Submission to the Review of the National Innovation System by

The University of Western Australia

Declaration of interests and affiliations

The University of Western Australia (UWA) was established in 1911 and is one of the most research-intensive of Australia's universities. More than 70% of the research funding received by Western Australian universities is provided to UWA. The University has substantial industry links and collaborative funding support, and is a significant national and international contributor to innovation in medical research, chemistry, minerals and energy research, plant sciences and research on the sustainable management of natural and agricultural ecosystems. The University has major partnerships with the Commonwealth science agencies, particularly the CSIRO, through Cooperative Research Centres, other joint venture arrangements and through bi-lateral research arrangements. The University has significant research partnerships with universities in the US, Europe, South America and Asia. We are dedicated to achieving international prominence in research and research training. We have one of the highest ratios of Higher Degree by Research students to undergraduate student numbers in the country.

Executive summary

The University of Western Australia urges reform in the innovation sector through increased public investment and reduced regulation in both public good research and research that is of commercial value. With a focus on quality and outcomes over process, it should be possible to stimulate innovation that is capable of transforming Australia's research base into one of the most innovative on the planet. The current system is crippled by a risk-averse culture and failure to fully fund the desirable outcomes of a sustainable and vibrant research culture.

UWA supports the Government's idea of a "hubs and spokes" model, allowing for greater scale and focus through identified pockets of excellence in the various disciplines and research endeavours around the country. However, UWA believes it is important to preserve both competition and redundancy in the system; both competition and redundancy are key drivers to quality in any evolutionary system.

Finally, UWA holds that universities are at the centre of the nation's innovation efforts, both in carrying out fundamental research at internationally competitive levels and in training the nation's future researchers. UWA believes that universities should be

engaged in the development of the commercial fruits of its research and awaits with interest this Review's response to the recent Federal Court decision on this matter.

Summary of all UWA recommendations

General recommendation on national innovation priorities

National Innovation Priorities

Outcome aspects

- World leadership by Australia in R&D in areas where the nation has a competitive advantage
- Greater involvement of Australian innovators in global problem solving
- Sophisticated national coordination of R&D funding
- A sophisticated network of specialist and generalist R&D providers
- Greatly increased R&D funding by industry
- A higher proportion of the population with postgraduate research training

Input aspects

- An increased focus on fundamental research and quality of research
- Levels of public funding for universities that will allow building of discipline depth in the sciences, social sciences and humanities, and the support of risk-taking in research
- Appropriate policy and incentives to promote public-private partnerships in research, development, adoption and commercialization with lower transaction costs
- Increased public funding to support international collaborations in research, development and commercialization
- A research training scheme that has competitive stipends for research students and supports the attraction of international students.

Research Training

1. The Government should increase the base APA stipend rate to at least $30,000 per annum tax free.
2. The Government should increase the duration of the APA to 3.5 years with a possible 6-month extension where necessary.
3. The Government should increase the number of IPRS scholarships.
4. The Government should increase the IPRS fee rate of international students, and use a formula that more realistically estimates universities' international profile.
5. The Government should consider allowing international research students to study on a part-time basis, or at least allow international students to suspend their studies for up to 12 months and allow them to work full-time during this period.
6. International students should be allowed, through their visa, to stay in the country for up to 6 months after submission of their thesis, in order to write up their

research for publication during the examination period, and deal with any required corrections while still having access to the required resources.

7. The Government should factor supervision training into the RTS funding scheme and universities should ensure that supervision training is a requirement of supervision.
8. Research training should only be offered in areas where the University can demonstrate sufficient quality, critical mass, sufficient research activeness, and adequate resourcing.
9. Given the above recommendation, the Government should facilitate collaboration between universities by allowing double-badged research degrees, with the load and completions shared across the participating universities.
10. Government funded competitive research schemes, such as the ARC and NH&MRC, should allow in the budget for a research training item that covers the stipend, as is currently the case, plus a research training maintenance fund of $10,000/annum to cover basic infrastructure, travel and consumables associated with the research training. In such cases, the track record of the investigator should include research training achievements.

Research Commercialisation

1. The Commonwealth Government should consider the establishment of a specific Higher Education Innovation Fund (HEIF) similar to the one operating in the UK with similar sub-programs.
2. That the Federal Government establishes and funds a “Visiting Industry Professor Scheme” to increase University-industry collaboration by placing experienced market-savvy staff in pat-time positions on campus.
3. That the Federal Government provides funding support in the form of an annual rebate scheme for *bona-fide* university pre-seed funding for on campus activities including proof-of-concept work.
4. That the Federal Government provide funding support, also by a rebate scheme, for on-campus IP commercialisation awareness and industry-interaction training for staff and PhD students.

Research Collaboration

1. That a new collaboration program be developed with two streams to support (a) basic public good research by universities, other R&D providers (including international partners) and industry, and (b) research with strong commercial potential undertaken by universities, other R&D providers and industry.
2. Stream one should be a Linkage Collaborative Centre Program managed by the Australian Research Council. This would allow a continuum for applied research from APA(I) scholarships, ADP(I) fellowships, ARC Linkage Projects through to ARC Linkage Collaborative Centres, in parallel with the more fundamental continuum of ARC funding through Fellowships, ARC Discovery Projects to ARC Centres of Excellence.

3. Stream two should be a Research Commercialisation Program managed by AusIndustry or a similar body. The focus here should be on moving beyond proof of concept to small trials involving industry, leading to spin-offs or product release.
4. There should be a transition phase of development of these two streams to allow some current CRCs to re-bid and continue operation while a new policy for funding is developed. This will minimize disruption to important existing partnerships and allow expansion of the Australian Research Council's capability to manage a new, more industry focused Linkage Collaborative Centre Program.

