and research groups than for companies with low levels of local R&D expenditure. The undertaking of local R&D activities is a particular issue in relation to multinational companies which have operations in Australia. While some multinationals conduct significant R&D in Australia, and tend to have strong links to university researchers, there are many that don't. In practice some university researchers have been able to form relationships with multinational research teams located in North America and Western Europe without the involvement of the Australian subsidiary of the company concerned. This tends to occur in only a minority of cases. Typically, a key criteria suggested for whether a company is in a position to enter into a constructive commercial relationship with universities is whether they have technical people on the ground in Australia that have the time and resources to engage in such relationships.

An illustration of the importance of this point is the Intel-ANU relationship outlined in Box 7.3. This relationship has been facilitated by the fact that the company has a motivated and interested technical person on the ground in Australia who is also in a position to approve project funding.

Intel's experience with its relationship with ANU raises an important issue likely to affect many subsidiaries of multinational companies. A key internal challenge Intel's Australian people faced was to convince Intel's US-based engineers to look at the project opportunity with an open mind given it falls outside the areas they are focused upon. This challenge is likely to be met often as a significant proportion of Australia's technology oriented companies are branch offices of multinational corporations.

### **Issues in dealing with universities**

#### **Business perspectives on universities as partners in commercialisation**

##### *What business wants from universities*

- clarity and increased visibility of IP or research services that are being offered by the university, including clear ownership of IP
- reasonable pricing of IP
- ability to deal with universities at one point, with universities using a client management approach to business relationships
- a partner who has the authority to make decisions in a timely fashion and maintain confidentiality
- a partner with an understanding of commercial realities

##### *What business can provide to universities*

- knowledge about what the market wants and values
- an ability to utilise and add value to university generated IP
- a capacity to give access to international markets where that is important to getting full value from university generated IP

The attitude of industry to universities as partners in business development whether by licensing technology or by being involved in start-ups is heavily influenced by their experience of working on research projects with key researchers and research teams. The biggest industry-university connection in research is through contract research which may or may not lead to commercialisation opportunities. Issues such as "are the researchers world class?", "can they produce outcomes in a timely fashion?", "can they maintain confidentiality agreements?" and "can they build effective research teams?" are of critical importance in determining whether a successful relationship can be built.

While the relationship of industry partners is with key university researchers, the systems within which they operate can either help or hinder the effectiveness of the relationship. Concerns were expressed about the difficulty of:

- getting decisions in a timely fashion;
- being certain in particular cases about who in the university has the power and authority to act on behalf of the university concerned;
- getting clear title to IP; and
- ensuring confidentiality agreements are complied with in practice.

The difficulties surrounding divergent views between industry and universities on the valuation of IP appear most likely to arise where there has not been a strong track record of previous industry-university involvement and where researchers lack a full understanding of what is required to take ideas to market.

Another issue raised by industry stakeholders is that some researchers lack an understanding of the importance to industry of project deadlines being met and for regular reporting of project progress.

Also, there appears to be a perception within industry that researchers are primarily interested in dealing with industry as a means to access further funding for the research they want to conduct, rather than having a focus on the achievement of commercial outcomes.

The Intel relationship with ANU (see Box 7.3) highlights a number of the features (from the perspective of the industry partner) of university researcher and commercialisation staff behaviour.

Key positive features of ANU's approach to the relationship have been:

- ANU's eagerness to have their research results successfully commercialised;
- ANU's willingness to engage with Intel on this project;
- the fact that the researchers themselves have been very easy to work with, knowledgeable, responsive to Intel's questions and capable of explaining their ideas and results to non-experts; and
- ANU's recognition of the potential application of their discovery.

A less helpful aspect was that initially proposed financial arrangements, including an unrealistically high equity stake in the new company for the university, were not commercially sustainable.

### **7.3 Perspectives from finance providers**

Early stage capital providers were asked to provide their views on both:

- issues internal to finance providers that affect their ability to enter into commercialisation relationships with universities; and
- issues relating to university behaviour.

#### ***Internal finance provider issues***

In order to operate effectively, finance providers need to have a sufficient capital base for investment, well developed commercial skills, networks both in Australia and internationally and technical knowledge of the fields in which they invest. Provided these factors are in place they believe that they are well positioned to play an active role in the commercialisation of university IP.

A belief was expressed that while there is not a large number of finance providers with these skills in Australia, the supply of venture capital is sufficient to meet the level of deal flow that is being generated by universities. This is based on the view that there are limits to the supply of really interesting bits of IP being generated in universities and that when something very promising is created there always appears to be multiple finance providers chasing it.

### **Issues in dealing with universities**

#### **Finance providers perspectives on universities as partners in commercialisation**

##### *What finance providers want from universities*

- clarity about the IP or research service that is being offered, including clear ownership of IP
- IP that has been developed to an investment ready stage
- reasonable pricing of IP including reasonable expectations about the value of equity at an early stage of business development
- ability to deal with universities at one point
- a partner that understands and values what a venture capitalist can provide in addition to capital
- a partner who has the authority to make decisions in a timely fashion and maintain confidentiality
- a partner with an understanding of commercial realities

##### *What finance providers can provide to universities*

- knowledge about what the market wants and values
- an ability to utilise and add value to university generated IP
- a capacity to give access to international markets where that is important to getting full value from university generated IP
- ability to enhance the ability of spin-off companies to reach their full potential by providing capital, advice and access to networks

The input received from the Allen & Buckeridge Emerging Technology Fund (A&B ETF) in relation to their investment in Fultec, highlight the desirable features (from the venture capital provider's perspective), of university commercialisation company behaviour. Key features of UniQuest's approach that facilitated A&B ETF's investment in Fultec were:

- that UniQuest already clearly understood what 'reasonable' Venture Capital terms look like;
- UniQuest policies and procedures were clear;
- UniQuest staff were highly skilled and adopted a flexible and 'deal oriented' approach to negotiations; and
- UniQuest recognised and valued the capabilities that A&B ETF could provide to Fultec beyond the simple provision of capital.

Unfortunately, venture capital providers appear to regard UniQuest as closer to being an exception than the rule. While a small number of universities were mentioned as having highly capable commercialisation operations, most universities were criticised for having cultures that undermined the often quite reasonable commercialisation structures and systems that they now have in place.

