

The university-business nexus in Australia

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Executive summary

An effective innovation system requires productive interactions between all its parts. Within Australia there is a view that business-university interactions are suboptimal. Government has set a target for doubling the interactions between business and publicly funded researchers by 2020; and the Group of Eight has a strategic priority to build closer links between its member universities and business.

Business and universities play complementary roles within the innovation system but have many interdependencies. Not least, universities are producing the graduates that business employs, many of whom will become change leaders, supporting business innovation, growth and the creation of new firms. University research provides a supply of ideas, opportunities and technologies that business can use; and universities store knowledge, competencies and capabilities that business can draw upon. Business has its own, different but complementary capabilities, technologies and information that it can feed into the strategic development of universities and which it can use to support the educational and research activities of universities.

There are many different types of business-university linkage and a diversity of mechanisms that the parties can use to initiate and support these linkages. They may be direct, indirect or system level; strategic and long term or ephemeral. As a minimum they require the flow of information; in many cases they also involve the flow or transfer of money and people. While research linkages tend to receive the most attention, cooperation in other areas of activity can be just as important if not more so; linkages can relate to education, employment, knowledge and technology transfer, the development of strategy and to philanthropy, although there are interconnections between all these areas.

Impediments to the development of effective linkages can include differences in culture and values; the lack of incentive structures; problems in identifying the right people or areas within a university, or in identifying a suitable business for potential cooperation; bureaucratic complexity or barriers; lack of knowledge or resources within small firms; matters relating to the valuation, ownership and management of intellectual property; the lack of funding to make university research outputs 'business ready'; and a range of other matters. However, when there is a will to cooperate, none of these potential barriers is unsurmountable.

Universities, businesses and their respective peak bodies can all take actions to increase and improve business-university linkages. Government also plays a role through the programs it develops and the policy environment that it sets. However, linkages are not an end in themselves but a means to achieving an outcome – beneficial to all the participants – that would not be possible in the absence of the linkage.

Empirical data and studies of innovation show that in Australia the availability of creative and skilled people is a bigger barrier to innovation than access to research, ideas and technology. Shortages can occur at a broad, often discipline level – such as a shortage of engineers or health workers. However, there is also concern among business that graduates lack some of the skills and competencies that business needs and expects. Closer linkages between business and universities have the potential to address some of these issues, help universities respond better to the broader needs of business and improve the transparency and relevance of the credentials they award. Increased diversity within the sector might also help better target the efficient and effective linkages needed to help universities better meet the national interest.

Key messages

- Business and universities are different but complementary parts of the national innovation system and the effectiveness of the system depends on them working together.
- All linkages build on the iterative flow of information between the parties involved and many involve the transfer of funding or the movement of people.
- Linkages require reciprocity and both sectors need to play a role in initiating and strengthening them; neither sector can act in isolation from the other and all parties need to respond to the needs and concerns of the others.
- The most significant linkage is the movement of graduates from universities to take up positions in business, as graduates carry with them the knowledge, skills, expertise and awareness of modern technologies and thinking developed through their university education.
- Businesses can interact with universities to influence and inform their teaching and the learning environment they provide. Examples include the accreditation of courses, guest lecturing, providing internships and work places for students, etc.
- Universities and business can also develop linkages through collaborative research, in the commercialisation of university inventions and through the use and provision of consultancy services. However, empirical evidence suggests that the major factor limiting business innovation is the lack of creative people and people having the necessary skills and expertise, not access to information and research.
- Linkages come in a great diversity of types and serve many purposes. They are not an end in themselves but a means to achieving something neither party can do alone: important questions are whether there are any impediments to the development of linkages or factors which reduce the effectiveness of linkages.
- Improved dialogue between universities and business has the potential to produce better, stronger linkages and to develop new ways to meet business needs, including better and more sophisticated work-integrated learning. However universities can respond only if business takes an active role in developing linkages and in creating the necessary opportunities.
- These issues are increasing in importance as the number of students attending university and as the proportion of the population receiving a university education both increase.

Introduction

Universities and businesses are important but different and complementary components of all national innovation systems. Because any kind of system works through the interactions between its various parts, an effective innovation system requires strong linkages and interactions between its business and university sectors, as well as interactions between these and other components of the system, including government.

In Australia (as in most other countries) there is a belief that the linkages between universities and business are in some way sub-optimal and that improving the number and quality of such interactions would improve the effectiveness of the overall system. There is also a view that business-university interactions in Australia are proportionally fewer than those in other or comparable countries and that this is to the disadvantage of Australia.

These issues are becoming especially important because of an increasing trend to open innovation in which firms look outside their own enterprises to identify opportunities for cooperation and innovation – sometimes through outsourcing research, often by buying in research outputs created by other organisations, including universities. The government certainly places a high priority on increasing business interactions with publicly funded researchers and has a target to double the existing level of collaboration by 2020.¹ One reason for this is the view that business provides the means through which it is possible to convert public sector research outputs to economic outcomes which capture the benefit of the government's investment in research.

Open innovation is important and is one reason why discussions of business-university linkages often focus on the research functions of universities and on the way university research capabilities and research outputs can feed into business innovation, especially technological innovation. Important as this can be, it is only one aspect of the way in which universities can (and should) work together with business to the benefit of both sectors. For example, universities need to seek and respond to signals from business about the needs for particular skills or competencies in their graduates; conversely, universities may be able to draw upon business expertise in seeking ways to improve their own productivity.

A fully effective innovation system needs business-university linkages across all areas of a university's functions and operations. Such linkages will develop most easily in an environment within which business and universities understand, appreciate and respect the roles played by each other and in which the participants are keen to engage in a way that produces maximum benefits for all.

The Group of Eight universities recognise the importance to themselves, to business and to the nation as a whole of strong and effective university business collaboration. For this reason the Group has as one of its strategic priorities for 2011 to 2014:

To build closer links between Go8 member universities and business. As a result, there will be increased university-industry collaboration in higher education and research; and business leaders will be more willing to champion the cause of excellence in university education and research.

1. The government's 10 year innovation strategy, Powering Ideas, states that the government will 'Aim to double the level of collaboration between Australian businesses, universities, and publicly-funded research agencies over the next decade — building on initiatives including mission-based funding compacts for universities, Enterprise Connect (including its Researchers in Business Program), Industry Innovation Councils, the new Joint Research Engagement Scheme, and the new Royal Institution of Australia.' See www.innovation.gov.au/Innovation/Policy/Documents/PoweringIdeasExecutiveSummary.pdf

Close links require trust, mutual understanding and an ongoing commitment that extends beyond short-term projects and issues. These take time and effort to build but there is already a sound foundation and it is important not to underestimate the strength and diversity of the linkages already in place. The purpose of this paper is to explore these issues in more detail and to provide a framework for an examination of the business-university nexus in other countries in order to identify what lessons Australia might draw from the practice of these countries. This is important because compared to experience elsewhere, it does appear that business in Australia provides less direct and indirect support for universities, for example by funding research or in public debate on the purpose and importance of university education, than does the business sector in other countries. If universities are to fulfil their potential in Australia, it is important to understand why this is and to take action to rectify it.

Background

Universities play a critical role within an innovation system because:

- they attract and cultivate students to provide a continuing flow of highly trained, knowledgeable and creative people that on graduation will work in the business and government sectors;
- their research creates ideas, capabilities and opportunities that directly and indirectly provide other sectors with the chance to innovate and improve their performance;
- they provide a storehouse of ideas, knowledge and competence that the other sectors can draw upon as the need might arise; and
- they provide a range of national and local intangible benefits such as their contribution to national reputation and to the culture and openness of society.²

The role of universities in the innovation system is strategic and long term. Universities go beyond meeting immediate labour market needs but are educating and training employees for jobs that may not yet exist and might be very different from any that do currently exist. Moreover, a significant proportion of university research is creating understanding and technologies which go beyond the existing needs of business and communities because the market has not yet imagined the need for them.

University graduates moving into the workforce are capable of performing the job they are given but also have the potential to develop; they should be agents of change in that they have the knowledge and skills to be productive but also the capacity to question, to identify the potential for improvement, to drive productive change and lead business development. An important consequence of this strategic role is the need for universities to look beyond the time horizon of current business needs while meeting society's current requirements. Only by doing this can they ensure that businesses will have the capacity to respond to new challenges and changes in their future operating environments in a way that maintains and improves international competitiveness.

In contrast to universities, businesses are the primary drivers of economic growth and development within the innovation system. They produce and provide the goods and services that both domestic and international customers want to buy and they develop the markets that allow them to sell what they can supply. To the extent that they do this efficiently and are able to anticipate, target and develop consumer needs, they help create national wealth, prosperity and wellbeing. Businesses provide employment opportunities for university graduates, as well as for people having other and different but equally important skill sets and competencies. Businesses also conduct the research they need to develop the business opportunities they have identified and which is necessary to maintain their competitiveness; they may also commission some research from universities. In addition, businesses may commercialise research outputs that universities have developed and which are within the capabilities of the business to use and congruent with the firm's business strategy.

While it is easy to argue that universities and businesses play different roles, it is important to recognise that there is also a degree of overlap between them. Even though public universities do not have profit as their overriding objective, they still have many characteristics of a business.

2. For a more detailed discussion of the role of universities in the innovation system see the Go8 discussion paper at: www.go8.edu.au/university-staff/go8-policy-_and_-analysis/2011/role-of-universities-in-the-national-innovation-system

Indeed, together with private universities and other private providers, they form an important part of a highly competitive and growing service sector, employ many people – academic as well as general staff – and are important purchasers of goods and services from other sectors of the economy. Universities also provide many intangible benefits for their local communities, including businesses.