Introduction

The University of Western Australia welcomes the opportunity to make a submission to the Innovation Review. It is important that there is a degree of coherence in public policy aligned behind supporting the full innovation process, which includes the funding of fundamental research and the conditions under which fundamental research is conceived, initiated and completed. Fundamental research, applied research and application development are interrelated in complex, variable, linear and non-linear ways. The path between fundamental research and subsequent application or impact beyond the world of research is frequently long, complex and full of uncertainty. Without a continuous supply of ideas and expertise flowing from fundamental research, the chances of building an innovative and creative economy to support wealth and social betterment are slight.

Major issues

We believe there are a number of major issues that the Review needs to consider as national priorities for innovation.

Quality: One of the key issues concerns the importance of competition and quality in the research process. Innovation and subsequent application are related to the quality of the research being done and made available for further development. Hence it is important to consider how quality research can be recognised and supported. There is an important link between competition in the allocation of at least some part of research funds and the assurance of quality in research. Schemes such as those run by the NH&MRC and the ARC, which are based on competition between proposals developed by investigators adjudicated by peer review, are drivers of research quality. Peer review of the quality of the applicants and the quality and potential of applications may be imperfect and may be conservative but it is the best mechanism we have to choose between competing proposals and to promote quality. Peer review and competition can not be the only ways in which funding of research is provided, but it is important that both peer review and competition remain prominent parts in the foundations of the innovation system.

Collaboration and competition: It is important that the Review of the National Innovation System undertakes a careful assessment of the role of collaboration. Collaboration is necessary to build capacity, to seek appropriate scale for research activity, to conserve scare resources or to build platforms of national capacity to compete with significant resource rich research concentrations in other countries (all valuable objectives). However, collaboration by itself, undisciplined by at least some forms of competition, is unlikely to provide incentives for quality. There is something of a mood in contemporary policy debate that says competition is bad, collaboration is good and that collaboration is a path to improved research performance and innovation. What is missing is any argument that can show that collaboration is linked to achieving quality. The Review should come to some clear views on the types of issues and the circumstances under

which collaboration is appropriate and the limits to be placed on collaboration, and show a willingness to embrace the link between competition and quality.

Taking and managing risks in research ventures: There is a problem in the Australian system over the question of risk-taking in research ventures. Firstly, there is a highly conservative element in peer review that is not conducive to funding projects that are very risky but which would lead to transformative paradigm shifts if successful. Many of the current schemes that support collaboration have no drivers for risk taking and are thus unlikely to support research that is more than incremental or that is not at the development stage. For a well functioning national innovation system there must be scope for funding riskier research with processes for identifying failure quickly while supporting path breaking work. This is a case for other forms of funding that can underpin grant competition or provide supplements at the crucial stage of research (below there is an argument for increased block funding of research to universities which in part can address this question of risk).

Role of public investment and public policy: Countries with the best performing innovation systems have a significantly greater proportion of their GDP in R&D than does Australia. Public policy in Australia needs to reflect the critical role that public investment makes in driving the whole of the innovation system through the support of fundamental research, and better incentives to drive public-private partnerships in R&D.

Full funding of research: One of the major problems confronting the smooth functioning of the innovation system concerns the continual partial funding of research through a whole variety of schemes. While the initial intention of partial funding may have been to encourage universities to seek additional funds from industry and other sources, the result has been sub-optimal performance across the board and a distortion of priorities and effort. Commonwealth research agencies need to be funded in ways that allow them to fund the full cost of research and reward universities in an appropriate way for success.

When a research grant is funded through either the ARC or the NH&MRC the research time of the university investigators committed to the project is not explicitly covered by the grant. It could be argued that the university investigator's time is funded through the IGS or RTS block grant schemes. However these schemes are not large enough to account for the partial salary costs of the investigators and to cover as well their intended use of training research students and early career postdoctoral fellows.

Leaving fellowships aside for one moment, investigator time can not be funded under ARC or NHMRC schemes. This has the perverse effect that the more successful a university is in winning competitive grants the greater the costs that have to be found by the institution. With the numerous schemes that seek to 'leverage' university dollars as part of a successful grant, this creates major burdens for successful, research intensive universities. In the case of the NH&MRC, the creation of PSP packages, which systematically underfund staff who are to be employed on a grant, are an increasing problem. Underfunding increases the complexity of managing the grant for Chief Investigators as they continually need to seek additional funding to try to maintain the

staff required to service their research work. It would be better and more appropriate if the NH&MRC allowed Chief Investigators to request funding of support staff at institutional rates and to provide one-line budgets, which at least reduce the complexity of their management tasks. Underfunding grants needs to be addressed by increasing the amount of money allocated to the competitive grant agencies, especially the ARC.

Fellowships are another matter. The design of the NH&MRC fellowship schemes needs some attention. At the moment there is a significant gap between the university levels for appointment and the qualifications needed for NH&MRC fellowships such that those classified at a higher level are only competitive for fellowships funded by the NH&MRC at a lower salary level and the gap must be met by the host organisations. This also needs to be addressed.

There has been a significant increase in the amount of research funding being won by universities, but the Research Infrastructure Block Grant budget has remained fixed for some time. The infrastructure needs of universities are being squeezed, and again the pressure is greater for those who are more successful. There must be an increase in money flowing to universities through the performance based block grants. Since these block grant funding mechanisms are performance based, and especially if quality as well as quantity is taken into consideration, the Government can be assured that research funds will be appropriately directed and achieve the best outcomes.