Key difficulties cited by early stage venture capitalists who deal with universities are that:

- there are very few researchers willing to leave the university to take on a role within spin-off companies, and that this, more so than difficulties in attracting commercial staff to take on roles within spin-off companies, is a major constraint on activity;

- many universities appear to have a narrow focus on the amount of upfront cash that they will receive through a deal and that they often have unrealistic expectations on this front due to an under-estimation of risks associated with early stage companies;
- universities do not tend to value the skills that venture capitalists can bring to a deal over and above the provision of capital;
- a general lack of awareness of the importance of 'timelines' in commercialisation activity causes problems; and
- that while many universities now have appropriate strategies and structure in place to support commercialisation, the culture within many universities acts against the achievement of positive outcomes.

## Chapter 8

# Models of commercialisation policy and practice appropriate to the Australian context

Before presenting best practice guidelines for university commercialisation policy and practice appropriate for the Australian context, it is important that:

- the defining features of an effectively operating commercialisation system are understood – these features are the outcomes that the model should be geared towards promoting; and
- the lessons from international best practice have been learned – while not all approaches that are regarded as international best practice will necessarily be appropriate in the Australian context, they do provide valuable lessons into what systems have been demonstrated to work well in practice.

These two areas are considered in this chapter.

### **8.1 The defining features of an effectively operating commercialisation system**

An effectively operating university commercialisation management system would be expected to have the following features:

- control of IP is clear;
- IP is properly protected;
- the organisational structure for commercialisation of IP allows for:
  - timely decision making within commercialisation activities – this may be influenced by both internal processes used within commercialisation entities and external processes imposed upon them through, for instance, Acts of Parliament establishing universities;
  - appropriate risk management being in place that fits the desired risk reward profile of institutions;
  - flexibility being available in the approach taken to commercialisation, with the choice of route to market (licensing, spin-off, joint venture, sale, etc) being determined on a case-by-case basis;
  - appropriate skills and other resources being in place to allow the commercialisation entity to conduct the full range of activities – which include identification and protecting of IP, negotiating deals, the education of researchers, risk management, providing funding to bring research to the investment-ready stage, building networks and market knowledge and buying in specialist skills as required for particular deals – necessary to encourage strong commercialisation outcomes;
- necessary incentives being in place so that universities and researchers share a common commitment to achieving strong commercialisation outcomes; and

- university governing councils and senior management should be committed to developing a culture, and systems for the reward and recognition of staff, that encourages commercialisation activity.

A model for university commercialisation policy and practice should be judged according to whether it effectively and efficiently promotes the development of these features within the system.

## 8.2 Lessons from international best practice

A number of recent studies<sup>57</sup> have sought to identify best practice in IP management and commercialisation management systems.

Most commentators are agreed that there is no single best model for IP policy and commercialisation management systems. Different approaches can work well in particular circumstances. However, there is broad agreement that the following four elements are crucial parameters for success for both IP policy and commercialisation management systems:

- IP ownership;
- strategies for protecting IP;
- organisational structures for commercialising university IP; and
- incentives for universities and researchers.

### IP Ownership

There is general agreement that IP should be owned, at least in the first instance, by the research organisation where it was generated. Niels Reimers (who founded and directed Stanford University's highly successful technology commercialisation program for twenty-two years) is unequivocal on this point on the grounds of accountability ensuring that the benefits from government-funded research are maximised. While the United Kingdom reports cited are more relevant to government laboratories than to universities, they take a similar line to that of Reimers. The Canadian Advisory Council on Science and Technology (ACST) accepts Reimers' view.

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See for instance:

OECD, (2002), *Benchmarking Industry-Science Relationships*, OECD, Paris

ACIIC, Howard Partners, Carisgold, (2002), *Best Practice Processes for University Research Commercialisation*, report to DEST, Canberra; and Christie, A, A'Alaisio, S, Gaita, K, Howlett, M J and Webster, E M, (2003), *Analysis of the Legal Framework for Patent Ownership in Publicly Funded Research Institutions*, report to DEST, Canberra.

Advisory Council on Science and Technology (ACST), (1999), *Public Investments in University Research: Reaping the Benefits*, report of the Expert Panel on Commercialisation of University Research.

Advisory Council on Science and Technology (ACST), (1999), *Public Investments in University Research: Reaping the Benefits*, report of the Expert Panel on Commercialisation of University Research.

Howells, J and McKinlay, C (PREST), (1999), *Commercialisation of University Research in Europe*, report to the ACST Expert Panel on Commercialisation of University Research; and Reimers, N, (1999), *Best North American Practices in Technology Transfer*, report to the ACST Expert Panel on Commercialisation of University Research.

National Audit Office (UK), (2002), *Delivering the Commercialisation of Public Sector Science*, HC 580; Baker, J, (1999), *Creating Knowledge, Creating Wealth*, report to the UK Minister for Science and the Financial Secretary to the Treasury; and Lambert, R, (2003), *Lambert Review of Business-University Collaboration*, report to the UK Chancellor

The most recent UK report (Lambert) addresses IP arising from collaborative research. Lambert recommends that the UK funding and research councils, in consultation with other stakeholders agree on a protocol for the ownership of IP in research collaborations:

"The common starting point for negotiations on research collaboration should be that universities own any resulting IP, with industry free to negotiate licence terms to exploit it. But if industry makes a significant contribution it could own the IP."

Lambert, R, 2003, *Lambert Review of Business-University Collaboration*

In the United States, one of the reasons for the *Bayh-Dole Act* (1980), which allocated to universities the IP rights to federally funded research, was to increase the prospects of commercial outcomes from the exploitation of IP. The passage of the *Bayh-Dole Act* marks the starting point of significant growth in IP commercialisation in the United States and although other features of this legislation play an important role, the ownership issue is fundamental because with it comes the right to sell, licence and assign IP<sup>58</sup>.

The Canadian ACST report is however critical of shared ownership arrangements:

"Co-owners of patents (in Canada) cannot grant exploitation licensing rights without the agreement of the other co-owners. In the event of a conflict, licensing is paralysed."

ACST, 1999, *Public Investments in University Research: Reaping the Benefits*

The ACST report notes that the Canadian situation is different to that of the United States in this regard. In the United States, any co-owner of a patent may grant non-exclusive exploitation licenses without the consent of the other co-owners. Co-ownership increases uncertainty and risk in commercialisation activities, discouraging companies from licensing IP so owned.

Clarity on IP ownership is important to potential commercial partners, who are wary of having to negotiate with multiple owners. When the results of cooperative research are shared between different institutions, this can be a barrier to licensing.

### **Strategies for protecting IP**

Best practice commercialisation of IP requires carefully devised strategies, designed on a case-by-case basis. These strategies require professional advice. While in some cases, applying for a provisional Australian patent may be an appropriate first step, in other cases it may be advantageous to commence with a US patent application.