Within Australia universities are responsible for one of the largest service sector exports (valued at around \$16 billion) through the education they provide to international students. And like any other business, universities experience intense competition in both their international and domestic markets, especially since the introduction of demand driven funding. This competition helps drive innovation, differentiation and specialisation, although a strict regulatory environment and government policy framework can limit the options and mechanisms for change and impede innovation within the sector such that it occurs at a level less than might be in the national interest.

Even though in many areas a university behaves as a business, the relationship between a university and its customers is different from that between most other businesses and their customers. This has implications for university-business linkages.

For most businesses the customer is king. The success of a business depends on giving its customers what they want, when they need it, at a price they can afford. There is no uncertainty about who the customer is; and who pays the piper calls the tune. Moreover, in the majority of cases, the outcome of a business transaction is clear at its start. Customers know exactly what they are buying and what its value to them will be.

The relationship between a university and its students is much more complex. This is not only because the students may be paying only a proportion of the cost of the education the university provides, or may in some cases have a limited understanding of what they are buying. In effect, a student is both the customer and, in the form of a graduate, one of the outputs of a university. In other words, a student is an input as well as a customer and the educational services that students purchase convert them to graduates – one of the outputs of a university. The situation is even more complex than this because students are active participants in the learning process and the quality of the learning environment depends in part on the contributions made by the students – which is one reason for concentrating excellence. Good students perform best when working with other good students because this extends them and their teachers.

Even when all the students participating in a particular course are paying the same for the service they receive, the university will itself determine the extent of the benefit each student has gained from that service and this may not be to the student's liking.³ A 'fail' has a very different value to a student than a 'higher distinction', even though the direct financial cost to the student of acquiring these different outcomes may be the same. In a very real sense, the credential that students are seeking serves the needs of employers – including business – as much as, if not more than, the needs of the students themselves. In ensuring the credentials they award are rigorous and meaningful, universities are demonstrating a strong link with those parts of the innovation system – and especially business – seeking information about the existing capabilities and potential to learn and adapt of the people they select to work for them.

3. While similar outcomes can occur in other service industries (e.g. an ugly haircut or disappointing theatrical performance) they are not strictly analogous as such outcomes are ephemeral and usually reflect more on the service provider than on the person paying for and receiving the service.

In their direct transactions with business, universities are usually in a more traditional customer-supplier relationship than they are with students. This is certainly the case when universities are buying equipment, supplies or services from the business sector. However, when business is purchasing goods or service from a university, the situation can become more complex. One reason for this is that because universities receive tax payer support, a business may feel that a university need not apply traditional cost and pricing policies – for example, that it does not need to make a profit above the cost of the service it provides, or that there is no need to pay the full cost or a market price because the tax the business has paid is already covering part of the cost. There can be a view that universities are part of the public infrastructure intended to support business and that this support should involve an element of subsidy.

This idea that universities are one of the government-provided support mechanisms for business can become especially problematic in university-business linkages relating to university research, although it can also arise in relation to the educational responsibilities of universities. For example, business groups may criticise universities because some university research is not relevant to business needs. This not only ignores the need for universities to serve government and the wider community as well as business, it also fails to recognise that university research is exploring issues and creating understanding that may eventually develop opportunities for commercial development that go way beyond those that already exist.

A more difficult situation can arise when a business commissions research from a university and does not appreciate the need to pay for the background IP and the specialised skills built up over many years of past research. Commissioning research can be difficult in any case because of the uncertainties that exist in research and the different focus of business and university researchers. While not insurmountable, these kinds of consideration can add to the time and effort necessary to develop sustainable linkages, even (or especially) when government supplements the funding provided by industry and the contributions coming from the university. The complex and often tedious negotiations required to develop intellectual property agreements for successful Cooperative Research Centres provide one example of this.⁴

The existence of private universities, run as a business and aiming to profit from the services they provide, demonstrates some of the overlaps that can exist between universities and business. More importantly, this illustrates the diversity that exists within the business sector when compared to the relative uniformity of the university sector. A hairdressing salon, garage or even small accounting practice is likely to have a very different set of relationships with the university sector than a pharmaceutical company or firms operating in the aerospace or communication sectors. Agriculture differs from manufacturing which differs from mining in terms of intra and inter industry relations and innovation processes. This means that in making comparisons between the level and nature of business-university interactions in different countries, it is necessary to take into account factors such as industrial structure and firm size.

The potential for productive business interactions with universities can vary significantly depending on the particular sector of a business, its competitive and business environments and on its location. Factors such as the prevailing policy frameworks, economic conditions, consumer confidence levels, availability of finance and levels of competition (to name just some) also play a role.

4. Multi-participant collaborations involving business, universities and government often have complex accountability and reporting requirements given the different needs and perspectives of the various parties.

Types of business-university linkage

Types of linkage

The connections between business and universities are many, varied and dynamic. In considering how to increase, strengthen and improve them, it is useful to consider the form they can take and the purpose they serve.

At its most basic, a linkage between two or more parties consists of an interaction in which one party responds to or meets the needs of the other. In some cases linkages enable the two parties to access resources from a third party that might not be available to each separately – for example when business-university collaboration is necessary to access particular government research funding programs. From a business perspective, working with a university can also provide a neutral environment within which it becomes possible to work with other firms from within the same sector to address problems of common concern.

A successful linkage will usually connect complementary capabilities. Indeed, the power of the connection comes from the synergies that result from the bringing together of different capabilities.⁵ This creates the potential to achieve something that none of the individual parties can realise by themselves. The most effective linkages are often multiparty, bringing together entities whose outlook, objectives and intentions may be quite different from each other. Especially in the case of linkages building on opportunities created by university research, this requires a trans-disciplinary approach that brings into the partnership the broader business expertise necessary to achieve market success.

Direct interactions between universities and business may be formal (involving a contract or agreement) or informal. Linkages may be strategic and long lasting or opportunistic and ephemeral. Many formal interactions will take place at the level of the institution but many informal interactions and linkages take place at the level of individuals, building on personal relationships and trust. This can be a major difficulty in trying to quantify the extent of the linkages that exist. (While formal agreements may be between institutions, it is important to remember that their implementation – and indeed the implementation of any form of linkage – takes place through the action of people working together. An impersonal linkage is one that is not working.)

Direct business-university interactions involve a flow of at least one of information, people and money – and often all three of these. A university can respond to a business need only if it knows about it – so a flow of accurate information is always necessary. The most robust linkages involve a two-way, interactive and iterative flow of information, creating a situation in which each participant learns from the others, and responds in appropriate ways as a result of this learning. Responding to an identified need will generally take up resources, so that a flow of money may be necessary to ensure an appropriate response, although in some cases in-kind support may be sufficient – and this can include the movement of people.

Most linkages require direct contact between the parties but there are many indirect linkages which add value. Indirect linkages often involve a broadcast flow of information rather than a targeted relationship. For example, researchers in a business are able to take advantage of

5. In some cases the benefits of linkages arise from increased scale rather than from the synergies that arise from difference – but this is more usual in the case of linkages within a sector – e.g. universities combining resources to purchase and share equipment that none of the parties might afford individually and that each party by itself could not use to full capacity. Such examples tend to involve cooperation rather than collaboration.

research performed by a university and published in a scientific journal, monograph or technical manual without making any direct contact with the university. University researchers similarly read papers and patents having authors from business. People working in business depend to a considerable extent on reading publications or attending seminars and other meetings to get ideas for innovation.⁶ Other kinds of indirect interactions can take place through publications such as newsletters or patent documents; through participation in scientific societies, academies and other third party bodies; and through other social interactions.

Indirect linkages take place all the time and without any formal contact between the university and the business. While indirect, often informal and frequently personal, they nonetheless make an immense contribution to the flow of ideas and knowledge that supports national wellbeing.

An even more pervasive but indirect connection is that businesses employ university graduates and benefit from the up-to-date knowledge and skills relevant to the business that the graduates obtained through their university experience. The movement of people is certainly the most effective means of technology and knowledge transfer but this movement of students through the education system to employment is really too general to consider a genuine linkage – even though it represents a huge benefit and the major economic contribution that universities make to national wellbeing. Nevertheless, the social networks that result from graduate mobility can provide a useful foundation for the development of more specific linkages, for example through the use of alumni organisations.

While in quantitative terms the movement of graduates to business is important, the movement of people with business experience into universities can also have considerable benefit. Such movements can take place at any level, from vice-chancellor down. The bringing of business experience into university administration can provide a different perspective and contrasting performance culture, while business-experienced lecturers can add practical insights into academic courses.

Indirect linkages in particular demonstrate the value of collocation of university and business facilities in a way that facilitates and encourages interaction. Unfortunately, geographical proximity in itself is not sufficient to generate the interactions that lead to linkages, although it certainly helps and there is much evidence to show that interactions of all kind are more likely the less the geographical distance between the cooperating entities.

In addition to the direct and indirect linkages already discussed, there is a third and very important level of linkage. This is the system level linkage which brings together the sectors rather than individual institutions. The need to produce the number of graduates in a particular discipline that the labour market demands is a system outcome that goes beyond a close relationship between particular firms and universities. A shortage of engineers or a potential shortage of postgraduate qualified researchers within business and academia requires that universities respond to system level signals and that business and other players work to ensure that the appropriate signals are communicated in a timely manner.