Infrastructure: Australia needs to develop a sophisticated continuum of sources to support the infrastructure needs of the innovation sector. The term 'infrastructure' has two uses in the debate over innovation and research policy. On the one hand it refers to the technical infrastructure (buildings and other resources) that need to be available to support research. On the other hand, it refers to block grants provided to support the operation of research within institutions. Regarding building and equipment, the nation needs an integrated continuum of funding to support the range and maintenance of technical infrastructure required to underpin the national innovation effort. For this we support the following arrangements: the ARC LIEF program; a program like NCRIS for national research infrastructure; and the HEEF scheme for buildings. For block grants we make the following observations. The single biggest impediment to research growth at universities is the continuing small and stable size of the Research Infrastructure Block Grant. Despite the huge increases in research income achieved by many of Australia's universities, their ability to invest in further growth and to underpin more risk taking in research is severely limited by returns through the block grants scheme. A major leap in the potential for innovation by the university sector would be delivered by a much greater investment by the Commonwealth in the block grant.

IP and commercialisation: UWA believes that there has been an over emphasis in Australia on what revenues universities could make from research commercialisation in order to support their own operating costs. This has proved often to be at the expense of getting the technologies and innovations created in the university to where they can be of most use to private and public entities at an early-stage in the innovation cycle. From a national perspective the focus on commercialisation of university IP needs to be on

efficient technology transfer to the market, not the quantum of financial returns to universities.

Hubs and spokes: In a nation with such a relatively small population it makes sense to build capacity in specialised areas of research and development. It also appears rational to refine the number of public funding sources and arrangements for supporting innovation. The current Commonwealth Government has spoken about a 'hubs and spokes' model for research delivery under which there would be concentrations of research strength in particular fields at one location (hub) with 'spoke' connections to small areas of strength in the same field. This is meant to remove redundancies in the system. There appears to be a similar focus on re-organising the sources of funding and arrangements for supporting R&D. We caution against taking this too far. As far as the distribution of R&D strengths is concerned, a reasonable degree of redundancy will ensure survival of the complex arrangements for R&D in a modern state. Similarly, while there has been a proliferation of research funding arrangements, care will need to be taken with rationalisations. For instance, many of the rural R&D Corporations have contributed to productivity growth in the agricultural sector that is the envy of most other sectors in the economy. To amalgamate them within one Commonwealth Department would, we believe, remove their ability to focus, decrease efficiency and create increased transaction costs in the delivery of R&D.

Role of the humanities and social sciences: The major issues facing the nation can only be solved by an innovation system that has outstanding R&D capabilities in the humanities and social sciences as well as in the sciences. There is a continuing lack of sophistication in public policy underpinning innovation for the role of the humanities and social sciences. This occurs to such a degree that major investments in scientific R&D are usually divorced from a clear understanding of the social context for the acceptance or adoptability of the technologies arising from scientific research.

Interdisciplinary R&D: There is a general understanding that complex challenges facing the Earth can only be solved through well coordinated R&D involving a number of disciplines. However, many of the nation's research funding bodies have a silo-like discipline focus in calling for research programs and project bids, and they lack the sophisticated arrangements necessary to assess the quality and value of proposals for interdisciplinary work.

Special issue of mathematics: Predictive capability in almost all areas of society and the economy, and the analysis of the vast amounts of information that can be collected by modern technologies, require major strengths in the nation in mathematics. However, Australia is falling behind many other nations in the scale of its research training and expertise in mathematics and related areas of quantitative sciences. This needs to be recognised with some immediacy by the Commonwealth and States, and policy options must be developed that result in a significant boost in funding for research training in the mathematical sciences.

General recommendation on national innovation priorities

National Innovation Priorities

Outcome aspects

- World leadership by Australia in R&D in areas where the nation has a competitive advantage
- Greater involvement of Australian innovators in global problem solving
- Sophisticated national coordination of R&D funding
- A sophisticated network of specialist and generalist R&D providers
- Greatly increased R&D funding by industry
- A higher proportion of the population with postgraduate research training

Input aspects

- An increased focus on fundamental research and quality of research
- Levels of public funding for universities that will allow building of discipline depth in the sciences, social sciences and humanities, and the support of risk-taking in research
- Appropriate policy and incentives to promote public-private partnerships in research, development, adoption and commercialization with lower transaction costs
- Increased public funding to support international collaborations in research, development and commercialization
- A research training scheme that has competitive stipends for research students and supports the attraction of international students.

Research Training

The Review of the National Innovation System provides an opportune moment for the nation to consider the nature and purpose of its research training programs. At a time when both Europe and North America are reviewing their own Masters and PhD programs, there is an opportunity for Australia to draw on its extensive experience in both domestic and international research training, and from its partnerships with other universities, to put in place the strategies and support structures that would underpin a world-class system.

According to national data, the Australian Higher Education system in 2006 was training 40,511 PhD doctoral students and a further 8,956 Masters by Research students, representing 33,943 EFTSLs. UWA, as a member of the Go8, is a major contributor to the nation's research training efforts, with approximately 2000 enrolled students and over 300 thesis completions each year. UWA is the premier research training provider for Western Australia, and its graduates fuel both the local and international economies.

Increasingly, research training is no longer viewed as the apprenticeship of future university academics. Research graduates take up employment in a broad range of

sectors, including Government and private research agencies, policy organisations, administration, and business. Highly refined research skills, and the high level of communication skills required of the research degree, are seen as key survival skills for the 21st century and essential to a thriving, vibrant and innovative economy and culture.

Strengths and Weaknesses of the Current System

High Quality Entry

The Australia Higher Education system, with research training embedded into its Honours degrees, Graduate Diplomas and Masters by Coursework programs (in general) provides an excellent entry point into the Masters by Research and the PhD. It also ensures that Australian PhD and Master's students commence their research work at the very beginning of their enrolment and can frequently be contributing to the research output of the country with a publication within their first year of candidature.

However, applications for domestic enrolments have been flat over the past few years, while international enrolments have seen huge increases. International candidates arrive with a variety of research training backgrounds. To compensate for this variety at entry, most universities now run a "Confirmation of Candidature" year as a probationary program for higher degree by research enrolment. Confirmation of Candidature often involves some coursework preparation, either in research methods or in advanced content in the field of study. Some coursework, directly related to the research program, is seen as an excellent way of making early progress. Additionally, enhanced methods of predicting success at entry, such as using GRE standardized tests, are being considered as a means of ensuring both high quality students in our programs and high quality outcomes.