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<sup>58</sup> Sampat, B.N. (2002), *Private Parts: Patents and Academic Science in the Twentieth Century*, points out that prior to Bayh-Dole there were ways for Universities to be assigned ownership of IP resulting from federally funded research. Beginning in the late 1960s three major US funding agencies - the Department of Defence, the Department of Health, Education and Welfare, and the National Science Foundation - began negotiating Institutional Patent Agreements with academic institutions with 'approved technology transfer capabilities' which allowed these universities to retain title to publicly funded patents and also allowed other universities to retain title via case by case petitioning. However, Sampat suggests that it was universities' concerns about agencies' commitment to these programs, together with complaints that patenting and licensing arrangements under these arrangements were cumbersome and costly, that provided the immediate catalyst for the introduction of the Bayh-Dole Act in 1980 - which was explicitly focused on facilitating patenting and exclusive licensing by research universities.

Delaying a patent application may provide more time to substantiate claims but this would need to be balanced against the risk of someone else getting there first. Relying on a single patent may be appropriate in some circumstances but, more often than not, there is a need to continue research and develop a family of patents to build a stronger position.

IP protection strategies also need to take into account the nature and scale of the market that the IP will address. For example, in circumstances where a challenge to a patent is likely, the best strategy may be to licence the IP to a large firm which has the capacity to defend the patent.

### **Organisational structures for commercialising university IP**

Reimers reports on a number of organisational models. In North America, commercialisation of IP is often managed from an office within the university administration headed by a vice president for research. Some universities have established separate non-profit or for-profit structures to commercialise their IP.

Best practice examples of single campus *internal* technology commercialisation offices include MIT, Stanford University, the University of Alberta and the University of British Columbia. Internal arrangements usually have close working relationships with university management, faculty and students. They often provide a one-stop-shop for a range of other activities such as contract research, consulting etc. As the Canadian ACST report notes:

"Firms .... Cannot be expected to develop individual relationships with thousands of university researchers to explore opportunities for translating university discoveries into innovations."

ACST, 1999, *Public Investments in University Research: Reaping the Benefits*

Best practice examples of *external non-profit* technology commercialisation structures in North America include the Iowa State University Research Foundation and Parteq (Queens University, Canada). Reimers suggests that external structures can avoid conflict-of-interest problems but this depends on their board structure and the location of their offices. These entities can also provide a one-stop-shop service.

Some universities work with *external for-profit* companies. University Technologies International is wholly-owned by the University of Calgary. Its activities are not confined to commercialising university IP. Some commentators argue that a for-profit structure reduces the motivation of some researchers and that for-profit companies have to be more selective, concentrating on a smaller number of most profitable projects, and not be influenced by public good considerations. If this is the only mechanism that a university uses to commercialise its IP, it could be inconsistent with the intent of the *Bayh-Dole Act*, which is to generate national public benefits rather than just revenues to universities.

Research Commercialisation Technology Inc (RCT) and the British Technology Group plc (BTG) are examples of successful IP commercialisation businesses that are completely independent and work with a number of universities. BTG grew out of the National Research and Development Corporation. For a period prior to its privatisation, BTG had a monopoly on commercialisation of IP from UK universities.

In analysing best practice in IP commercialisation, one organisational factor that is readily evident is the frequency with which incubator and science park facilities are associated with the creation of spin-off companies and the development of closer links between universities and industry. Both Stanford and Cambridge Universities have such related measures available to assist the successful commercialisation of their IP.

### ***Building commercialisation skills and scale***

What international experience shows is that it is the ability of commercialisation entities to draw upon appropriate skills and scale of activity, rather than their organisational structure, which is the single most important driver of performance.

All commentators recognise the importance of ensuring that staff entrusted with managing the commercialisation of IP have the necessary skills. These skills, which include a basic knowledge of patent law, technology valuation and licensing, negotiation and new business formation skills, are in short supply in most parts of the world and need to be paid for at market rates – which is an argument sometimes used to support the use of an external structure.

Some commentators go further than this to urge that universities should offer courses to raise the commercialisation skills of both students and faculty. In Australia, such courses for students are now offered at a number of universities within disciplines such as engineering.

As for the scale of activity required, recent work done in the United Kingdom (reported in the Lambert Report) suggests that before individual universities can achieve the critical mass necessary to support an effectively operating commercialisation arm, a minimum research budget of £20 million (around A\$50 million) per annum (1999 dollars) is required. One of the recommendations of the Lambert Report is for universities to share resources on a regional basis in order to bring about an adequately resourced commercialisation operation.

In Canada, this same problem has been addressed by the Maritime universities, which have established NU TECH as a non-profit company to commercialise their IP. Reimers considers NU TECH an excellent model for universities that have small research programs and lack the economies of scale necessary for a campus office.

### ***Incentives for universities and researchers***

#### ***Incentives for universities to commercialise IP***

The *Bayh-Dole Act* provides other important incentives for US universities to commercialise IP from federally funded research. The Act contains provisions of a "use it or lose it" nature as well as reporting requirements which would make any non-compliance highly visible. The *Bayh-Dole Act* also provides US universities with economic incentives from the proceeds of technology transfer. However, the emphasis of the *Bayh-Dole Act* is on national benefits rather than providing an additional revenue stream for US universities. Thus universities in the United States recognise the public good elements of technology transfer and will invest effort in transferring technology even when the returns to the university are likely to be low.

In the United Kingdom, universities are well aware of some of the success stories from the commercialisation of IP. In recent years there has been increasing pressure on UK universities to facilitate commercialisation and to contribute to economic growth at the regional and national levels and the government has provided additional funding specifically targeted at this objective (the Third Stream). Following the release of the 2003 White Paper, *The Future of Higher Education*, one of the measures introduced to speed up and support the rate of innovation was establishing a Higher Education Innovation Fund of £140 million over three years as a 'third stream' of funding to Universities for knowledge transfer, alongside the funds they receive for research and teaching. Following a recommendation in the Lambert Report of 2003 this has now been built upon by a second round Higher Education Innovation Fund of £187 million.

In Australia, universities have received little in the way of incentives to facilitate the commercialisation of IP<sup>59</sup>. While Commonwealth government agencies have only rarely sought to own IP, and have placed few constraints on IP commercialisation, the government has not provided financial incentives of the type or on the scale of those provided in the United Kingdom or Canada.