While there is a variety of mechanisms through which system linkages can develop, some of the most useful involve cooperation between the various peak bodies or between peak bodies and government; and the establishment by government of consultative groups (such as the

6. For example, the most recent Australian innovation survey shows that 27.8 per cent of innovating businesses used websites, journals, research papers and publications as a source of ideas and 21.6 per cent used professional conferences, seminars, meetings and trade shows. Only 2.6 per cent used universities or other higher education institutions directly.

current sector Innovation Councils) involving senior representatives from the necessary sectors. Mechanisms such as these can play important roles in the development and transmission of the necessary high level signals. They can also help cultivate the personal relationships that can facilitate an effective response to these signals.

Purpose of linkages

A different perspective on university business linkages comes from considering their purpose. Discussions of business-university relations often focus on linkages that relate to the commercialisation of research or the provision of research services. While these are important and often easy to quantify, they represent only a small proportion of the total interactions that take place. Concentrating on research-related linkages can distort our understanding of the rich and multifaceted business-university nexus and lead to simplistic conclusions. Moreover, it is important to recognise that while much of the discussion in this area covers the need for business to access and make use of university expertise and facilities, there are as many benefits for universities in being able to make use of the specialised skills, knowledge and infrastructure available within business.

Research

Even within the context of university-business research linkages there is a wide variety of possible models and approaches. Two broad extremes are when the university has developed technology and actively seeks business support to commercialise it (technology push); and when a business seeks to use the capabilities of a university to conduct a clearly defined research project needed to solve an already defined problem (market pull). In reality these are the opposite ends of a multifaceted spectrum of relationships involving different degrees of both commitment and complexity of interactions. Moreover, the technology-push approach is a specialised example of the more general relationships relating to technology and knowledge transfer.

Looking more specifically at the market pull research linkages, there is again a spectrum of possibilities. The situation in which a business seeks to enter a long-term relationship with a university to explore defined research areas with a view to identifying possible commercial opportunities is very different from that in which a business, lacking either some of the necessary expertise or equipment, approaches a university with a carefully defined problem and the research strategy to deal with it. Moreover, the potential of and for such linkages, and the need for them, can vary significantly from place to place and business to business. This is because it depends to a considerable extent on the capabilities a business already has and on factors individual to each business, such as its risk profile.

Issues relating to costing and pricing, the need to deal with background, prior and tacit IP, ownership and licensing agreements, and many other matters are different in these two cases, as will be the degree of interconnectedness and strength of the resulting relationship. There is no sharp distinction between what is a strictly commercial research service and a collaborative research activity – and without sensitivity in handling them, these issues can cause concern and misunderstanding. Fortunately, the commercialisation and technology transfer offices of universities have considerable experience in negotiating and managing these kinds of linkage.

While many business-university research interactions are bilateral, some are more complex. For example a contract or project can bring together many parties (as with the Cooperative Research Centre program), require joint approaches for government funding or result from mediation through a third party, such as an industry research association.

Knowledge and technology transfer

The commercialisation of university inventions through licensing arrangements or the establishment of spinoff companies is a prominent form of knowledge transfer from universities to business. As already noted, the most significant knowledge transfer mechanism takes place through the movement of new graduates into the workforce. Publications, whether formal academic papers or university newsletters also play a role, as do alumni connections.

Staff secondments, short-term appointments and joint appointments can occur in either direction and for a variety of purposes. These range from staff training to ensuring continuity and the transfer of the necessary tacit knowledge in taking an invention from a university to an industrial research laboratory.

There are also specific and targeted activities for knowledge transfer. These can include field days, technology fairs and markets, establishing public databases of the technology available for licensing, or promoting the more general capabilities a university can provide to business. Without effective promotion, business may find it difficult to determine what opportunities or capabilities for collaboration might exist, even when there is an interest in joint work; and an open invitation to an event can attract businesses that a university might otherwise know nothing about.

There are also longer-term interventions to support knowledge transfer such as the development of technology parks and business incubators which provide access to advice from across the university.

Education

In addition to the well-canvassed linkages relating to research, some important university business linkages relate to the educational function of universities. These are many, varied and clearly involve knowledge transfer. In some cases this transfer may be from the business sector to the university, as with the role of certain professional bodies (for example in engineering, medicine or accounting) in accrediting university courses. Such accreditation provides a direct connection between the needs of professional practice in business and both the content of courses and the standards that universities apply in assessing the students undertaking the courses.

Accreditation processes ensure universities are aware of what professional practice requires and that they can respond to the needs of business by ensuring their courses are current and that their assessment processes provide the confidence that business requires. At a more strategic level, employers and trade unions were active participants in the negotiations that led to the most recent Australian Qualifications Framework.

When there are no formal course accreditation processes involving business, the default position is often that the academics are setting professional standards for knowledge and capabilities through their work in developing curriculums and in the standards they set for assessment.

Business can and does contribute to the education of university students (and to the ongoing education of university staff) in many other ways. Examples include senior business people providing guest lectures and seminars, or taking part in workshops; firms in different sectors offering or seeking internship positions or offering vacation work relevant to a student's degree course; business people offering to mentor students or provide advice, for example for entrepreneurship courses; and firms providing opportunities for field visits. At the postgraduate level a firm can work with a university to develop a research project of mutual interest and perhaps by offering the postgraduate student access to facilities, experience and placements. More formal

arrangements can include joint appointments. Some firms will offer scholarships to students working in disciplines of particular interest to the firm or support students attending university through work release schemes when the disciplines are relevant to the needs of the firm.

Conversely, universities can respond to business needs by developing and offering courses tailored to the needs of a particular business or sector, or by offering short courses (at the university or in-house) for professional development that recognise and respond to the constraints experienced by people already in the workforce.

Closely related to the education and training connections are those in which business draws upon the facilities of a university to seek information and advice. Universities may offer consultancy services, which, by drawing upon existing knowledge and expertise do not involve research but make use of past research, understanding and the skill sets available in the university. Consultancy services can involve non-research scientific services, such as testing and analysis or providing access to specialised equipment, as well as a very wide range of activities that can draw upon all the disciplines and scholarship available within a university. It is important not to underestimate the multiplicity of business needs that a university can serve. A construction company might seek archaeological and historical expertise to support a heritage assessment, a manufacturing company help with computational fluid dynamics, a geosciences exploration company might need anthropological information relating to people in areas having potential for exploration, or a truffle growing cooperative seek help in the translation and broader interpretation of French technical and company literature.

Strategy

Universities operate in a complex, changing environment and have multiple taskmasters with no single point of accountability. They are responsible to governments (which provide a decreasing proportion of their funding), standards bodies, to students, their staff, the general community, their local region, to a multitude of different funding bodies and to business. They have to meet different and sometimes conflicting expectations in a way that maintains their sustainability and financial viability while upholding the excellence across all their activities needed to support the university brand and its international reputation. Moreover, university staff may have allegiances to bodies outside the university (relating to their research funding, discipline groups or collaborators) which in some cases may be as strong as their allegiance to the university and may see themselves as members of a particular school or department rather than as members of the university as a whole.

In needing to meet multiple objectives within what are usually decentralised operating environments, the management of universities can face challenges in developing their strategic and operational plans that often exceed those of most firms. Nevertheless, having business representatives on university councils, advisory boards and committees brings in complementary expertise. This can directly support the strategic management of the university but just as importantly provides a source of intelligence on the external environment that is not otherwise available.

At a level lower than that of the organisation as a whole, there are other opportunities for collaboration. For example, universities can invite business participation in activities such as the longer term planning of courses. Indeed, in situations where industry experience is essential to achieving the final qualification this may be essential, if only to understand the numbers of industry placements that will be available. Other opportunities for interaction can be the development of research strategies and technology roadmaps, although this kind of exercise may originate with third parties and require the participation of multiple firms and universities.

Just as universities can benefit from having business representatives contributing to their decision making and planning processes, so can a business profit from the participation of academics as members of their boards and in taking part in broader planning and strategic processes. This is not only because of an academic's technical expertise. Just as important and useful can be the international reputation of the academics, their network of contacts and the awareness this network creates of research developments around the world. This broad perspective will often enable an academic to identify the longer term and potential impacts of current and emerging developments on a firm's technology and business development strategies. While this kind of cooperation can often take place between a firm and a particular academic, at a broader level (for example the development of technology roadmaps) it can take place through industry associations and researchers from several universities.

Another way in which business and universities can work together strategically is when they join forces to inform and influence policy development in areas of common interest. Government and other inquiries will often address matters of interest to both sectors. Depending on the subject of the inquiry or review, a joint submission from universities and business (or from the peak bodies representing them) is likely to have more influence than a separate submission from each. Similarly, the presence of both academic and business representatives on government and other committees can provide a useful indirect linkage allowing the exchange of views and a mutual understanding and in some cases there may be opportunities for joint lobbying.

It is certainly the case that when business seeks to inform and influence government policy deliberations in areas that impact directly on business competitiveness such as tax, trade law, the regulatory environment, innovation processes, and so on, they can draw upon the huge resource of high level expertise within universities. In many cases this can provide a wider and more up to date perspective than that found within individual businesses and may help present the arguments in a more disinterested way.

Philanthropy

While business-university linkages often build on the flow of funds to a university to purchase a specific output – a license agreement, a particular piece of research or a tailored course – there is also a tradition of business philanthropy, which is stronger in many other countries than in Australia.

Philanthropy may entail businesses providing funding to support universities, a university or a particular school within the university, independently of any specific output or return. Philanthropic donations acknowledge the importance of the indirect and diffuse but nonetheless critical contributions that universities make to national wellbeing and business development. The intent of the philanthropy can be one-off or strategic, and the extent of continuing business involvement in the distribution and management of donated funds can vary enormously. Moreover, while philanthropic activity will usually involve the donation of money, it can also involve in-kind support, such as the provision of equipment or people.

