The role of universities in innovation

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CHECK AGAINST DELIVERY

Thank you, Ken, for your kind introduction.

I am grateful to the National Press Club and, especially, to Thomson ISI the sponsor of today's occasion, for this opportunity to address you on the role of universities in innovation.

I do so in the context of a comprehensive Government Review of the National Innovation System. And I am hopeful that remarks that might at another time pass into the ether today may fall on some attentive ears.

I would like to start by commending Senator Kim Carr, Minister for Innovation, Industry, Science and Research for initiating the Review, for appointing persons of substance to the review panel, and for giving it such far-reaching terms of reference.

Indeed, let me acknowledge the particular care the Minister has taken to explain how wide-ranging he envisages this review to be and the challenges he has set for us all.

Today I want to address the first term of reference of that Review, namely, *"a set of principles to underpin the role and participation of the public sector in innovation*."

I will focus on the role of universities, noting however that other research organisations, such as the CSIRO, and other institutions such as TAFE colleges, make important contributions to innovation.

The concept of a national innovation system is helpful in capturing the interconnectedness of different activities. And it is important to encourage such an approach by government regarding:

- trade and financial openness;
- competitive pressures for continuous improvement;
- appropriate regulation and taxation;
- knowledge accessibility;
- and investment in infrastructure and skills.

However, the metaphor of a national innovation system is less useful beyond the realm of public policy.

Innovation is normally not a logical or linear system in the sense that engineers conceive of systems.

Innovation is more random, more in the sense that biologists and ecologists understand the evolution of organisms.

Innovation also crosses national boundaries. An innovation in one country is likely to draw upon outputs from R&D of other countries.

At the same time, national innovation is regionally distributed, with productivity growth the sum of incremental improvements in local operations, including those that are internationally connected.

In its call for submissions, the Review panel sees innovation contributing to:

- business productivity and competiveness;
- improved delivery of public and community services;
- and the increased capacity to deal with major challenges such as climate change, energy supply and population health.

In this wider context, I am attracted to the Productivity Commission's expansive definition of innovation as *"deliberative processes by firms, governments and others that add value to the economy or society by generating or recognising potentially beneficial knowledge and using such knowledge to improve products, services, processes or organisational forms."*

I wish to expand on the understanding of 'knowledge' in that definition.

I would challenge orthodox thinking about national innovation policy and suggest another view:

- one that better appreciates the multiple dimensions of innovation; one that better suits Australian realities;
- and one that better reflects the contemporary roles of universities.

This is not to discard everything about the orthodox view, because there are aspects of it that apply well to parts of Australian industry which we would do well to intensify.

Rather, my argument is for a more broadly-based and balanced approach to achieve better outcomes to enhance Australia's prosperity.

I see three main deficiencies in the orthodox model:

- a limited notion of innovation;
- an undifferentiated policy approach;
- and a narrow role for universities.

First, the issue of a limited notion of innovation: in much of the international discourse, but more narrowly in Australia than elsewhere, the concept of innovation has been reduced to the Midas-like task of turning ideas into dollars.

In this view, the main focus is to transform research discoveries and commercialise highly novel technologies.

There is typically an emphasis on – and a fascination with – products and manufacturing enterprises, and on new firms in new industries. These are usually ICT, biotechnology and nanotechnology.

Innovation is often seen as a set of one-off breakthroughs rather than an incremental process.

The orthodox view of innovation is one of 'science-push' rather than 'market-pull'. Curiously, research is seen as a key source of business ideas.

There is often a stress on impediments to innovation from that source, such as:

- protection of intellectual property;
- technology transfer mechanisms;
- and access to support for proof of concept.

Yet taken together these concerns represent merely a very small part of national innovation.

In the real world, most innovation occurs in established firms in existing industries through incremental improvements.

This innovation involves non-scientific and non-R&D based knowledge such as creative design, marketing, organisational improvement and tooling-up.

Most firms in most industries actually obtain their business ideas from their customers, their service delivery partners or their competitors.

Breakthroughs do happen but you would not want to bank your future on them.

Ideas matter but people matter most – especially in terms of their understandings, skills and relationships.

The second deficiency in the orthodox model of innovation is an undifferentiated approach to innovation policy.

With increasing globalisation we have seen a tendency for international convergence of policy approaches through the auspices of the OECD and other groups.

The sheer complexity of capturing the diversity of operations within countries can lead to an abstracted view of innovation that does not reflect national and regional differences in economic structure and institutional culture.

Most of the literature on the links between science and industrial performance comes from the larger advanced economies with established innovating enterprises.