#### *Incentives for researchers to commercialise IP*

One possible incentive for researchers to become involved in the commercialisation of IP is the opportunity to share in the financial returns. However, as several studies show, many researchers are not particularly motivated by the possibility of such benefits. The reasons for this have been well documented, and include:

- patents, licences and the formation of spin-offs do not feature prominently in status or promotion;
- many researchers would prefer to spend their time writing papers rather than helping to draft patent claims;
- researchers perceive that the financial rewards from licensing will take some years to eventuate and most reward sharing mechanisms provide no benefits to researchers until patent and other commercialisation costs have been covered;
- many Australian researchers are under time pressure from their research, teaching and supervisory commitments and are unwilling to commit the time and effort needed to commercialise IP in a timely manner; and
- researchers often prefer to assign IP in return for additional funding for their research and to take no further interest in the IP.

Providing incentives for researchers requires best practice action on a number of issues, including:

- stronger university commitment to commercialising IP;
- taking account of IP achievements in promotion of staff; and
- ensuring that financial reward structures recognise such achievements.

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<sup>59</sup> It is recognised however that Commonwealth Government measures such as the Pre-Seed Capital Fund and the Biotechnology Innovation Fund, each of which have been extended through to 2011 under *Backing Australia's Ability - Building Our Future Through Science and Innovation*, do provide support for the creation of spin-off companies.

Reimers argues that paying a one third share of net proceeds (after costs) to the researcher inventors is the North American standard. He favours allocating a one third share to the researcher's university department, with the remaining third allocated to the technology commercialisation entity which, he notes, finances the activity and bears the risk of loss. Reimers defines net proceeds as gross income, less a percentage to the commercialisation entity and other expenses. This formula, with some variations on the percentage for the commercialisation entity, is found around the world.



## Chapter 9

# Pre-requisites for optimising university research commercialisation outcomes

### **Pre-requisites for optimising university research commercialisation outcomes**

The commercialisation of university research requires an effectively operating marketplace in which universities, business and finance providers can come together to produce the best possible outcomes. Pre-requisites for an effectively operating commercialisation marketplace include:

#### **Universities**

- Universities should have a clear mandate to engage in the commercialisation of research and this should be acknowledged as a legitimate third role for universities alongside teaching and research.
- Universities need to be producing excellent research, as it is excellent research that is most likely to generate the most significant commercialisation opportunities, and need to publicise their research capabilities.
- Universities should exercise their IP ownership rights, ensure IP control is clear and take appropriate steps to protect IP.
- Universities wanting to effectively commercialise should empower a central commercialisation entity to manage the commercialisation of university research. These commercialisation entities must be appropriately resourced to allow them to: identify and protect IP; pro-actively identify commercialisation options; fund the further development of research to the point at which it is commercialisation ready; negotiate deals; and manage risk.
- University councils should not be involved in the micro-oversight of commercialisation activities.
- University governing councils and senior management should be committed to developing a culture, and systems for the employment, promotion, reward and recognition of staff, that encourages commercialisation activity.

#### **Business**

- Business should identify need for innovation and options to achieve this.
- Business should be able to engage with universities to pursue commercialisation opportunities where the university research is aligned to their product and service areas.
- Business should recognise that universities can access global markets for IP if local business is unable to use it.

#### **Finance providers**

- Venture capitalists must have both the capital and the expertise to allow them to add value to the formation and development of companies built on university generated IP.
- Venture capitalists should be able to provide soundly based judgements of the risk-return profile of business propositions.

#### **Government**

- Government research funding programs should provide incentives for universities to engage in commercialisation of research (which require alteration of funding formulas), access international markets, support universities in establishing appropriate IP and commercialisation management systems, including where necessary to help build "critical mass" in commercialisation bodies shared between groups of universities where appropriate.
- State and/or Commonwealth governments should not be involved in the micro- oversight of commercialisation activities and legislation and policies should not preclude universities engaging in commercialisation activities.
- Commonwealth and State governments should continue to address gaps on the market for early stage capital for growing technology-based businesses.

## 9.1 Optimising commercialisation outcomes requires more than just best practice university policies and practices

While the policies and practices in place within universities will have a considerable impact upon commercialisation outcomes achieved in Australia, it is important that, while focusing upon these policies and practices, sight is not lost of the other drivers of commercialisation outcomes. Best practice university policies and practices on their own will not deliver optimal outcomes. Other drivers, often outside the control of universities, must also be addressed. It is important that in focusing on university systems, the following 'other' drivers of performance are taken into account:

- the quality of research being produced by universities;
- the availability of early stage venture capital;
- the presence of strong local receptor industries; and
- the behaviour of participants within the research commercialisation system.

Improvement is needed in each of these areas in Australia if commercialisation outcomes are to be optimised.

In relation to the quality of research, a focus on encouraging excellence is vital as it is excellent research that is most likely to generate the most significant commercialisation opportunities.

In relation to early stage venture capital, while the situation has improved considerably in recent years, Australia still suffer from a comparatively shallow capital and skills pool<sup>60</sup> when compared to many of our international competitors.

In relation to strong local receptor industries, Australian industry R&D investment levels lag behind those in most other developed countries and many of our technology intensive businesses are subsidiaries of multi-national corporations. Unless Australian industry increases its investment in R&D, commercialisation prospects will continue to be constrained relative to those available to universities in leading innovator countries such as the United States.

Given the size and structure of industry in Australia, it will become increasingly important for Australian universities to access the international market for IP. Opportunities may exist for enterprises to support universities in their efforts to break into the international markets.

Separate to the issue of the quantum of research conducted or funded by Australian business, *how* industry approaches its research relationships with universities will have an impact on commercialisation outcomes. Some issues that industry should bear in mind when dealing with universities, either as a purchaser of IP, a research partner or as a contractor of research from universities, include:

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<sup>60</sup> PMSEIC, (2002), *Management skills for high growth start-up companies*, Paper for 9<sup>th</sup> meeting, 5<sup>th</sup> December 2002

- it is important that companies approach the relationship with a clear internal understanding of exactly what they want out of it. Companies should only seek to acquire comprehensive rights to IP that they actually need and can make use of rather than seeking rights to possibly un-necessarily broad sets of IP; and
- companies should be aware that universities would like to be able to form long-term relationships with industry and become involved in longer term projects where a sustained commitment is required before pay-offs will be realised. Business should be aware that it is very hard for such long term relationships to be formed if their R&D budgets, research priorities and key staff tend to regularly change.

Regarding the behaviour of participants within the commercialisation system, feedback we received suggests that work is needed to build greater understanding between industry, finance, and university stakeholders regarding their roles, capabilities, needs and the constraints that they face. The single common feature, across each of the examples of successful commercialisation outcomes that we encountered, was that the participants involved in the commercialisation event were able to form effective working relationships based upon a common focus on achieving a mutually beneficial outcome for all parties involved. Goodwill, respect for the varied skills that each party had to offer, and the adoption of a flexible approach to negotiations are vital in securing successful commercialisation outcomes.