In some cases philanthropy will support a specific institution, in others it might sponsor, for example, a particular cultural activity, research discipline or training. Company donations can support the establishment of a professor or fellows but might also provide scholarships and other support for students in selected disciplines. In making philanthropic donations, firms can operate independently or through industry associations. Donations of this kind provide a very direct mechanism through which firms can influence the growth of educational and research opportunities in new or emerging areas that have significance for the development of the firm or sector.

Competitions and Prizes

A subset of philanthropy can be when business offers prizes for students or staff excelling in particular activities. Sometimes this can involve business sponsorship of competitions. Entrepreneurship and the development of business plans are frequent targets of such competitions and the business sponsorship will often include mentoring as well as providing the prize.

Employment

This paper has already noted that the most pervasive, if often unremarked linkage is that based on businesses employing university graduates. Students go to universities to gain the skills and knowledge that will allow them to enter interesting, worthwhile and hopefully well remunerated jobs which provide scope for development. Businesses are seeking to employ the best and most talented graduates, as assessed according to the needs of the business. This provides an opportunity for business to develop and create a variety of linkages that will enable them to identify possible employees and assess them before they graduate so they can make early offers of employment.

A close interaction between a business and a university department can provide early intelligence on likely employees and offering internships, vacation jobs or other work experience opportunities can provide a useful means of attracting the best and most capable graduates to a business. A university able to offer such work experience opportunities, especially with businesses of high standing, may be in a better position to attract the best students in particular disciplines than those which do not do this.

Impediments to the development of linkages

Even though business-university linkages can provide many advantages for the participating institutions and help strengthen the overall innovation system, there can be impediments to their development. Such impediments can vary from institution to institution and from case to case, although some may be general and flow from the cultural and structural differences that distinguish universities from the business sector.

Different universities and even the departments or schools within the same university may have dissimilar interests in (and capabilities for) interacting with business. As a result, the relative importance of particular kinds of barrier or impediment can vary from situation to situation. Moreover, personal values, attitudes and interests can also play a significant role in the initiation and continuation of linkages. A complicating factor is that universities and business can have quite different perspectives on the potential barriers and on how to overcome them. This means that an ongoing dialogue is essential to understand the differing points of view and is anyway necessary to understand what opportunities for serious partnership realistically exist.

At the outset it is important to state that there is no simple or single way to improve the number and quality of linkages. Not least, this is because the relative importance of particular impediments can vary depending on the geographical location of businesses relative to the university, the purpose of the linkage, the personalities and level of funding involved, whether the required linkage is bilateral or multilateral, and so on.

It is also important to emphasise that while this section of the paper identifies impediments that can exist or are said to exist, Australia is not very different from equivalent countries in the extent of linkages; that both universities and business have considerable experience in working together

and in overcoming any of the barriers to collaboration and cooperation that they believe might exist; and that while there is always room for improvement, there are significant achievements that demonstrate both the importance and the effectiveness of existing linkages. Where there is a will to work together, some barriers turn out to be illusory, others are easily overcome. This is why it is always important to pay attention to the incentives that encourage and facilitate working together.

Cultural differences

Because universities and business have different objectives, the people they employ often have different values and certainly work within different performance frameworks. This can manifest itself in terms of organisational culture (with universities often operating more as a single brand franchise with significant devolved autonomy, rather than as a single enterprise managed from the top down). The hierarchical reporting structures that exist in many businesses do not operate so strictly in a university – for many good reasons – but this can create problems for a firm trying to communicate with a university for the first time.

Some of the most profound cultural differences between business and universities exist in relation to research, especially research directed towards science and technology. University researchers may have a greater interest in advancing knowledge and in following up interesting, exciting and abstract lines of inquiry, no matter where they lead or how long they take; researchers in business often have a greater focus on a particular end point, on timeliness, on short-term development, on the cheaper solution that works and on what is practical. This means industrial research will seek outcomes within the capabilities of the firm conducting the research, which from an academic perspective might severely limit the options to follow up. These factors can create tensions especially when, for example, a business contracts to a university research which has a higher risk of failure and greater uncertainty of outcomes than the research the business performs in-house.

Some business people believe that academics may undervalue the financial and intellectual contributions that business can provide and lack respect for the important and complementary contributions from business needed to convert an invention into an innovation. Academics can believe that working too closely with business can in some way limit their academic freedom, distort their research agenda to a focus on the immediate and trivial and create conflicts of interest, for example by placing financial return higher on the agenda than public issues of safety, health or environmental concerns.

The demands of a business research environment can call for a greater degree of pragmatism, discipline and a 'will do' approach than does academic research, which strives for a complete understanding and is often more abstract. Industrial research is not an end in itself and research management in business will often include a greater element of top down direction that takes into account factors other than the excellence of the science. Indeed, brilliant and provocative research that has no short-term practical outcomes may be of little value in most industrial research laboratories, while it might put the academic researcher in line for a Nobel prize.

There are other important cultural differences. Given the particular outcomes the researchers in the two sectors are often aiming to achieve, it is not surprising that the sectors may adopt dissimilar approaches to risk management. Another important difference is that university research is often explicitly a training exercise and a means of developing research skills in students undergoing higher degree by research training (and this can be its primary purpose). Among other things, this means that university research is usually aiming to achieve several objectives simultaneously, while business research has a more single-minded approach, trying to achieve an already defined end point as quickly and as cheaply as possible and in a way that will expedite the

transfer to market of the research outputs. In business research normally takes place as an integral part of a commercialisation strategy. A plan to take the technology to market is not an add-on once researchers (or a commercialisation office) recognise the potential value of a research output but forms part of the research strategy from the start of the research. This may mean that business researchers are more entrepreneurial than academic researchers and they certainly have a greater exposure to the commercial realities of the market the research will serve.

Cultural differences between the sectors are genuine but it is important not to overemphasise their significance. Culture reflects the sum of individual behaviours and varies even within a single institution and across disciplines. This is not surprising given the diversity and wide variety of people who work in each sector. There are very entrepreneurial academics and it is certainly the case that large and research intensive firms have supported long-term and high risk research that has led to the award of Nobel prizes. Nevertheless, the sectors do behave differently in general and this is why there can be advantages in linking them.

Incentive structures

One issue that often arises in discussions of the number of business-university linkages is whether there are incentives to support their development and maintenance; or even whether there are disincentives, especially in the university sector, which serve to inhibit the development of robust relationships between the two sectors.

At the national level there are government programs that support linkages and provide funding only for projects that include universities and business working together. Obvious examples include the CRC program, the ARC Linkage programs including the Industrial Transformation Research Program and the support available under programs such as Enterprise Connect. The availability of this funding provides a clear and explicit incentive for the sectors to work together.

Similarly, the fact that the business sector is able to pay for the research it commissions or for the licenses it seeks to negotiate provides a significant incentive to universities and individual researchers, who are always short of funds.

The establishment of university commercialisation offices also demonstrates university interest in developing a relationship with business – given that this is their purpose. Moreover, as the proportion of government funding in university budgets has fallen, the incentive to work with business and broader sources of funding has increased.

The development of government surveys such as *Australian National Survey of Research Commercialisation* introduces an element of competition into this area by providing comparative data that enables universities to assess their own performance against that of other universities. However, while commercialisation offices demonstrate a commitment to cooperation, there can also be a perception among business that technology transfer offices are often bureaucratic, making it more difficult for business to communicate directly with researchers and serving to take away from individual researchers the responsibility to think about commercial opportunities.⁷ However, countering this is the view that by employing professional staff these offices enable universities to make a more realistic assessment of the value of a technology disclosure, facilitate a more strategic approach to commercialisation and move away from a focus on potential windfall gains.

7. The communiqué of the ATSE May 2011 workshop on strengthening links between industry and public sector research organisations stated that some delegates saw technology transfer offices as part of the problem, rather than as a way of improving collaboration and that 'within industry they are often seen as posing a major and undesirable hurdle in building a relationship with a promising academic researcher'. www.atse.org.au/resource-centre/func-startdown/451/

Despite these national level incentives, a frequent complaint is that university promotion, performance and employment criteria do not recognise or give weight to the work that academics perform with or for business. This can disadvantage researchers doing contract work for business and can limit options for academics wishing to move between university and business employment, resulting in a significant barrier to mobility between the sectors. (Other factors such as salary differentials and issues relating to the transfer of superannuation can also play a part in limiting mobility, although over recent years the latter has become significantly less of a problem than formerly.) Organisational cultures which facilitate temporary movement can be especially useful in transferring complex technologies, for example by having an effect on the risk assessment of researchers considering a move to a start-up company. Useful measures can include, for example institutional support for carrying the teaching load of an academic on temporary secondment.

University measures of the excellence of research usually emphasise publications in highly rated, peer reviewed journals and citations. Work for a business might not lead to such publications or to their delay for reasons of commercial confidentiality, while still having major impacts such as the increased competitiveness of the business, the generation of employment and exports, improved profitability, and so on.⁸ Similarly, time spent in providing consultancy or advisory services for business is time that cannot be spent on research. Even though these activities play a critical role in knowledge transfer, which is an important function of universities and in some sense as important as knowledge creation, they may not rank highly in performance assessments. Some academics and people in business believe that academics spending time supporting business may experience a personal disadvantage because this will reduce the time they can spend generating the outputs that universities use to assess individual performance.⁹

A similar argument has been made at the institutional level with the contention that the ERA process favours the more research intensive universities at the expense of those universities that work more closely with industry or which perform research which more directly leads to commercial outcomes. For this reason work has started to explore processes to measure the impact of research to complement the ERA process. Impact in this sense is about changing the world as distinct from changing the way people understand or think about the world. One of the conceptual issues this work has to address is that some of the greatest impacts arise from research performed many years ago that has had a pervasive influence across a whole range of real world outcomes and contributed to a wide range of real world impacts by providing a theoretical and practical basis for subsequent advances in thinking and technology. Project or even program specific measures of impact will not pick this up but such broad ranging impacts tend to flow from the really exciting research as measured through the traditional excellence measures used in processes such as ERA.