Relatively Short Formation

Compared to both the North American and some European systems, the Australian PhD is relatively short, usually being accomplished in around 4 years full-time enrolment. This is to be commended, as the North American PhD can take up to 10 years or longer, and some European countries still take 5-7 years for the PhD. This means that Australian graduates, on average, join the workforce at an earlier age and, particularly for women, they are able to establish their careers before domestic arrangements and childbearing add extra constraints. However, even at 4 years, the Australian PhD is not fully funded for domestic candidates, with substantial subsidization of research training within universities, and scholarship funding to students only for 3 years, with a possible 6-month extension. In addition, scholarship funding to universities in the form of Australian Postgraduate Awards (APAs) and International Postgraduate Research Scholarships (IPRS awards) is not fully funded, being based, as it is, on an assumed discipline cost profile and expected attrition rates. For many of the research-intensive universities, the HDR profile is substantially in the high-cost areas, it is almost entirely PhD, and the attrition rates are low. This means that many universities are committing large amounts of

funding towards scholarships and to unfunded load in order to bolster their research training endeavours.

International Quality

International examiners of high standing are generally chosen to examine Australian research degrees, and the examination is carried out in an independent and unbiased manner. Supervisors are not involved in the examination process. However, for the most part, it is only the thesis that is examined, not the student. The addition of an oral component to the Australian examination process would strengthen our confidence in the quality of the graduates we produce. The inclusion of student publications in the forthcoming ERA will provide the Government with clear metrics on the quality of the research that is accomplished through research training.

Supervision Quality

Australian supervision is of variable quality. The best supervisors are research active, they tailor the research training to the individual student, they keep up to date with research training policies and procedures, they supervise as part of a robust team so that each student is confident of back-up and alternative support when necessary, and they are able to provide the necessary resources for the student to complete the project. However, supervision has yet to become fully professionalised and some research programs are fragile. There should be required levels of research output, supervision training and grant success, coupled with critical mass and a positive research culture before universities offer research training in the various disciplines.

Resourcing for Students

Resourcing for students focuses around a stipend and basic research infrastructure. The current stipend levels are too low, compared to the lost salary that potential research candidates are foregoing. In many of Australia's capital cities, the cost of accommodation has become prohibitive, and research students simply cannot afford to live on the stipend. As a result, many are engaged in other income generating activities for their allowed 8 hours per week. When they fall off stipend, typically after 3.5 years, they are forced in more substantial jobs and their likelihood of completion drops dramatically. UWA welcomes the Federal Government's promise to double its investment in research scholarships, but would urge the Government to consider increasing the stipend to $30,000 per annum, and to increase the scholarship duration to 3.5 years, with a possible 6 month extension.

Basic infrastructure such as shared office space and a computer are often not available to research students, particularly those in the Arts, Humanities and Social Sciences, where the low-cost funding regime provides particular difficulties. Across all funding weights, the common costs include the salary of the supervision, basic accommodation, and the provision of a basic computer. These items should be fully-costed and funding provided uniformly to all disciplines. Additional costs, relating to the specific project, can then be

sought either through a high-cost bonus to the research training load, or through competitive research grants.

Resourcing for Projects

In many areas, research training is now only possible if the supervisor or research team has won external funding to support the work. Even in cases where the supervisors have won a competitive grant, they can still find themselves struggling to properly support the research training component, for example covering the gap in student fees (the supporting scholarship from an overseas source may be only for 3 years), providing scholarship support for the final 6 months of candidature, covering travel costs to attend international conferences, covering journal page costs and purchasing the basic infrastructure for the student's research (laptop, office costs, IT costs etc). It would be desirable if the ARC and NH&MRC included as an allowable budget item, maintenance costs associated with research training, above the basic scholarship allowance. For example, a project maintenance budget of $10,000/annum, awarded on the basis of the CI's demonstrable research training achievements, would release substantial amounts of time to productive research, time that is currently being wasted on chasing very small amounts of funding for unanticipated events or opportunities that arise during candidature.

Resourcing for Universities

The RTS is strongly performance based and ensures that Government funds for research training go to those universities that have the enrolments and the demonstrated ability to both deliver successful completions and provide a rich research environment. However, there is a substantial time lag in the funding model: it can take up to 10 years after the initial enrolment before the final completion funds arrive at the home institution. This places considerable pressure on programs in a growth phase. Recent research indicates that universities are currently underfunded by about 30% of the true cost of research training, meaning that other aspects of the university's portfolio (such as undergraduate teaching) are subsidizing the research training. The coupling of this time-lag with the under-funding means that there are clear stresses on the system.

We strongly support a revision of the RTS scheme that considers the base research training costs as they apply to all disciplines, that reviews the weights associated with the current High Cost:Low Cost regimes to ensure that appropriate and fair levels of funding flow to all disciplines, and that addresses the current time-lag in the RTS so that growth in research training can be achieved.

Generic Skill Acquisition

It is important that our research graduates are well-equipped for the workforce, be that as a researcher within the University sector or in Government or private industries. Currently, Australian universities present a broad sweep of training programs in general competencies; the only one of these that is directly funded by the Government is the Commercialisation Training Scheme. We believe that there is ample scope for developing

a comprehensive program in competency training, including skills in leadership, ethics and compliance, project management, university teaching, and grant writing. We support the direct embedding of this aspect of research training into our existing programs.