Focusing attention on only one or two drivers will not deliver the outcomes that industry, universities and the Government are seeking to achieve in the area of university research commercialisation. We therefore stress that while in this study we are primarily focused upon university IP and commercialisation management systems, continued efforts on a number of other closely related matters are also needed.

## **9.2 Context for best practice guidelines for university IP and commercialisation management systems**

The best practice guidelines for university IP and commercialisation management systems presented in the remainder of this chapter should be viewed as providing a broad framework for university systems rather than being narrowly prescriptive.

The best practice guidelines comprise five core areas and the general principles that we believe should be adopted within these are applicable across the university sector. However, the general principles within some of these areas can be complied with through the adoption of a range of more specific policies and processes within different universities.

The five core areas of the best practice guidelines are:

- the need for a mandate for university involvement in commercialisation
- the appropriate approach to IP ownership within universities
- the appropriate approach to IP protection within universities

- the appropriate functions and resourcing for commercialisation entities and organisational structures for commercialisation management – it is in this area particularly that a number of specific approaches could be adopted that would meet the key general principles that are recommended
- the appropriate incentives that should be in place for universities and researchers to engage in commercialisation activities

### **9.3 Guideline 1: A clear mandate should be given for university involvement in commercialisation**

While there appears to now be a consensus emerging that universities should take an active role in ensuring that the potential commercial and other benefits from research are realised, there is currently no clear mandate in Australia stating that this should be a core function of universities activities alongside teaching and the conduct of research. In this respect Australia is different from the United States, where the *Bayh-Dole Act* establishes this principle, and now the United Kingdom where this 'Third Stream' role for universities, additional to teaching and research, has been explicitly outlined, and funding in support of it provided, in Government policy for the higher education sector<sup>61</sup>.

The fact that universities should undertake this third role should be made clear in legislation that relates to the sector as well as within university constitutions.

### **9.4 Guideline 2: Exercising IP ownership in universities**

As a direct consequence of acceptance of Universities having a role in ensuring that potential benefits from their research are realised, it is essential that IP should be owned, at least in the first instance, by the research organisation where it was generated.

The University of Melbourne's experience with its policy (which is now being reconsidered) of broad relinquishment of IP ownership rights in favour of researchers highlights the problems associated with the alternative approach to universities exerting their rights to IP ownership.

Given the increasing significance of collaborative inter-university research projects in Australia, it is important that at the outset of such projects all parties agree upon how IP ownership should be assigned. Clarity on IP ownership is important to potential commercial partners, who are wary of having to negotiate with multiple owners. Therefore, where the results of cooperative research are to be shared between different institutions, a separate entity should be established, in which the participating institutions have an agreed ownership stake, to own the IP resulting from collaborative projects. Furthermore, one commercialisation entity should be charged with the responsibility of managing the commercialisation of the IP that is held within the new entity.

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<sup>61</sup> Department for Education and Skills (UK), (2003), *The Future of Higher Education*

### **9.5 Guideline 3: Ensuring IP protection within universities**

Ensuring appropriate IP protection measures are taken with respect to university owned IP, should be the responsibility of the commercialisation entity (irrespective of whether it is an incorporated entity or a division or office within the university) of the university. It should not be left to individual researchers or faculties to undertake this task. A fragmented approach runs the risk of IP 'falling through the cracks' or researchers with insufficient skills or support in this area adopting inappropriate IP protection strategies.

If a centralised IP protection system is to be introduced effectively, it is imperative that systems for the timely disclosure of IP to the university's commercialisation entity are implemented and enforced. Approaches to this are discussed within the context of organisational structures for commercialisation management and functions for commercialisation entities.

### **9.6 Guideline 4: The functions and resourcing requirements for commercialisation entities and organisational structures for commercialisation management should reflect the complexity and risks associated with research commercialisation**

The functions and resourcing of commercialisation entities and organisational structures for commercialisation management will have important impacts upon a number of areas, namely:

- the timeliness of commercialisation processes;
- the adequacy of risk management;
- the resources required within commercialisation entities; and
- the effectiveness of commercialisation entities in carrying out their functions.

#### ***The functions and resourcing for commercialisation entities***

##### ***Functions***

Currently, commercialisation functions are sometimes separated from the management of contract research, the identification of IP in faculties and the education of researchers. While the separation of these activities across multiple bodies will not necessarily cripple commercialisation outcomes, on balance, there are good reasons why these related activities should be undertaken by one entity. Reasons in favour of combining these activities within one entity include:

- management of contract research activities involves the development of networks with industry stakeholders. Access to such networks would be valuable for those involved in identifying potential industry licensees for university technology. Such network sharing is more likely to occur within an entity that across separate entities;
- some of the skills involved in structuring research contracts and structuring licensing contracts are similar and it may be possible to better utilise scarce skills in these areas if both activities are undertaken by the same entity;

- when educating researchers and raising awareness of commercialisation issues, it is important that consistent messages are sent and that these messages are consistent with the universities' systems for research commercialisation. Having the entity managing commercialisation also being responsible for education and awareness raising will deliver this consistency; and
- it means that there is a clear 'one-stop-shop' for researchers, industry and finance providers to deal with, thereby removing potential for confusion amongst stakeholders over their responsibilities.

In our view, university commercialisation entities need to be able to undertake a wide range of activities in order to operate effectively. Key commercialisation functions (in addition to any functions associated with management of contract research for the university) that should be undertaken by the commercialisation entity and the conditions that are required to enable them to carry out these functions effectively, are set out in Table 9.1 below. In effect the commercialisation entity should be able to act as a 'one-stop-shop' for university commercialisation activity.

Table 9.1

**COMMERCIALISATION ENTITY FUNCTIONS AND REQUIRED ACTIONS**

Functions	Conditions required for success
Identification and protection of IP	Presence of a clear system for IP disclosure by academics that is encouraged and enforced by the University. Maintenance of an active presence within the faculties. Skills required to assess IP either 'in house' or the ability to buy in these skills as needed. Resources required to protect, enforce and defend IP.
Pro-active identification of commercialisation options	Strong technology and market knowledge or the resources required to acquire services for the provision of that knowledge. Networks into industry and finance provider sectors.
Development of research to the point at which it is commercialisation ready.	Continued involvement of researchers. Ready access to seed funds in the order of \$50,000 to \$300,000 per case where further development of IP is required.
Negotiation of deals	Skills in license negotiation, the establishment of companies, and in negotiations with investors. This requires them to be able to provide remuneration packages sufficient to attract and retain key staff.
Management of risk that reflects its reward objectives	Strong deal sign off processes that nevertheless do not prevent the timely conduct of commercialisation activities. An appropriately skilled board (in the case of incorporated commercialisation entities) or University Council finance sub-committees (in the case of commercialisation entities that are divisions within universities) that provides regular oversight of activities. Activity externally audited on a regular basis.