One indication of the strong link between traditional research excellence and the impact of research is that scientific papers cited in patent documents are generally those most cited in the scientific literature; another indication is the preference that business has to commission research from institutions having a record of academically excellent research. For example, the

8. Even when a researcher publishes the results of work performed for business, the publication may receive few citations because the research will often be of less general significance. This does not reflect the poorly on excellence of the research but is a consequence of business research seeking outputs designed for a particular set of circumstances defined by business needs and capabilities. Business research uses criteria for excellence which are different from those used for academic research. Both sets are equally valid, reflecting the purpose of the investment.

9. A recent report on UK academic attitudes to industry engagement concluded that while academics feel supported by their department and their university for their engagement efforts with industry, few considered this activity as rewarded or valued by their department or university. See: www.aimresearch.org/uploads/file/Publications/Academic%20Publications%202/Republic_of_engagement.pdf

Go8 universities received 70 per cent of total university research income in 2010, as reported in the Higher Education Research Data Collection (HERDC) and also received 61 per cent of the income reported from Australian grants and contracts from industry and 'other' sources. (The Go8 universities also received 68.5 per cent of research funding from international sources.)

Visibility issues

Australian universities have many facilities, capabilities and technologies of potential interest to Australian businesses. Each university has its own specialisation, networks, sets of expertise and stores of knowledge. The problem for a business seeking support for a particular problem or a certain type of advice is to know where the necessary expertise or facilities might be. Businesses can also have a problem in judging the quality and worth of the services a university might offer.

The devolved structure and management of universities can add to the difficulties businesses face in trying to find the capabilities they are seeking. There is often no central, comprehensive and publicly available register of university capabilities or even of current research projects or of the specialised skills available.

This may not always be a major hurdle because many businesses which perform research use the scientific literature and are aware of where the relevant research is taking place and of who is conducting it. However, this does not help the business seeking technical advice, specialised scientific services or access to sophisticated research equipment; nor is it helpful to a business without its own research capability which has recognised the potential of a particular research project and wants to contract it out.

The Go8 universities are addressing this problem through the development of a publicly available database of the universities' research capabilities (*Australia's Knowledge Gateway*). The plan is to widen the scope of this database to include all Australian universities and government research agencies. The Gateway is a freely available, searchable database linking directly to researcher expertise and it enables business and other users to identify universities and individual researchers with strength in particular disciplines by entering non-technical search terms. By using plain English key words, a business is able to identify researchers and universities having expertise, based on the publications resulting from the various research groups.

As well as businesses finding it difficult to locate the capabilities they need, other information failures can occur within individual institutions – for example, due to a lack of information on the opportunities and mechanisms for engagement, or of explicit and widely promoted policies promoting and supporting interactions with business. This lack (or poor availability) of information is not just a characteristic of universities. Similar problems can exist within and about firms. For example, a university can find it difficult to find firms having the capabilities and characteristics that might give it an interest in exploiting some novel technology the university has developed.

Individual universities can do much to promote their services within their local region and do so, not least because there is considerable work that demonstrates the importance of geographical proximity to effective collaboration.

Bureaucratic issues

A university differs from most other businesses in its operations, processes and policies may be different from those found in most businesses. Moreover, universities have a degree of public accountability that goes beyond that experienced by most businesses; and the responsibility of universities to different sets of stakeholders can produce processes and procedures that can appear

unnecessarily onerous to a business having a clear and primary responsibility only to its shareholders. Among other things this can mean that management procedures, accounting systems and the reporting and accountability requirements imposed on university researchers can be difficult to match with those of a business. There is no uniformity among universities in terms of procedures, requirements or systems and the situation can become especially complex when it is necessary to account separately and under different criteria for funding coming from multiple sources – even different government programs. While these matters are irritants, none is insurmountable and they do not prevent the many and often complex, multiparty linkages that are already in place.

Multiple responsibilities

Another factor that can present problems for business is that many university researchers have responsibilities above and beyond research. Academics can have many competing demands on their time – teaching, administration, student assessment, counselling, existing research commitments, and so on. These demands vary in intensity over the course of a year and the experienced researchers that a firm might want to contract are not necessarily available, especially at short notice. This can make it difficult for a university to respond quickly to a business need, especially when for one reason or another a business wishes to work with a specified individual rather than rely on a university's capabilities more generally. Business can also interpret the need to work through commercialisation offices rather than directly with the researchers themselves as adding unnecessary bureaucracy to the negotiation process and even as imposing additional costs. Having explicit institutional policies and mechanisms for business engagement and ensuring that staff are aware of these can help overcome such obstacles and generate mutual understanding.

Business knowledge

Compared to many other OECD countries, Australia has few large firms or firms operating in the more high technology areas. A small firm may not have the resources, internal knowledge or time to identify the particular ways in which it might benefit from the development of direct linkages with a university. It can be difficult to develop a research project or maintain an awareness of relevant research in universities without an internal research group. In a small firm in which growing day to day demands occupy the time of all senior managers, it may be difficult even to identify opportunities to offer internships to university students – and to commit to the training that accepting a student would entail.

Even a firm having a small research group may lack the resources necessary to offer a postgraduate student a project relevant to the firm, especially given the issues that can arise from postgraduate training, such as the need for early publication or for a student to complete training even if it becomes apparent that the intended commercial outcome is unlikely.

Conversely, the lack of business experience and knowledge among many academics can make it more difficult for them to relate easily to business requirements. This is also a factor in making some academics reluctant to follow their research outputs into a start-up or other company intent on commercialising them.

IP ownership

Reaching agreement on the ownership and management of intellectual property developed through a business-university relationship can sometimes present difficulties, as can reaching agreement on the value and contribution of the background and tacit IP each party brings to

the collaboration. Indeed, the communiqué of an ATSE international workshop in May 2011 on *Strengthening links between industry and public sector research organisations* stated that from an industry viewpoint two of the major impediments to collaboration were questions of ownership of IP and 'often entirely unrealistic valuation of the IP' by the research performing organisation.¹⁰ Fortunately, there is a great deal of experience now developed in this area.

One problem in setting up research collaborations can be that all the collaborating parties base their negotiating position on the assumption of a blockbuster outcome that is at best unlikely. Another complicating factor is the different approach to IP ownership between business and universities.

Researchers in business have research as their full time job and the firm that employs them provides the resources necessary to perform the research – which may also be subject to significant top down management. The firm owns the resulting IP. Within a university the situation is often different. An academic may have teaching and other responsibilities, as well as research. Moreover, the funding for the research may be coming (at least in part) from outside the university. In most cases this funding flows from the reputation of the individual researchers and the excellence of the proposals that the researchers develop – and in at least some cases the funding will follow the researcher if the researcher moves to a different institution. A further complication is that postgraduate students conducting research are not in any technical sense employees of the university. The management of university research is normally a matter for the senior researchers themselves – not a matter for the institution as a whole. For these reasons a university handles IP issues in a different way from a company, with the researchers enjoying at least partial ownership of the IP they develop.

An interesting IP issue can occur when the university seeks to commercialise an invention that it has developed independently of any business collaboration. This is because, as already discussed, universities often perform research that is broader in scope than research conducted by business. As a result, universities may develop patent applications having claims flowing from the more fundamental research they have carried out which are wider than those a firm might normally use. One consequence is that a university invention can have potential patent applications that go beyond the immediate needs, capabilities and interests of any single business so that the university may need to explore opportunities with more than one business, perhaps with businesses working in different sectors. This requires a sensitive and sophisticated approach to any licensing agreements. Another consequence is that wide-ranging claims may be more likely to attract appeals against the grant of a patent and make it more difficult to enforce the patent. (A further complicating factor here is that overall only 2.7 per cent of Australian businesses use patents to protect IP and 12.4 per cent use secrecy; even among firms with over 200 employees the figures are still 17.1 per cent and 40.4 per cent, so that secrecy is by a large factor the preferred IP strategy.¹¹)

Public funding has created much of the background IP owned by universities and has purchased the facilities they use for research. As a general policy principle, universities need to maximise the economic and other benefits that flow from public funding outcomes. Again, this might require the university to explore licensing the technology to a number of firms, whether on a general, non-exclusive basis or exclusively, but in discrete and complementary fields. In some cases the most rapid diffusion and uptake of a technology, and the means of maximising its economic impact, might be through making the technology freely available. The interests of universities and of individual firms, and their respective responsibilities, do not always coincide but it is possible to maximise the collective benefits through appropriate dialogue and negotiation.

10. www.atse.org.au/resource-centre/func-startdown/451/

11. www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/8167.0Main%20Features32009-10?opendocument&tabname=Summary&prodno=8167.0&issue=2009-10&num=&view=

There are many possible approaches to these issues and in November 2011, the University of New South Wales announced an addition to its commercialisation policies, recognising that the financial return to the university from many of its inventions is small. When the university assesses that this is likely to be the case, it provides licence fee free third party access in the hope that this will serve to develop links between the licensee and the university.