The available evidence points to considerable differences among nations, as well as between industries within nations, in the degree to which research agencies and universities are used as partners by innovating enterprises.

Importantly, differences have been identified in the contributions to innovation of codified knowledge (that is, published knowledge), tacit knowledge (or personal know-how) and instrumentation (such as devices and techniques) in different industry sectors.

Additionally, in its 2007 report on Public Support for Science and Innovation, the Productivity Commission noted that Australia's economic structure has particular characteristics. So, innovation support mechanisms should fit Australia's circumstances.

The three main characteristics about Australia's economic structure are:

- its reliance on primary exports as a source of national income;
- a high proportion of small and medium sized enterprises;
- and a large services sector.

The services sector accounts for 70% of Australia's GDP and 75% of the workforce. It has the highest proportion of tertiary qualified personnel.

Australia has a range of service strengths – for example, in education services, information services, professional and technical services and finance and insurance. Yet Australia contributes only 1.2% of exports of world services.

Between 1985 and 2005, Australia's services exports as a proportion of GDP grew from 2.5% to 4.3%. Over the same period, the UK grew its services exports from 7 - 9%, India from 2 - 7%, Singapore from 26 - 44%, and Ireland from 7- 44%.

When you look at the current range of Australian government programs, CRCs, industry action agendas and other measures, the services sector and Small and Medium Enterprises appear seriously under-represented.

Less than 1% of SMEs in Australia are involved in innovative cooperation with universities, compared with 33% in Finland – another mostly SME nation.

Clearly, we can do better.

The third issue with the orthodox model of innovation is a narrowly conceived role for universities.

In the orthodox view, universities are regarded primarily as sites of scientific research discoveries. There are two difficulties with this view.

The first is the neglect of the humanities and social sciences. Some recognition is now being given to the creative arts, design and new media particularly in relation to the 'creative industries'. That is important and promising.

More broadly, the humanities and social sciences, along with their intrinsic worth, are essential for dealing with the economic, social and environmental challenges identified by the innovation review panel.

For example, to address an ageing population we have to rely on more than pharmaceuticals and medical treatments. An active ageing strategy requires preventative health measures and these are informed by understandings of people's living conditions and lifestyle factors.

Similarly, to address a national problem such as salinity, it is necessary not only to draw on various sciences but also to understand the economic and other incentives that drive farmers to behave in different ways and help them to improve their management practices.

The second difficulty with the narrow view is that it has given rise to a myopic preoccupation with patents, licensing arrangements and business spin-offs.

Australian universities have been criticised for failures to commercialise public science in these ways, especially by comparison with counterparts in the US and other countries.

However, these apparent gaps may have been exaggerated, even for patents where the US does stand out, but especially for invention disclosures, licenses executed and company start-ups.

Knowledge production is indeed a role of universities, alongside knowledge transfer and preservation, and it is important to understand the nature of each function and the relations that universities create between them.

Universities contribute to building the stock of knowledge not only through discovery but also through problem-solving.

Research is often not breakthrough but a patient gathering of understanding through incremental processes, testing, improved measurement, better instrumentation and new applications of technology.

University research can thereby lead to small, almost unnoticeable, flows of useful new information that cumulatively can have a large impact.

The relentless pursuit of understanding builds know-how, skills, experience, and problem solving methods. These are the things that are of most use to business seeking innovation and public agencies seeking to solve community problems.

Universities transfer knowledge primarily through the production of highly qualified graduates.

University research underpins quality in the education of graduates:

- it challenges students to look beyond the appearance of things;
- it excites their curiosity and their appreciation of diversity
- and it develops their questioning and analytical skills, together with their problem-solving and communication abilities.

Universities transfer knowledge in many formal and informal ways.

Policy should focus on building relationships and better communication between universities and the communities they serve, so that there is better understanding of needs and capabilities.

A business with a complex operational or technological problem seeking to seize a market opportunity should expect a quality researcher at least to know where in the world and how to obtain the best available advice.

What is needed is not so much what is known, but the way knowledgeable people think, the questions they ask, the options they identify, the possibilities they uncover.

What is of value to business is access to networks of expertise and information through professional contacts in the international research community.

Those contacts are made possible primarily through participation in basic research.

To sustain economic competitiveness Australia cannot rely on a strategy of passive absorption of foreign technology. To benefit from the public good of world knowledge we have to be actively engaged in cutting-edge research.

However, it is not simply having scholars who can access the open science.

Free-riding on the rest of the world's research is not a realistic option – because the links between researchers are personal and they are based on informal trading in ideas, techniques and devices.