### ***Implications for resourcing***

For a commercialisation entity to undertake these activities, a significant annual operating budget and access to capital for proof of concept activity is required. Feedback from stakeholders and investigation of the operating budgets currently in place within commercialisation entities that undertake most of these functions suggests that, at a minimum, an annual budget for commercialisation functions (not including the management of contract research) would be in excess of \$2 million per annum. For larger research performing universities, where the deal flow is likely to be greater, annual operating budgets of more than \$5 million could be required. In addition, to enable the regular further development of IP to commercialisation readiness, access to a revolving capital pool of in excess of \$5 million is required.

Clearly, such resourcing levels may be both unsustainable and inappropriate for universities with research budgets lower than \$100 million per annum. A consequence of this is that some consolidation and resource sharing amongst smaller research universities should occur. This could occur most effectively under the incorporated commercialisation model combined with an approval and monitoring process that does not involve Ministers or full university councils in the micro-oversight of commercialisation activities.

One way for this to occur would be for incorporated commercialisation entities to be established jointly by two or more universities and for such commercialisation entities to handle commercialisation activity at each of the universities involved.

### ***Organisational structures for commercialisation management***

The two most important elements regarding the operational structure for commercialisation management are:

- whether the universities commercialisation entity is a division within the university or is established as a separate incorporated entity; and.
- the procedures adopted for the approval and monitoring of commercialisation activity undertaken by the commercialisation entity.

### ***Choice of commercialisation entity structure***

As experience both overseas and in Australia demonstrates, both commercialisation entities that operate as a division or office within universities and commercialisation entities that are established as separate incorporated entities can operate successfully. Therefore, it is not necessary for a commercialisation model to be prescriptive on this point. However, on balance, we would suggest that the incorporated structure does carry some advantages over the division or office approach. Some benefits of the incorporated structure are that:

- feedback from industry and finance providers suggests that they would prefer to deal with this structure as they are familiar with it;
- it may improve risk management for reasons including:
  - an appropriately skilled board can be established perhaps more easily than it is possible to establish an appropriately skilled finance sub-committee drawn from membership of university councils;

- as an incorporated entity it must comply with the reporting and audit procedures mandated by corporations law;
- quarantining of legal risk from the university; and
- due to being unconstrained by university human resources policies, it is likely to be able to adopt a more flexible approach to staff remuneration which may assist with the attraction and retention of key staff.

The incorporated structure would be clearly preferable in the case of entities being established jointly by multiple universities.

The composition of the Board of such an entity would be very important. It could ideally comprise an independent chairman, a representative from each university council (preferably the council members who chair the finance or risk committees of the respective universities) and a number of independent board members who bring strong commercial and risk management skills.

Geographical proximity does matter in commercialisation activity, so it is likely that universities would be best served by collaborating with other institutions located in the same geographical area when forming such shared commercialisation entities.

Staff employed by the shared commercialisation entity who are involved in the identification of IP and the education of researchers would be located within faculties at each participating university, while senior management, administrative staff and staff who are involved in deal management would be located within the offices of the commercialisation entity.

#### *Procedures for approval and monitoring of commercialisation activity*

Procedures for approval and monitoring of commercialisation activity should allow for timeliness within commercialisation activities and for appropriate risk management.

As was detailed in Sections 4.7 and 7.1, in our view the involvement of full university councils and State Government Ministers in the micro-oversight of commercialisation activities are clearly detrimental to the achievement of positive commercialisation outcomes and are also unlikely to provide for appropriate risk management. Recommendations being made by several State Auditor Generals in this area appear to be misguided.

Legislative reforms may be needed in the case of some states and universities before appropriate structures can be implemented in this area.

Unisearch appears to be a highly appropriate model and could serve as a useful template for those universities that have (or will have in future) established incorporated commercialisation entities. Perhaps the most important draw-back to the alternative model of establishing commercialisation entities as a division or office within universities is that this clear and efficient approval and monitoring approach may not be able to be implemented.

## **9.7 Guideline 5: Provision of incentives for universities and researchers to engage in commercialisation activities**

### *Incentives for universities*

Currently there is little direct incentive for universities to actively engage in commercialisation activity. Commonwealth research block grant funding formulae reward universities that are successful in attracting contract research funding and in the publication of papers, but do not reward universities that achieve outstanding outcomes in the area of commercialisation. This situation should be addressed.

Similarly, it may also be appropriate for researchers and their institutions commercialisation performance to be taken into account in the awarding of grants under ARC and NHMRC competitive research grants programs.

It is important, however, that simplistic and inappropriate metrics for the measurement of commercialisation performance are not introduced into either block grant or specific research grant program criteria. For instance, it would be highly undesirable if measures such as 'number of spin-off companies formed' or 'number of license agreements signed' were adopted as measure of commercialisation performance as these measure do not capture the size of economic benefits being generated. The metrics used will need to be more sophisticated than this and encompass desired outcomes.

While it is not within the scope of this study to develop such metrics, examples of the richer and more complex metrics than the 'number of spin-off companies formed' could include 'turnover of spin-off companies that have been formed', 'employment within spin-off companies that have been formed' and 'export earnings generated by spin-off companies that have been formed'.

Another very direct incentive that could be provided to universities to encourage, and empower them to seriously engage in research commercialisation activity would be for the Commonwealth or State Governments to make available some additional funding to universities expressly for use in such activity.

### *Incentives for researchers*

While under many universities' policies relating to the distribution of proceeds from commercialisation activity academics are given a personal financial incentive to assist in the achievement of good outcomes, this is not a sufficient incentive for many academics to become actively involved in commercialisation activities. The value of a share of eventual returns from commercialisation may be heavily discounted by academics as time lines may be long and outcomes are very uncertain. An alternative may be for academics to receive pay bonuses in the short term when their research outcomes are assessed as giving rise to a commercialisation opportunity. Modest short term bonuses could be paid in addition to academics retaining a share on final commercialisation returns. Perhaps some trade off could also be offered between the size of short term cash bonus paid and the academic's share of eventual commercialisation returns.

Promotion criteria for researchers are currently focused very heavily upon the production of peer recognised research publications and the attraction of competitive research grants. Promotion criteria should be broadened to also take into account the contribution that researchers make to the successful commercialisation or application of their research through other avenues.