Two of the key drivers of collaborations aimed at commercialising a new technology are the potential value of the technology and the costs of getting it to market. Inventions, especially in the pharmaceutical and medical area can cost hundreds of millions to bring to market, with no certainty of success. This level of investment requires the participation of large companies and requires that the company have an assured period for the exclusive exploitation of the invention, to increase the likelihood it will obtain a return commensurate with the level of investment necessary and the scale of the risks. Australia has few such companies and inventions requiring this scale of development will often require the participation of overseas companies. In comparison, a technology that has low value and low cost to bring to market, for example a small software program, may be better disseminated widely at low or no cost.

This difference in culture between universities and business with respect to IP ownership and the rights of individual researchers is a fact of life and one which research contracts with business need to address directly to avoid any uncertainty. In some ways these issues are easier to address with respect to focussed research service contracts for which there is a clear understanding of the IP the collaboration is to produce. These issues can become more difficult in planning and developing more strategic relationships in which the potential nature and value of the IP the research might create is unknown. (One reason for this is that all the parties hope this value will be very high and negotiate accordingly, despite the low probability of any extremely high value IP coming from any single partnership). The more partners involved in a particular collaboration, the more difficult and expensive the negotiations become with respect to the unknown IP the collaboration might produce. It is easy to confuse issues relating to IP ownership with the right to use IP or to commercialise it. Better clarification can assist the necessary negotiations.

A further important issue is that many businesses prefer to use secrecy as their preferred means of protecting IP. The ABS found that in 2010 79% of businesses did not use any type of intellectual property protection method. The most common types of intellectual property protection were secrecy (12%) and copyright or trademark (9%), whereas all remaining methods were 4% or less. While businesses with 200 or more persons employed were almost four times more likely (63%) to use some form of intellectual property than businesses with 0-4 persons employed (16%), 40.4 per cent of businesses in this category used secrecy compared to the 17.1 per cent using patents.¹²

IP management

Agreement on the management of IP can be as important as reaching agreement about the ownership of IP developed through collaborative activity. There are many issues to consider, including what IP rights to apply for, in what countries, through what routes and when. Associated questions relate to who will pay the fees and who is responsible for monitoring for infringement and for taking action in respect of any infringement. These are not trivial issues given the significant costs involved and the huge legal forces that large companies can direct towards defending infringement actions, especially against parties that do not have the commercial strength to sustain long legal battles.

¹² www.abs.gov.au/ausstats/abs@.nsf/Products/8167.0~2009-10~Main+Features~Business+Structure+and+Arrangements?OpenDocument

Licensing agreements can also cover a wide variety of matters, depending on the invention and the nature of the IP right. Matters that they may need to cover to maximise the benefits to both the owners of the IP and the licensees include the length of the agreement, its geographical and sectoral coverage, the responsibilities of the different parties for maintaining, monitoring and enforcing IP rights, the sharing of subsequent developments relating to the IP and so on.

The details agreed for the management of the IP form important aspects of the overall collaborative relationship between the university and a business and impinge on decisions relating to the ownership of the IP and the sharing of benefits that arise from the exploitation of IP. Effective approaches to IP management can provide strong support for long, strategic and mutually beneficial collaborations.

Availability of finance

The different research roles of universities and business create a need for effective linkages to capture the benefit of at least some university research and to provide the complementarities that make cooperation between the sectors productive. However, there can be a problem when universities develop research that clearly has significant commercial potential but which is not yet at the stage at which business is able (or willing) to take it up. Additional proof of concept work might be needed or some applied tweaking necessary to test the invention's compatibility with regulatory, consumer or other requirements. One reason that this can happen is that academics, quite properly given the purpose of much of their research, may be working in an environment largely divorced from market signals, local needs and business research; and isolated from market regulatory requirements.

One common problem is that the research funding available to universities does not cover research needed to make or assess a technology as business ready. This kind of research, because of its more applied nature, is likely to be less competitive when assessed against the excellence criteria used by bodies funding university research. At the same time, the work may not yet have reached the stage at which business feels able or inclined to provide funding. This is especially the situation for the smaller firms found in Australia which lack the resources necessary to take large scale risks. This is the so-called valley of death. Without an appropriate means of financing the necessary work it is likely that the potential, not just for strong business-university collaboration, but also for substantial commercial outcomes, will be lost.

Making available the finance necessary to take research to a business ready stage, so that university research does not stop before it creates a genuine business opportunity, is one means of promoting business-university collaboration. From a public policy perspective, however, this presents two issues; one is that such research is high risk and for a variety of reasons the research might fail to produce a useful commercial outcome or significant public good benefits; the other is that should the research be successful, it might result in significant gains for a particular company. This is one reason why approaches such as the use of contingent loans might be useful and help address the concerns that otherwise exist about public subsidies for private gain.

Other issues

There are many other factors that can impinge on the development and success of business-university linkages, some flowing from the circumstances peculiar to a particular situation, others more general. Some of these factors can include:

- Unrealistic expectations about capabilities, responsiveness and pricing on both sides.

- Universities underestimating the financial, intellectual and other investments a business partner will need to make to take an invention to market.
- Different approaches to research management and attitudes, e.g. towards deadlines and milestones.
- The need to publish compared to the need for commercial confidentiality.
- Silos within universities and competitiveness between different parts of a university that inhibit holistic and trans-disciplinary approaches – business schools not collaborating with research scientists.
- Research students not having any experience of an industrial research and development environment or having negative perceptions about such environments.
- Rapid staff turnover in business inhibiting strategic engagement and build up of trust.
- Universities competing against rather than working with business, for example through the use of spin-off companies.

As before, while there may be individual instances of these factors delaying the development of effective cooperation, where the need for an effective linkage is strong these impediments do not impose an impenetrable barrier.

University actions to promote business-university linkages

There are many factors that motivate universities to engage with business. One is to draw on the best available talent, wherever it may be, to support the growth and development of the university. Another is to seek additional funding, perhaps for research, perhaps for more general purposes. Individual academics engage with industry to make their teaching and research more relevant, to better understand the research that business is performing and perhaps to see what opportunities this provides for identifying interesting research problems, or finding projects that might be suitable for postgraduate research training, perhaps with business support.

Each university needs to determine what kinds of interactions with business it wishes to encourage and for what end – and then to develop the appropriate policies, processes and procedures to facilitate these interactions and to market itself to the business sectors it is targeting. This paper has already mentioned many of the mechanisms that universities can and do use, including commercialisation offices, consultancy services, tailored educational and training programs, and facilitating access to university facilities while encouraging business to make use of them. Factors such as regional location and discipline mix can affect what is most suitable in any particular case.

An editorial in *Nature* recently noted that as government support dries up there is a clear trend for universities to become more active in seeking philanthropic support – from business and wealthy individuals. New web-based fund raising techniques also exist that provide a means of collecting small amounts of money from a very large number of individuals. ‘Crowd-funding’ of this kind can use established platforms such as Kickstarter¹³ which provide a potential means of seeking funding for specified research projects.

It is important in considering the options to acknowledge that university-business linkages are not an end in themselves – rather they are a means to something else, whether this is to strengthen the university’s educational capability, ensure the more effective use of its research or research capabilities, make its teaching more relevant, garner community support or promote an understanding of the important roles that modern universities play. The aim is not to increase the number of such linkages but to ensure that those that exist are effective and achieve their intended purpose; and to ensure that there are no barriers to the development of additional linkages whose value will exceed the cost of maintaining them.

13. www.nature.com/nature/journal/v481/n7381/full/481238a.html

Business actions to promote business-university linkages

The paper has described the benefits that accrue to business from engagement with universities and the mechanisms that businesses can use to expedite such linkages and make them more effective. These mechanisms can originate with individual firms, consortia, industry associations, professional bodies or other intermediary bodies. While in many cases they involve direct interactions, there is also the potential to develop strategic interactions between peak bodies, such as business councils and university groups, either on a national or regional basis. As well as the direct benefits that firms gain from these interactions there can also be indirect gains – for example working with a university can help promote a firm as a good corporate citizen and support for universities can demonstrate a commitment to corporate social responsibility.

As this paper has emphasised, the development of linkages requires actions by business as much as by universities; and the ways in which individual firms can benefit from actively engaging with universities are many and diverse. They include the ability to attract funding that is available only to the parties in such linkages and an ability to make use of expertise that is not available within the firm. A strategic relationship with a university can provide current knowledge about the directions of basic research and the opportunities it might create, as well as access to problem solving capabilities and the use of specialised kit and equipment. At a more general level, engagement with universities can provide information about emerging technologies, not just within Australia but from around the world – and access to the networks that are developing these technologies. On a more immediate timeframe, universities are producing graduates. Working with universities is one way of helping to identify the best and most able students as potential employees, while mechanisms such as the offer of vacation employment allow the assessment of able students in a business context.

Government actions to promote business-university linkages

While the focus of this paper is on business-university linkages and actions by these sectors, there is no doubt that governments (at all levels) can do much to facilitate, encourage and even require cooperation between the sectors. Indeed, increasing the level of cooperation is a government priority and reflected in recent changes to the administrative arrangements order which created the new Department of Innovation, Industry, Science, Research and Tertiary Education. In January 2012, the Minister for Tertiary Education, Science and Research, Chris Evans, gave a speech in which he said that:

... I am very confident that the integration of these portfolios will enable the Government to build better connections between research and tertiary education; and strengthen partnerships between universities and industry.