Visas for International Students

International students, because of their visa constraints, experience a different research training environment from their domestic counterparts. Firstly, all international students must be enrolled on a full-time basis. They are unable to take any periods of suspension throughout their candidature, unlike domestic students, who can suspend for up to 12 months. Sickness, maternity leave, carer responsibilities, or simply the need to gain additional resources through paid employment, are severely restricted in the current arrangements. The research students who come to Australia are selected on stringent merit-driven criteria – they are among the top intellectual achievers that arrive in this country, and they have a great capacity to contribute to this nation while they are here. UWA strongly supports a review of visa conditions for international research students. Favourable visa conditions for international research students would give Australia an innovation boost by making us strongly competitive with respect to other destinations.

Recommendations with Respect to Research Training

1. The Government should increase the base APA stipend rate to at least $30,000 per annum tax free.
2. The Government should increase the duration of the APA to 3.5 years with a possible 6-month extension where necessary.
3. The Government should increase the number of IPRS scholarships.
4. The Government should increase the IPRS fee rate of international students, and use a formula that more realistically estimates universities' international profile.
5. The Government should consider allowing international research students to study on a part-time basis, or at least allow international students to suspend their studies for up to 12 months and allow them to work full-time during this period.
6. International students should be allowed, through their visa, to stay in the country for up to 6 months after submission of their thesis, in order to write up their research for publication during the examination period, and deal with any required corrections while still having access to the required resources.
7. The Government should factor supervision training into the RTS funding scheme and universities should ensure that supervision training is a requirement of supervision.
8. Research training should only be offered in areas where the University can demonstrate sufficient quality, critical mass, sufficient research activeness, and adequate resourcing.
9. Given the above recommendation, the Government should facilitate collaboration between universities by allowing double-badged research degrees, with the load and completions shared across the participating universities.
10. Government funded competitive research schemes, such as the ARC and NH&MRC, should allow in the budget for a research training item that covers the

stipend, as is currently the case, plus a research training maintenance fund of $10,000/annum to cover basic infrastructure, travel and consumables associated with the research training. In such cases, the track record of the investigator should include research training achievements.

Research Commercialisation

Universities as Key Components of National Innovation Systems[1]

The importance of university research as part of national innovation systems has been clearly identified in the United Kingdom (The Lambert Review 2003 and The Sainsbury Review 2007)[2]. Below, we outline how UWA views IP commercialisation within the context of a National Innovation System and how this might be improved.

The Lambert Review 2003 highlights the importance of the UK's government's "Third stream funding". The UK's HEIF (Higher Education Innovation Fund) has provided a major boost to their innovation system through support of the university sector. We have provided a relevant excerpt from this report at Attachment 1.

UWA believes that there has been an over emphasis in Australia on what revenues universities could make from research commercialisation in order to support their own operating costs. This has proved often to be at the expense of getting the technologies and innovations created in the university to where they can be of most use to private and public entities at an early-stage in the innovation cycle. From a national perspective the focus on commercialisation of university IP needs to be on efficient technology transfer to the market, not the quantum of financial returns to universities.

Fundamental, basic scientific research underpins major innovative breakthroughs that lead to successful commercialisation. It is therefore crucial that Commonwealth and State Governments provide strong funding to the university sector so that fundamental research can be progressed and knowledge expanded.

Commercialisation of IP resulting from basic research takes time. The success of Gardasil vaccine, based on research from the University of Queensland, is providing

---

[1] Our submission has been prepared based on the fundamental assumption that universities own the IP created by their academics and that universities can act on their staff's behalf to seek commercial exploitation of such IP in return for a revenue sharing arrangement. In view of the recent decision in the UWA-Gray-Sirtex legal case (see Attachment 1) this "understood" position has been overturned. It is too early for a detailed position on all the aspects and impacts of the case on commercialisation by universities but we provide the information below for the Review panel, as it has fundamental ramification for the management of IP by universities.

[2] Lambert Review of Business-University Collaboration, Final Report, December 2003; Lord Sainsbury of Turville *The Race to the Top. A Review of Government's Science and Innovation Policies*. October 2007

major benefits to women's health in Australia and worldwide and also yielding royalties to the university, but the original research dates from the mid-to-late 1980's.

Current Government programs to support commercialisation

DIISR and AusIndustry

There are a number of innovation and commercialisation schemes that are of great value to early start-up companies.

However, the schemes require that successful applicants be a legal entity such as a company. This can be a mixed blessing for on-campus commercialisation as access to the funds, via company formation, becomes a driving force rather than the technology and market plan driving the spin-out company decision. It is our view that this can lead to excessive focus on spin-outs with sub-optimisation of the proper commercialisation process.

Current Market Failure

Venture capitalists and angel investors can provide funding for innovation and commercialisation but do not invest in the early stages of IP development. There is thus a funding gap leading to a failure in technology transfer of university IP and knowledge.

Specifically, more support needs to be provided for prototype and market development of innovations for university efforts to transfer findings. These efforts have been addressed by many universities, including UWA (see below) through the establishment of pre-seed funds. However, such funds are sourced directly from university discretionary funds and are not currently supported by any leveraged funding from Government.

The funding gap for the development of IP arising from pure and strategic research

Funding from the ARC and NH&MRC supports fundamental research that underpins new discoveries and the funding bodies provide IP commercialisation guidelines. However, when research leads to findings that have some commercial potential there is usually a funding gap where support is required to further the commercialisation process. Currently universities provide pre-seed funds because this stage of commercialisation is too risky for venture capitalists.

Importance of Proof-of-Concept Funding

On-campus proof-of-concept funding for market assessment, prototype building and animal trials is essential for numerous reasons:

- To assist the development of a commercialisation plan
- To mitigate or lowers risk for both the potential investor and the university
- To confirm whether IP protection should be pursued

We believe it is critical to confirm the validity of the IP before seeking commercialisation partners. In many cases, where patents are applied for on the basis of fundamental research findings, they may later be dropped if proof-of-concept funding is unavailable. Wherever possible, the proof of concept work needs to be funded and completed before patent protection is sought. It is this sort of verification that is valuable to the inventors and investors alike.