A disincentive for many academics to accept a position within a start-up company that is based upon their research is that if the company fails, there is no guarantee that their former job within the university will still be open to them. Processes should be introduced to allow academics to take up to a year or more leave from the university to pursue a commercialisation opportunity with the guarantee that if they wish to return to the university within that period that can do so.

Another incentive to encourage researchers to actively engage in research commercialisation activities would be for free training in the area to be made available to them so that they can increase their skills base in this area. Provision could also be made for sabbaticals that focus on researchers establishing commercialisation networks.

### **9.8 Implementation issues**

The implementation of the proposed model for IP and commercialisation management within universities would entail different levels of change across the sector. For some, most notably the University of Queensland, little (if any) change would be required for their current systems to fit within the proposed framework. For some other universities, however, a considerable amount of change would be required. Such changes could include:

- alterations to university foundation acts;
- the establishment of new entities, possibly in partnership with other institutions;
- changes to promotion criteria for academics; and
- the commitment of significant additional resources.

Given the range of changes required, the process of implementation may take in the order of two years for some institutions.

Implementation of incentives for universities would also require action to be taken by the Commonwealth Government and by major research grant bodies.

Metrics for the measurement of commercialisation outcomes performance by universities need to be developed and incorporated into granting criteria and Commonwealth research funding formulas where appropriate.

Also, the Commonwealth Government will need to consider providing initial funding to support universities in their efforts to establish new, and potentially shared, commercialisation entities. It will also need to consider providing financial support for the establishment of appropriate capital funds for these entities to use in their commercialisation activities.

We believe the objective of having the entire university sector operating within the proposed framework within three years is achievable if universities and the Commonwealth and State Governments co-operate in this endeavour.

## *Appendix A*

# Contemporary case studies of university research commercialisation in Australia

The key point that emerges from these five case studies is that while there is no one ideal structure for commercialisation success there are common features of behaviour for success:

- co-operation between parties;
- acknowledgement of the diverse skills each party has to offer;
- shared focus on getting the deal done; and
- technical competence.

### ***Acyte Biotech***

*Example of the formation of a new company by key researchers and a university research commercialisation company that is growing incrementally rather than through securing upfront capital investment by a third party.*

ACYTE is a biotechnology based company formed by Unisearch to commercialise IP developed by leading researchers Prof Peter Gray and Assoc Prof Noelle Sunstrom from the University of New South Wales, in the area of mammalian cell expression of recombinant DNA derived proteins.

While looking to become an early stage producer of purified cell lines for large pharmaceutical groups its initial strategy has been to work with large international pharmaceutical and biotechnology companies to prove the technology. This provides ACYTE with the cashflow to complete its development programme whilst obtaining acceptance of this new approach from leading industry players. As part of this approach these companies are provided with an option to licence the technology for in-house use and the payment of milestone payments and future royalties.

The commercialisation phase commenced in July 2001 and over the past two years the company has generated gross income in excess of \$1.8m. Of this approximately 50 per cent has been derived from international pharmaceutical and biotechnology companies, 25 per cent from local biotechnology companies and 25 per cent from government grants.

To date the company has been self-funding, although it is recognised that as it moves into a marketing phase that additional capital will need to be raised, most likely through partnerships with leading industry players. The fact that the company can demonstrate a track record of generating revenues from research contracts is expected to improve the outcomes achieved from future investment raising activities.

Based on discussions with Unisearch and Prof Gray, perhaps the key lesson to emerge from the ACYTE experience is that, while it took some time to reach, the adoption of a true partnership approach between Unisearch and the researchers involved was crucial to the development of the company. For the company to succeed, the commercialisation staff and the researchers needed a shared goal of creating a sustainable long-term business rather than a goal of maximising short-run financial returns.

Both Unisearch and the researchers have provided capabilities essential to the development of ACYTE. The researchers have entrée to the key industry forums that has allowed the technology to be brought to the attention of potential contract research customers. Also, without the continued involvement of the lead researchers, the company would not have the technical capabilities required for it to operate. Unisearch has provided required high quality accounting, company structuring and license/contract negotiation skills. The appointment of a company chairman with a strong merchant banking background has also been very beneficial to the company's development.

### **Fultec**

*Example of the spin-off of university generated IP into a venture capitalist backed company.*

Fultec was formed in 2001 to commercialise the Transient Blocking Device (TBU), a technology developed by a PhD student at the University of Queensland. The TBU is a patented device specifically designed for use in the over voltage protection of telecommunication and data systems.

In the mid-1990s UniQuest identified the underpinning research being undertaken in this area at the University of Queensland as having potential commercial value. A patent for the technology was lodged by UniQuest and a number of commercialisation avenues then pursued.

Following the failure of a number of attempts to secure research contracts to further develop the technology (for reasons unrelated to the technology), UniQuest decided to set up a company, Fultec, with early stage finance sourced through Uniseed – the early stage venture capital fund jointly established by the University of Melbourne and the University of Queensland in 2000. Subsequently, once the technology had been developed to proof of concept, successfully tested in the field, and had elicited commercial interest, additional and more substantial investment was raised from the Allen and Buckridge Emerging Technologies Fund (A&B ETF). The pre-seed funding and supporting activity provided by A&B ETF enabled Fultec to develop to the stage that it was ready to secure first round Venture Capital investment.

Fultec moved its operations into UniQuest's incubator facility and is now establishing a presence in the US market. Through A&B ETF's networks in the US, further capital has been secured from leading US venture capital firms and a US based management team has been assembled.

From the perspective of UniQuest, keys to this successful expansion of Fultec have been:

- that UniQuest has the systems in place to identify promising technology being developed at the University of Queensland;

- the fact that UniQuest was able to source, through Uniseed, the very early stage capital required to develop and demonstrate the effectiveness of the technology;
- the subsequent choice of a venture capitalist, A&B ETF, that could provide not only capital but expertise and networks in the US have considerably accelerated Fultec's development; and
- the positive and constructive nature of the working relationship that UniQuest established with A&B ETT make the process much smoother.

From the perspective of A&B ETF, key features of UniQuest's approach that facilitated their investment in Fultec were:

- that UniQuest already clearly understood what 'reasonable' Venture Capital terms look like;
- UniQuest policies and procedures were clear;
- UniQuest staff were highly skilled and adopted a flexible and 'deal oriented' approach to negotiations; and
- UniQuest recognised and valued the capabilities that A&B ETF could provide to Fultec beyond the simple provision of capital.