Connections which enable our nation's universities to train more graduates ready to take on the high-skilled jobs of the future; to undertake industry-linked research which drives innovation and boosts productivity; and to ensure our investment in science flows through to practical applications. ... The structure of the new portfolio is the result of a very deliberate decision by the Prime Minister because it will allow us to better align skills training, higher education and research to the needs of industry and the economy.¹⁴

Mention has already been made of government funding programs available only for projects or for extended cooperation between business and universities. Governments also support pre-seed and venture capital funds that help universities to make their research outputs business ready and attractive to commercial partners. Enterprise Connect can support the placement of researchers in business, while the Australian Research Council provides scholarships for postgraduate students working with industry.

The structure of tax incentives and the taxation environment can support linkages in many ways, from the tax credit supporting industry-commissioned research by universities to the taxation benefits of philanthropic donations to universities. Government can impose levies on industry to support research (as with the rural research and development corporations); and the bodies commissioning the research funded by levies may direct some of the funding to universities and often have advisory boards or councils with representatives from both business and universities. In the past the government has imposed a training levy on companies investing less than a baseline amount on staff training and this also had the potential to improve business-university interactions.

As well as having a direct impact, government initiatives can also send strong signals about the importance it places on increasing collaboration and improving its effectiveness. The establishment of bodies such as Commercialisation Australia¹⁵ or programs such as the Industrial Transformation Research Program¹⁶ can have a significant multiplier effect through their visibility.

The government's direct financial support for universities also provides a means of influencing university behaviour, as through the development of compacts and the introduction of

14. <http://minister.innovation.gov.au/chrisevans/Speeches/Pages/SPEECHTOTHEAUSTRALIANTECHNOLOGYNETWORKSYMPOSIUM.aspx>

15. www.commercialisationaustralia.gov.au/Pages/Home.aspx

16. www.arc.gov.au/ncgp/itrp/itrp_default.htm

performance measures that encourage business linkages. More generally, placing business representatives on funding advisory bodies allocating research or other funding provides a means of keeping business alert to some of the more exciting research taking place in universities. Conversely, academic representatives on bodies allocating research funds to industry or on government councils and committees seeking to promote innovation in different sectors (such as the Innovation Councils) can develop indirect links between sectors, promote a better understanding of the strategies that each is adopting and identify opportunities for closer collaboration. Another area in which governments can provide assistance is through the support of intermediary bodies that facilitate knowledge and technology transfer between the sectors.

Limiting itself to that government support which aimed at promoting innovation, the 2008 review of Australia's innovation system discovered that together the Commonwealth, State and Territory Governments were running 221 separate programs aimed at supporting innovation in firms. Of those programs, 135 claimed to have a direct impact on innovation and the remaining 86 were supporting the foundation conditions of innovation. An additional 101 programs were either having an incidental impact on innovation or were more general business development programs.¹⁷ As most of these programs provided support for the early phases of the research commercialisation chain (R&D and early commercialisation) or for knowledge production and knowledge application, a significant proportion of these programs would either directly or indirectly support business-university interactions. While this number of programs demonstrates a commitment to improve the current situation, this plurality can also present problems in terms of awareness and selection, adding to the transaction costs of both businesses and universities seeking support for their collaborative activities.

17. www.innovation.gov.au/Innovation/Policy/Documents/NISAnnex9.pdf

Joint initiatives

As well as acting individually or through their peak bodies, it is possible for business and universities to establish a single organisation involving members from both sectors to progress their joint agenda. In Australia this has happened through the Business Higher Education Roundtable (B-HERT), a not-for-profit organisation established in 1990 to strengthen the relationship between business and higher education. B-HERT's members are 'leaders in higher education, business, industry bodies and research institutions'.¹⁸ The mission of B-HERT is 'to pursue policies and collaboration initiatives that will advance the goals and improve the performance of business and tertiary education', a mission that recognises the mutual interdependence of the two sectors.

¹⁸. www.bhert.com

Data on business-university linkages

There is little data available on business-university linkages and there are problems in interpreting the data that are available. There are many reasons for this. One is that most of the data focus on research and commercialisation linkages; another is that the data cover formal linkages which may account for only a proportion of the total cooperative activity taking place. However, another problem is that there is no straightforward basis on which to compare the data from different countries. There are no absolute standards in this area and, as previously discussed, the potential for effective cooperation can vary widely for a whole range of different reasons.

If the available data show a lower level of linkages in one country than in another, this is not in itself a useful indicator of the need for action to lift the level until it is equal in both countries. The questions policy has to address are not how does Australia compare to what is happening in other countries; but rather, are there any impediments within the Australian innovation system that make it more difficult than it should be to develop linkages that will be useful and provide a return greater than the cost of maintaining them; is there any unmet demand for business-university linkages; and are there any areas in which Australia's investment in universities is less than it might be because of the absence of effective linkages with the business sector?

It is useful to consider data specific to business-university linkages in the context of the broader economic environment. Australia is a wealthy country, its per capita GDP of \$40 800 ranking it 18th in the world. Agriculture contributes four per cent to national GDP, industry 25.6 per cent and services 70.4 per cent. Mining, based on abundant and diverse reserves of minerals is a major driver of the economy and attracts considerable foreign investment so that large, foreign-owned companies are major players in the sector. Major exports are natural resources, energy and food so that although the economy overall is diverse and sophisticated, it does not have a high representation of high technology firms or industries competing in the international market. Nevertheless, the competitiveness of the mining and agriculture sectors is a result of the strong support provided by research and the application of the best available technologies.

Australia's economic structure clearly affects both the potential for business-university linkages and the mechanisms that can best expedite it. The large companies operating in the mining sector have a very different approach and scale to Australia's generally small manufacturing firms, which again present different opportunities from those presented by the agriculture sector.

The importance of mining and agricultural exports to Australia makes it very different from most other developed countries and this has implications for the structure, development and operation of its national innovation system. This is important when using data to compare Australia's system with that of other countries; at the same time it is important to remember that innovation is necessary across all sectors of the economy, whether they produce significant exports or not; and that the competitiveness and productivity of non-traded sectors can have direct impacts on the productivity of traded sectors. Moreover, innovation that produces small improvements in the productivity of sectors that make up a significant proportion of the nation's economic activity (such as retailing or construction) can have a greater impact, certainly in the short term, than

a major innovation within a sector that hardly appears in the national statistics because it is so small. With this context it is useful to consider a number of recent reports that examine Australia's innovation performance and which have some relevance for the consideration of business-university linkages.

*The 2010 EU Industrial R&D Scoreboard*¹⁹, for example, includes only ten Australian companies in the list of the top 1000 non-EU companies ranked according to their R&D expenditure.²⁰

The top ranking Australian company in terms of research expenditure (at 66) was Telstra; the next three were all banks (ANZ ranked at 198, CBA at 228, and NAB at 231); CSL, a biotechnology company came next at 243. The remaining Australian companies were OneSteel (359) in the industrial metal and mining sector, Aristocrat Leisure (517) in the travel and leisure sector; Cochlear (594), healthcare equipment; Computershare (764) other financials; and Nufarm (772), chemicals. The two companies with the highest R&D/net sales ratio (and at levels significantly above the others) were Cochlear at 13.9 per cent and Aristocrat Leisure at 12.5 per cent. (For comparison, all the banks were between two and three per cent.) The ranking of these companies demonstrates the significant role of services in the overall economy, including the Australian interest in gambling – a sector not usually included in the list of high research intensity industries – although it is significant that the list also includes a bio- and a health services company.

The *GE Innovation Barometer for 2012*, based on a telephone survey of 2800 executives from 22 countries, found that only two per cent of global respondents identified Australia as one of the top three 'innovation champions'. However 88 per cent of Australian respondents agreed that 'innovation is about partnership between several different players more than stand alone success' and 47 per cent (compared to 38 per cent globally) agreed that a combination of partners playing together will be the main driver of innovation over the coming decade. Moreover 69 per cent of Australian executives agreed that the context for innovation in Australia had improved over the past five years. Another significant finding with respect to business-university linkages and the role of universities was that 67 per cent of Australian respondents (73 percent of global respondents) agreed that today innovation is driven more by people's creativity than by scientific research.

One of the areas in which Australia scored significantly higher than other countries in the *Innovation Barometer* was the view that 'local universities prepare tomorrow's leaders'. While Australian satisfaction in relation to easy research partnerships with universities was marginally less than the global average, over 40 per cent of Australian respondents identified 'having more people with advanced technical expertise', 'having more financial support from public authorities' and 'having more creative people on the team' as in the top three factors necessary to help innovation; only 18 per cent identified 'working with universities and research labs for our product development' as falling within this category.

The Milken Innovation Report, which used data from the World Economic Forum's Global Competitiveness Report 2011-2012, identified Australia as a leader with respect to university-industry collaboration in R&D, gross expenditure on research and development, utility patents, STEM education and the business environment. With respect to the remaining two indicators it presented (venture capital and high tech exports) the report assessed Australia as above average.

The *Global Innovation Index 2011* ranked Australia as 12 out of 122 countries in terms of university/

19. http://iri.jrc.es/research/docs/2010/SB2010_final_report.pdf

20. For comparison, Singapore has seven companies in the list, three of which spend more on research than the ranked Australian companies; and South Korea has 26, of which 23 spend more than the ranked Australian companies. Finland has 56 companies in the top 1000 EU R&D performers and of these only 9 exceed the R&D expenditure of Nufarm, the lowest ranking of the Australian companies making the non-EU list.

industry cooperation on R&D.²¹ This ranking derived from a World Economic Forum Executive Opinion survey and used the average answer to the question: 'to what extent do business and universities collaborate on research and development in your country: 1=not at all; 7=extensively'. Australia's score of 68.91 suggests that there must be a degree of satisfaction with the current situation, at least from a business perspective. (The USA had the top score of 79.82.)