Expanding Interaction with Business and Industry

Over the last decade, Australian universities have increased their collaborations with the business and industry sector appreciably. This includes local, national, and international linkages and interactions. These contacts need to be increased and support provided to foster them further. Most universities have eminent alumni who have had successful careers in their chosen professions and who should be encouraged to take up "Visiting Professorships" in specifically identified fields such as Biotechnology and ICT, amongst others, on a part-time basis.

IP commercialisation at UWA

Definitions and Overview

We understand research commercialisation to encompass three major interacting vehicles for transfer of technology and know-how to the marketplace:

- External Research Contracts & Consultancies
- Licensing of the University's IP
- Formation of Spin-out Companies

Interactions between these three vehicles are particularly important at the early stage of the innovation cycle. For example, a research contract with an industry partner can lead to a licensing agreement and *vice-versa.* A start-up company may not have the resources to carry out their required research, so will contract that back to the university or indeed the university will license its IP to a start-up company. This highlights the transaction-intensiveness of the technology transfer process because all of these arrangements need legal agreements.

UWA established an Office for Industry and Innovation in 2001 to support researchers in making contact with SME's and larger companies for research collaboration. Alliances, partnering, and collaborative research arrangements are now becoming more common with the multi-national technology companies. Such arrangements are critical as they offer benefits to both parties well-above the more narrow focus of IP commercialisation. Specifically, there are opportunities to offer staff-secondments, hiring of graduate students, improved industrial knowledge for staff & students, and support of higher degree students.

UWA Pathfinder Fund

In 2002 UWA established the "Pathfinder Fund", which allows up to $60,000 per project to be invested for proof-of-concept work, market scoping, and related activities. An external consultant panel assists the UWA Office of Industry & Innovation to assess the worthiness of prospective projects. Extensive details can be found at http://www.oii.uwa.edu.au/pathfinder. These funds can also be coupled with co-investment by an industry partner or early-stage investor, thus mitigating risk but still allowing early-stage deals to flow.

The two UWA case studies described below were both recipients of UWA Pathfinder grants.

IP Commercialisation Awareness and Training

At UWA awareness training is addressed by the Office of Industry and Innovation. This training falls into two broad areas:

- A minimum "awareness" training covering IP policies, IP protection and commercialisation is required (usually a half-day session).

- More advanced IP commercialisation training for postgraduate students such as the Commercialisation Training Scheme (CTS) was introduced through DEST in 2007. This should be promoted and continued. In addition, staff interested in this field can access MBA programs with high entrepreneurship and innovation content.

Case Studies

The following two case studies are provided to show some of the differences in technology transfer outcomes managed by UWA through its Office for Industry and Innovation. Both are licences, with the first case study being a non-patented technology that led to success in commercial returns amongst other benefits. The second case study describes a technology that did not lead to commercial benefits but involved 4 patents and led instead to a very successful ongoing collaboration with a US multi-national company.

Case Study 1: Lectopia System
Institution: The University of Western Australia (UWA)

Technology / Product / Service
The Lectopia (previously iLecture) system uses the internet to deliver lecture recordings over a standard internet connection. A high degree of automation ensures that audio and video content is captured, processed and delivered via a streaming web server 'on demand'. UWA currently records 340 lectures each week and delivers over 10000 individual lectures per week both on campus and in regional areas of Western Australia. The development of the Lectopia system commenced in 1998 and the system was rolled out at UWA from 1999 onwards. The success of Lectopia at UWA led to considerable interest from other Australian universities.

Commercialisation Strategy
UWA's Office of Industry and Innovation worked closely with the Lectopia development team to devise and implement the commercialisation strategy. A moderately costed licensing model was developed in which universities pay a licence fee proportional to the number of recording venues in which the system is installed. Annual software maintenance fees generate additional revenues to fund regular system updates and product enhancements. This strategy led to good results during the period 2002-2007, with 18 local and two overseas (Duke university, US and Newcastle-upon-Tyne, UK) universities licensing the technology. In mid-2007, to target overseas markets, UWA concluded a sale of Lectopia with the US company Anystream, which involved the UWA development team moving to form Anystream Australia.

Outcomes and Current Status
As of April 2008, eighteen licence deals with Australian & New Zealand (Auckland university is a licensee) universities have been negotiated or approx. 50% market share within Australia. Cumulative licence and related revenues will have exceeded several million dollars making it the most successful UWA licensing arrangement to date. More significantly, this valuable technology has been delivered to a large number of Australian universities for their benefit and that of their students. Finally, through the deal with Anystream the UWA technology will be further developed by Anystream Australia in conjunction with its parent company and offered to universities worldwide.

For more information see: www.lectopia.com.au

Case Study 2: Smoke Project
Institution: The University of Western Australia (UWA)

Technology / Product / Service

For over 10 years, four research groups in the world were trying to isolate the chemical in "bushfire smoke" believed to be a potent seed germination initiator. The novel compound known as "butenolide" was isolated and characterised by researchers at the University of Western Australia (Gavin Flematti, PhD student), in conjunction with researchers at Murdoch University and the Botanic Gardens & Parks Authority in Perth, Western Australia. The chemical, and its agricultural activity, was patented in late 2003, published in Science in Aug 2004 and then licensed to DuPont Agrochemicals in July 2005.

Commercialisation Strategy

The nature of the technology (a new chemical with commercially relevant applications) backed up by multi-disciplinary technical experts (chemists at UWA and MU, botanists at the BGPA) and a strong IP position, provided an opportunity for the Office of Industry & Innovation to take this to a major industry leader for them to maximise the chances of developing it into a range of agricultural products far quicker than the research institutes could do themselves. Accordingly, a development licence was duly signed in July 2005and a period of co-work began which led to a further 3 patent applications. Visits to DuPont's US headquarters by the Perth technical and commercialisation team and reciprocal visits by DuPont staff led to a good collaboration.