To access and make sense of basic research you have to be a contributing insider to the community of international researchers in a field.

The deficit view of universities failing to commercialise science underestimates the contribution of Universities in public good research and the indirect ways that universities contribute to innovation.

This view promotes instrumentalism and short-termism in research, and directs expenditure to marginal commercialisation activities at the expense of investment to sustain core capacity.

And Australia's core capacity for basic research is at risk.

The proportion of Australian university R&D spending directed to basic research has fallen from two thirds in 1990-91 to less than half in 2004-05.

In research output volume China and India are rising rapidly. In quantitative terms, using Thomson ISI data, Australia is slipping behind the UK, Canada and other countries across a range of research fields, including chemistry, physics, mathematics, economics and engineering.

In the biosciences, one of our strongest areas, we are struggling to keep pace.

At home we face declining interest in academic careers. In some fields there are not enough local students commencing PhD studies to replace the retiring academic workforce and the attrition of mid-career researchers.

At the same time we need to increase the supply of research-trained graduates to the wider labour market in order to increase the nation's capacity in knowledge-intensive areas.

Hence, we must seriously take steps to attract international doctoral students and post doctoral fellows while increasing the incentives for local students to undertake doctoral programs.

More broadly, Australia needs to comprehend what it means to be a player in the global knowledge economy and set about building relationships with the next generation of research scientists over a 25 year horizon.

We must make arrangements that enable young researchers to stay in contact personally with their international peers, such as through regular visits to overseas centres and conferences.

Australia is nowhere near to matching the scale of investment in research capability in the northern hemisphere, whether in North America, Europe, China, Korea or elsewhere.

This is particularly true when considering major research platforms and facilities, distributed laboratory networks, and teams of young talent working with state-of-the-art equipment in modern facilities.

We are vulnerable to being by-passed, cut off and left behind in the advancement of knowledge. And if we allow that to happen we can kiss goodbye to an innovative Australia. The way forward is to collaborate rather than compete against our northern hemisphere counterparts.

We need to explore co-investment in research platforms, shared facilities and networks, and full participation in cyber-infrastructure and associated data services.

Two examples of this would be Australia's involvement in the Square Kilometre Array telescope project and the European Molecular Biology Laboratory.

At home, we face a serious run-down in the condition of university infrastructure. In the Group of Eight universities, we estimate building and services maintenance in excess of 1.5 billion dollars.

The main source of the problem is that in the arrangements for funding of university research *success leads to loss; winners are losers*.

The Go8 universities win some 70% of competitive research funding.

The Australian Research Council provides on average only 70% of the application cost of a successful research project, and has no regard to the indirect costs of the research through administrative overheads and capital depreciation.

The net result is, as best we can estimate, that the Government contributes less than 40% of the full actual costs of research. The difference is made up through cross-subsidies from international student fees and from deferred capital maintenance.

Public funding for university research must reflect its full economic cost.

Australia cannot sustain research of international quality by continuing to cross subsidise shortfalls in research funding from university budgets for teaching and capital maintenance.

In the US, the UK, the Netherlands and other countries, arrangements have been put in place to fund the actual costs of research.

The US Office of Management and Budget sets an indirect cost rate for each university according to its research profile, and this rate is applied by research granting agencies.

In Britain, the full economic costs of research are estimated by universities and validated by the funding councils.

We would be wise to learn from their experiences and develop an appropriate approach that fits Australian circumstances.

For those who look for an efficiency dimension in these matters I expect that as in the UK, universities would be required to reduce their backlog maintenance and demonstrate cost-effective stewardship of their properties.

In terms of efficiency, universities are performing well. The cost per person year to perform R&D in universities is $75,000 compared to $150,000 in the government sector and $209,000 in the Australian business sector.

In summary, the clear priority is to enhance our capacity for basic research of high quality by international standards.

That means greater investment in the development of intellectual talent, deeper immersion into international research networks, full funding of research and flexible block funding for research infrastructure.

Very importantly, we need to do more to extend the engagement of universities with users of knowledge in business and the public and community sectors.

In the UK a dedicated stream of funding, additional to funding for teaching and research, has been introduced to enable universities to provide a range of services to enhance knowledge-transfer to their communities.

I believe it is time for Australia to embrace such a scheme to build collaborative relations between universities, business and the community. This could form part of the new Government's mission-based compact funding for universities.

Initially, such a scheme would focus on building understanding of the respective roles and capabilities of universities and businesses.

The National Innovation Review presents us with an opportunity to take up these challenges for the economic, social and environmental benefit of Australia.

Australia's universities are prepared to meet the challenge.

Thank you.

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