The most recent *Australian Innovation System* (2011) report prepared by the Australian government provides a useful compendium of domestic data with some international comparisons, demonstrating progress with the government's target of doubling collaboration between business, universities and government research agencies over the next decade.²² Among the information presented in the report is that:

- The proportion of innovation-active businesses collaborating with universities increased to 2.4 per cent in 2008-09 from 1.6 per cent in 2006-07. (As discussed earlier, these figures provide a significant underestimate of the benefits business receives because they ignore the indirect linkages through publications, meetings, web sites, etc.)
- The proportion of higher education research and development funded by business was 5.86 per cent in 2008, down from 6.76 per cent in 2006. This ranked Australia 11th in the OECD.

Research commercialisation metrics can also provide a description of the current situation.²³ For example, in 2009 universities were employing 460 commercialisation staff. The publicly funded research organisations (PFRs) in total (including government research agencies and medical research institutes) reported gross incomes totalling \$319 million from licenses, options and assignments; and a further \$1.2 billion from contracts and consultancies with end-users. In 2009, the PFRs recorded having an equity holding in 176 start-up companies.

In considering what proportion of Australian businesses might form a target for the activities of commercialisation offices, it is worth noting that overall, 81 per cent of Australian businesses sell goods or services in the local area and only 7.4 per cent sell goods and services in overseas markets, although this proportion does vary depending on the size of the firm, ranging from six per cent of businesses with 0-4 persons employed, to 33 per cent for businesses with 200 or more persons employed.²⁴ This is important because for many technologies and new developments, the Australian market by itself is too small to support the risks involved in commercialisation.

21. www.globalinnovationindex.org/gii/GII%20COMPLETE_PRINTWEB.pdf

22. www.innovation.gov.au/Innovation/Policy/AustralianInnovationSystemReport/AISR2011/index.html

23. www.innovation.gov.au/Innovation/ReportsandStudies/Documents/NSRCReport200809.pdf

24. www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/8167.0Main%20Features42009-10?opendocument&tabname=Summary&prodno=8167.0&issue=2009-10&num=&view=

Conclusions

Australia is facing many challenges. These flow from causes as diverse as the fragile and uncertain condition of the global financial system to the regional disparities in economic growth whose origin lies in the uneven distribution of minerals across Australia's land mass. While the economy is currently performing relatively well, external shocks arising from decisions made in Europe, the US, China or elsewhere could have a major impact on the nation's current competitiveness and prosperity. National productivity is not increasing and business is struggling to cope with an appreciating but often fluctuating currency. There are also longer term problems, some global, ranging from climate change and water management, to energy supply, energy security and the need to cope with an aging population. Moreover, the geopolitical and security situation is complex, changing rapidly and doubtful. Talented and creative people having the skills necessary to develop solutions and implement them are as necessary to address these problems as is the development of appropriate and accommodating institutional frameworks.

Universities are working to develop many of the people, ideas and technologies needed to keep Australia resilient, prosperous and healthy in both the long term and the shorter. However, universities are only one part of the overall innovation system and need to work in partnership with the other players if the system as a whole is to be effective. Interactions are necessary with all the players within the innovation system – including the other parts of the education system and with government. In many ways, however, the most important connections need to be with business. This is because the business sector is the major employer of university graduates and provides the means through which many of the ideas, technologies and capabilities that universities develop add to national wellbeing.

A major theme running through this paper is that business-university linkages need to go beyond those aimed at research collaboration because the lack of research is not always the factor that most limits business innovation. Data presented in the previous section of this paper demonstrate that creative people are as important as research for much business innovation and the Australian Bureau of Statistics' *Selected Characteristics of Australian Business 2009-10*²⁵ provides more useful information about this.

Forty four per cent of Australian businesses were innovation-active in the year ending 30 June 2010, with the proportion of innovation-active businesses increasing with each successive employment size range and reaching 74.3 per cent for those businesses having over 200 employees.²⁶ Because customers are usually a very important source of ideas for innovation, it is also significant that almost half of all businesses relied on a small number of clients, customers or buyers to generate a significant proportion of their income, and even 34.5 per cent of firms having more than 200 employees rely on a small number of customers.

Not surprisingly, given the increasing importance of open innovation, almost 14 per cent of all businesses undertook some type of collaboration.²⁷ Overall 3.5 per cent were participants in joint research and development – although this figure increased to 12.5 per cent for firms having more than 200 employees.

25. www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/8167.0Main%20Features12009-10?opendocument&tabname=Summary&prodno=8167.0&issue=2009-10&num=&view=

26. The survey defined innovation as new or significantly improved goods or services, operational processes, organisational/managerial processes and marketing methods.

27. The ABS defined collaborative arrangements as participation in joint projects with other businesses or organisations (including wider parts of the business's enterprise group), irrespective of potential commercial benefit. This included informal collaborative arrangements but excluded straight fee-for-service and franchise arrangements.

The most important barrier to innovation (at 20.4 per cent of firms) was a lack of skilled persons (within the firm or labour market), while only 3.8 per cent of firms identified lack of access to knowledge or technology as a barrier. The survey also identified the lack of skilled persons as a major barrier to general business performance or activities.²⁸ As discussed in an earlier Go8 paper, only a proportion of the skilled people that business is seeking require a university education and in some sectors the major shortage is of technical and trade skills; but there are certainly shortages in sectors or disciplines that do require university training.²⁹ One example is the shortage of engineers; another is the anticipated shortages of PhD qualified people to fill academia's own needs for new staff along with the increase in demand for researchers working in business that government policies aim to achieve.

An important issue for universities is how they can best respond to acknowledged, specialised shortages in the labour market that require an education that only universities are able to provide. One major problem is that effective education takes time and there is no way to provide an immediate solution. Given the volatility that inevitably exists in the labour market, there is no certainty that the shortages that exist now will still exist (or be important) in three or four years time when students entering courses now will graduate. Labour market planning is notoriously unreliable. In any case, addressing these problems at a system level requires system linkages, rather than direct and indirect linkages between particular institutions.

One way to link shorter term labour market fluctuations more strongly to the educational services provided by individual universities might be to provide even easier access to part time education. Firms experiencing skills shortages could encourage and provide opportunities for their existing employees to upgrade their skills and provide placements for new employees agreeing to take the relevant courses that the universities provide. Students are then already working in an environment within which they can apply and extend their new knowledge and skills, and test their relevance. While this can already happen, there is still considerable potential to explore whether closer links between universities and business might help in tailoring the courses and opportunities for work-integrated learning so that they better meet business needs.

While headlines such as *Shortfall in engineering industry blamed on unis*³⁰ attract attention, there are other, more pervasive and more insidious issues that relate to business views about the employability of graduates (and of postgraduates). These relate to arguments that universities do not produce graduates having the generic skills such as good communication skills, an ability to work effectively as part of a team and general problem solving ability. As the proportion of the national population going to universities increases, not least in response to the targets the government has set, such a mismatch, should it actually exist, will become ever more important. This raises the issue of whether universities need to work more closely with business to understand and perhaps define the basic set of skills and competencies that it is reasonable to expect a graduate in any discipline to possess.

Understanding what outcomes business seeks can at least provide the basis for dialogue as to whether it is reasonable to expect universities to be responsible for producing these outcomes. This can also raise issues about the transparency of university communication with business through the credentials that they award. Business dependency on such credentials for selection and recruitment processes requires a transparent assessment process and one that is comparable

28. www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/8167.0Main%20Features92009-10?opendocument&tabname=Summary&prodno=8167.0&issue=2009-10&num=&view=

29. www.go8.edu.au/__documents/go8-policy-analysis/2011/innovationpaper_25feb.pdf

30. Canberra Times, 1 February 2012

across all institutions offering the same credential. Again, this could provide a suitable topic for cross sector dialogue at a level of detail that goes beyond that contained in the Australian Qualifications Framework. As well as direct cooperation with the universities, this requires tripartite approaches including government (and its education regulatory agencies) as well as business and universities.

As the student population increases in both absolute terms and as a proportion of the available population, universities will need to become more responsive to business needs. However, to cope with significantly increased numbers of students, universities will need to increase their own productivity without in any way reducing their own standards or the reputation of Australian higher education qualifications.

Improved productivity becomes even more of an issue given that public funding overall is not increasing in line with student numbers. The fact that students themselves have to provide an increasing proportion of the cost of their education adds another factor into the equation. As students become in some sense more like traditional customers they may expect greater say over the service for which they are paying. A complicating factor is that as student numbers increase, their expectations, preferences, interests and capabilities become more diverse. Universities may find that working with business (including private education providers) is one way of seeking ideas and approaches on how to improve their productivity and performance. Moreover, ongoing dialogue with business will provide an important way of monitoring standards, to the extent that they are set by business demands and needs, and by the requirements of best professional practice.

Business-university linkages exist, are diverse and are important; however, there is no doubt that with the changes and challenges facing Australia and the policy environment within which universities are operating, such linkages will need to increase, become more effective and perhaps cover more explicitly the non-research aspects of the business-university nexus. A more diverse university system, flowing from increased innovation within the sector facilitated and encouraged by government policies and an open regulatory framework might well promote the differentiation and specialisation within the sector that would expedite such cooperation. A more diverse sector would make it easier for universities, as well as for business, to target better the partners they need to lead to better national outcomes.