Outcomes and Current Status

In the event, DuPont terminated the licence for technical reasons, including breadth of efficacy and toxicity issues. The compound is currently being evaluated for use in plant tissue culture systems at UWA and the BGPA. In addition, it's back to more fundamental research on some of the mechanisms of action. The relationship with DuPont has exposed the Perth researchers to the realities of industry-focussed research as well as funds and resources that weren't available locally, and advances in the project have also resulted in substantial grant funding coming to the original inventors. It is hoped that the compound will find application in tissue culture systems. In addition, the close collaboration with DuPont has led to close understanding of each other's capabilities and a separate project on screening of UWA's natural product's chemical library. This project is nearly complete. In summary, very modest financial returns to UWA but a breadth of collaborative work in organic agri-chemistry with DuPont. In 2006, Gavin Flematti was awarded the Sir John Cornforth award for the best organic chemistry PhD in any Australian university.

Recommendations with Respect to Research Commercialisation

1. The Commonwealth Government should consider the establishment of a specific Higher Education Innovation Fund (HEIF) similar to the one operating in the UK with similar sub-programs.
2. That the Federal Government establishes and funds a "Visiting Industry Professor Scheme" to increase University-industry collaboration by placing experienced market-savvy staff in pat-time positions on campus.
3. That the Federal Government provides funding support in the form of an annual rebate scheme for *bona-fide* university pre-seed funding for on campus activities including proof-of-concept work.
4. That the Federal Government provide funding support, also by a rebate scheme, for on-campus IP commercialisation awareness and industry-interaction training for staff and PhD students.

Research Collaboration

Introduction

The CRC Program commenced in 1991 and has the following objective: 'To enhance Australia's industrial, commercial and economic growth through the development of sustained, user-driven, cooperative public-private research centres that achieve high levels of outcomes in adoption and commercialisation'.

UWA believes that the CRC Program has been a highly successful interaction between researchers and the users of research across many sectors, and along with other initiatives has contributed to a major shift in the way that research is done in Australia. However, after 17 years, the Program has evolved in such a way that research innovation can be stifled. It is timely that the current Australian Government is reviewing the program.

Below we provide a short analysis of the CRC Program from the perspective of The University of Western Australia. The University is a major contributor to R&D in Western Australia and Australia and UWA has been a partner in many CRC's since 1991. UWA is approaching this submission by asking what sort of collaborative program would make Australia world class and underpin economic and social well-being in the nation.

UWA analysis of the CRC Program

Strengths

Before the Cooperative Research Centre (CRC) Program was launched in 1991 much of Australia's R&D was fragmented. Except at the project-level the Commonwealth science agencies, universities, state agencies and industry were often working in isolation. The result was that major issues that faced the nation, and for which R&D was required, did

not attract a critical mass of research effort integrated to provide solutions. Major benefits of the CRC Program have been:

- National collaborations that did not exist before the CRC Program was introduced have flourished over the last 17 years. A benefit of these collaborations not often appreciated has been a more sophisticated understanding amongst all researchers of the business drivers of the variety of institutions involved in CRCs. The R&D partnerships forged through CRCs have been the envy of many other countries.
- The CRC Program leveraging of funding produced by the injection of Commonwealth funds allowed research of a different scale than had been possible before.
- Mixing teams of researchers from different organizations has resulted in an integration of research efforts that would not often have occurred in the absence of the CRC Program.
- A major success of the Program has been capacity building through the training of higher degree by research students. In many cases CRCs have added value far above just the allocation of scholarships through professional training obtained from working in large group projects, placements in industry and special professional training in particular areas of the business of research and research delivery.
- The ability to incorporate in many instances has created vehicles for more effective operation, with particular emphasis on technology transfer.
- CRCs have had an important role in communication of research findings. Much of the research conducted with the support of the ARC and the NH&MRC does not get communicated effectively to the community. Owing to their scale and obligations under the Program, most CRCs have very effective communication plans.

Weaknesses

Shifts in the emphasis of the Program, changes in the globalization, scale and competitiveness of R&D, and the development of new business drivers and collaborative networks within R&D provider institutions have all resulted in the CRC Program in its current form being a less attractive model for driving innovation than it was in the early 1990s. Particular weaknesses that are impediments to innovation are:

- The current program does not encourage international linkages at a time when innovation is a global endeavor.
- Incorporation has often created many barriers to innovation in CRCs. The very strong focus on development and commercialization in the latest rounds of the Program has meant a shift from public good research. Low risk strategies of investment owing to the investment by industry needing to be tied to specific research outcomes are leading to a much lower probability of innovative research.

Innovation
For UWA the focus on development activities in many of the programs of the several CRCs has meant that it has become difficult to get our academic staff excited about contributing to their research programs. At the same time the management teams of the same CRCs have chosen lower quality researchers from state agencies to perform the relatively pedestrian research. It appears that UWA will not meet its in-kind contribution to some of these CRC in the first years of the CRC.

- The size of the Commonwealth grant provided to CRCs has not kept pace with the cost of research, nor the size of teams bought together to focus on the important issues being addressed by CRCs. The outcome is that CRCs are not as attractive to R&D providers as vehicles to support innovation.

- Relative to the quantum of Commonwealth funds available for research, the transaction costs of engagement in CRC-funded research are high. Incorporated Boards now have to pay Chairs and Directors and there are significantly increased legal costs to incorporation that were often provided as in-kind contributions by Centre Agents in unincorporated JVs. For spatially distribute CRCs (the norm) there is also an added cost for partners in attending partners' meetings with the Board. The outcome of all of these overheads is less funding available to support research activities and higher cost inputs for partners.