### **Intel-ANU partnership**

*Example of the formation of a new company to carry forward the development of university generated IP that is of interest to a major industry stakeholder.*

ANU has discovered a physical property of a material that makes the material very attractive to Intel for use in a particular type of electronic product. More work is required to fully understand the physical property and to design products exploiting this property. Together with Allen and Buckridge's Emerging Technology Fund, Intel and ANU are forming a company to carry out this work and commercialise the products.

From Intel's perspective key positive features of ANU's approach to the relationship have been:

- ANU's eagerness to have their research results successfully commercialised;
- ANU's willingness to engage with Intel on this project;
- the researchers themselves have been very easy to work with, knowledgeable, responsive to Intel's questions and capable of explaining their ideas and results to non-experts; and
- ANU's recognition of the potential application of their discovery.

From Intel's perspective, one less helpful aspect of ANU's approach has been that certain parties involved have suggested inappropriate financial arrangements, including an unrealistically high equity stake in the new company for the university.

In order for Intel to engage in this relationship it has been important that it has a motivated and interested technical person on the ground in Australia who is also in a position to approve funding for the project. An internal difficulty Intel faces is the difficulty involved in getting Intel's US-based engineers to look at the opportunity with an open mind – given it falls outside the areas they are focused upon.

From the perspective of the senior ANU researcher involved in this project, this experience has provided a number of important lessons, namely:

- that getting a major industry partner, Intel, involved very early on in the development of the technology – at the stage when a provisional patent application was being prepared – has added real value to the provisional patent subsequently received;
- that Intel and A&B ETF (via a technical consultant) both bringing people to the negotiations that could understand and talk to the researchers about the technology helped build trust and confidence from the researchers perspective;
- that the adoption by all parties of a constructive (amicable and flexible) approach to negotiations is essential to getting a positive outcome as inevitably there are always be points of difference that need to be worked through during the negotiation process. The fact that all parties in this case have had past experience in the area of university research commercialisation helped; and
- the researchers and the ANUTECH staff member attached to the faculty took a proactive role in briefing the ANU finance committee, who must sign off on any commercialisation deals within ANU, on the progress of the negotiations which is important if fast internal ANU sign off is to be obtained.

### **RABiT**

*Example of the formation of a joint venture entity to conduct commercially focused collaborative research endeavour involving multiple universities and industry partners.*

RABiT is a cooperative facility for vehicle dynamics research and the development of by-wire (BW) technology. BW technology is likely to replace mechanical hydraulic systems and become highly influential in the automotive industry.

RABiT is aimed at filling a gap in terms of Victoria's research base, both in the Universities and key automotive companies, in the important emerging field of BW technology. The uptake of BW technology is expected to accelerate at the start of the new decade. In response, industry, educational and research groups in Victoria have formed RABiT, which is a collaborative venture aimed at bringing cohesion and focus to the development and commercialisation of BW technology in Australia. Not responding to the challenge to get on top of the technology could put at risk significant parts of the Victorian automotive supplier base.

RABiT represents the combined efforts of Pacifica Group Technologies Pty Ltd, the University of Melbourne, Bishop Innovation Limited and Swinburne University of Technology and the Victorian Government. The Victorian Government, through its Science, Technology and Innovation (STI) Initiative provided funding of \$4.7 million to RABiT, while the four industry and university partners together contributed \$5.6 million in initial funding to the project. RABiT has used the combined funding to secure the first BW facility in the Asia Pacific region. Comparable facilities are located in North America and Western Europe, and mostly owned by multinational companies.

The industry partners involved in RABiT ensure that the venture is viable and sustainable in the long run. They provide a commercial focus for the initial research efforts, along with established networks for the early commercialisation of intellectual property generated by RABiT.

Limiting the number of core partners has ensured a common purpose and better coordination during RABiT's start-up. Further into development, however, the intention is to allow additional partners. It is anticipated that RABiT will be largely self-sufficient at the end of the three-year STI grant period.

Between 2003 and 2005 it is expected that the capital expenditure involved in the establishment of RABiT will be \$8.788 million. This will be funded by the four parties (mainly PGT and the University of Melbourne) and the STI Initiative by way of a grant of \$4.732 million.

The infrastructure operating costs from 2003 to 2005 are expected to be \$952,000. These costs will be borne by the four core partners.

The four partners envisage that total commitments to research from 2003 to 2006 will gradually build up from \$1.991 million in 2003, to \$2.815 million in 2004, \$3.45 million in 2005 and \$3.978 million in 2006.

By June 2005, revenue generated from RABiT, together with additional grants and private funding, is anticipated to fund the ongoing running of the facility.

### ***Flinders – Enzymatics methods for measuring Ions***

*Example of the licensing of university generated IP by a university technology commercialisation arm.*

In 1987 (the late) Professor Michael Berry (Professor Medical Biochemistry Flinders University) advised Flinders Technologies Pty Ltd of his invention for measuring ions such as sodium & potassium.

The rights to manage the intellectual property were transferred to Flinders Technologies. Clinical chemistry assays for sodium and potassium are the most commonly ordered throughout the world. However, the technology had competition from alternative technologies and the medical diagnostics market is dominated by large trans-national companies. Flinders Technologies added technical and commercial value to the invention through clinical trials, patent applications and market studies.

A licensing strategy was devised, targeting large diagnostic companies, that would secure funds for further R&D on the invention and optimise market penetration. Discussions were held with several companies under confidentiality agreements.

An exclusive License and R&D agreement was negotiated with a large European company. This provided significant license fees and minimum royalty payments. The agreement was terminated in December 2000 with a large payment and all of the intellectual property rights reverted to Flinders Technologies (about 30 patents & manufacturing know-how).

Flinders Technologies subsequently negotiated non-exclusive licenses with other 5 companies in different geographic regions of the world. One of these companies was NASDAQ listed and the technology was crucial for their business. During 2003, Flinders Technologies had negotiations to sell the patents and the other non-exclusive licenses to the NASDAQ company. The final stage was the sale in December 2003 of a portfolio of 29 patents and 4 non-exclusive licenses for a 7 figure sum to a NASDAQ listed company. This was the culmination of about 16 years technical and commercial effort.

Over the years, large sums have been provided to Flinders University from commercialisation of the enzymatic methods invention to the benefit of the inventor, the university, the medical school and hospital.

Some lessons learnt by those involved in this process have been that:

- Long term strategies may be required to optimise research commercialisation.
- Professional management of intellectual property is crucial.
- Adding value to intellectual property arises through both technical and commercial activities.
- Understanding markets and the needs of target companies is crucial for successful deal-making.
- Things never go exactly as expected: it is prudent to have a professional IP manager like Flinders Technologies to carry the risk.

## Appendix B

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