- New Commonwealth rules regarding incorporation have driven behaviour that is more focused on competing for funds than collaborating on research programs. Behaviours have been particularly difficult regarding the management of IP in CRCs focused on commercialization activities.

Voting rights for CRC Boards
During the development of the case for new CRCs, UWA has received requests for the funding support necessary to 'buy' voting rights on Boards. For instance, here is a quote from one such letter…..'proposed minimum for voting rights for the ZCRC Board of Directors will be in the region of $200.000 - $300,000 per annum'

- In UWA's experience the CRC Program has often acted to provide a large subsidy for industry R&D rather than attracting significant industry investment in research. Industry partners are notoriously risk averse when it come to R&D investment and often only enter CRCs as supporting partners or at the project level when the riskier research is completed.
- Over the years since the beginning of the scheme universities have become the greatest contributors to R&D funding within the CRC Program[3]. This was clearly never the intention when the Program began.

[3] Since the commencement of the CRC Program $12.3b has been invested by all partners, with the highest contribution of $3.1b form universities. In comparison the CRC Programme itself has provided $3.0b and

- The insertion in current versions of the CRC Program Commonwealth Agreement of a clause referring to the waiving of Moral Rights is an extreme example of the warping of the collaborative system when it is driven by commercialisation and the protection of IP at the company level.

Moral Rights
Offering a stipend to a PhD student requires the student to waive their moral rights to their work or what is described in the agreement provided by one CRC in which UWA is a partner, as the "Scholarship Material". UWA sought clarity on what was meant by the term "scholarship material" This was ignored by the CRC who claimed UWA had to agree with all clauses on IP management in the Commonwealth Agreement with the CRC. Having students waive the right to be recognised as the authors of their own work is strange as is allowing a CRC to change what has been 'discovered' by the student without the student having recourse. We hold that this is not good research practice - and may contradict the NHMRC code on the attribution of authorship.

UWA thoughts on the questions posed in the call for submissions

UWA believes that overall the CRC Program has been an enormous success but that in its latter phase, where the emphasis has been on commercialization at the expense of public good research and cutting edge, risky and innovative research, it has moved away from its original objective. Is there a better model to promote and fund collaborative research among public and private institutions that will result in world-class R&D outputs and innovative solutions to National issues?

Opportunities for an improved CRC scheme

The University of Western Australia believes that the following criteria should guide the development of a new collaborative research program:

- There should be a focus on research excellence at the international level
- There should be a greater focus on public good research – many of the major problems facing the nation and the world at the moment require highly innovative research funded by government
- The transaction costs of any collaborative scheme should be minimised
- Funding support mechanisms for IP commercialization should be separated from funding for collaborative strategic and applied research and development
- International partnerships should be a major feature of such a program and overseas higher degree students and postdoctoral researchers should be attracted to work in such programs and allowed to stay to grow and enrich Australia's innovation system

---

industry and CSIRO $2.5 and 1$1.2b, respectively.
https://www.crc.gov.au/Information/ShowInformation.aspx?Doc=about_programme&key=bulletin-board-programme&Heading=The%20Program#Overview on 21 April 2008.

- Adoption and commercialization of research should be managed by a special stream of collaborative funding

Recommendations with Respect to Research Collaboration

1. That a new collaboration program be developed with two streams to support (a) basic public good research by universities, other R&D providers (including international partners) and industry, and (b) research with strong commercial potential undertaken by universities, other R&D providers and industry.
2. Stream one should be a Linkage Collaborative Centre Program managed by the Australian Research Council. This would allow a continuum for applied research from APA(I) scholarships, ADP(I) fellowships, ARC Linkage Projects through to ARC Linkage Collaborative Centres, in parallel with the more fundamental continuum of ARC funding through Fellowships, ARC Discovery Projects to ARC Centres of Excellence.
3. Stream two should be a Research Commercialisation Program managed by AusIndustry or a similar body. The focus here should be on moving beyond proof of concept to small trials involving industry, leading to spin-offs or product release.
4. There should be a transition phase of development of these two streams to allow some current CRCs to re-bid and continue operation while a new policy for funding is developed. This will minimize disruption to important existing partnerships and allow expansion of the Australian Research Council's capability to manage a new, more industry focused Linkage Collaborative Centre Program.

30 April 2008

Attachment 1

A recent major challenge for commercialisation of IP generated by University researchers

UWA-GRAY-SIRTEX LEGAL CASE

In a recent decision (April 17) of the Federal Court of Australia (FCA 498) in the above-mentioned case, the judge ruled that The University of Western Australia had no right to own the intellectual property of its academics. A quote from the judgment follows:

*"**12** UWA's case against Dr Gray and Sirtex was critically dependent upon the proposition that it was an implied term of Dr Gray's contract of employment that intellectual property developed in the course of his employment belonged to UWA. Although there seems to have been an assumption among some at UWA that such an implied term operates generally in the case of academic staff who research and use university facilities, I have concluded that the assumption is not well founded. Absent express agreement to the contrary, rights in relation to inventions made by academic staff in the course of research and whether or not they are using university resources, will ordinarily belong to the academic staff as the inventors under the 1990 Act. The position is different if staff have a contractual duty to try to produce inventions. But a duty to research does not carry with it a duty to invent."*

If this ruling stands external research contracts, licensing, spin-out company formation and related commercialisation agreements would be handled individually by the academics not the university. The ramifications of this decision across the public sector research organisations in Australia are extensive and would fragment the commercialisation and innovation efforts arising from university R&D as the onus would fall on individual staff members not organisations. If the academics and not the university have ownership of inventions, IP and subsequent commercial returns emanating from university research, universities would question the provision of commercialisation services. An additional issue is that ARC & NH&MRC funding is currently provided to universities with clear IP guidelines for institutions.