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Putting Research on the Policy Agenda

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Putting research on the policy agenda

There has been a reasonable degree of media coverage and political interest in the Group of Eight discussion paper on higher education launched in June by Glyn Davis; but much less interest in research, including the proposals in that discussion paper relating to regenerating Australia's university research, research training and research infrastructure.

The Government's 2007 Budget made little reference to research, with the major exception of the Higher Education Endowment Fund (HEEF), some part of the proceeds of which may be devoted to research infrastructure but on terms not yet made clear.

Significantly, no commitments were made about *Backing Australia's Ability* Mark 3.

Perhaps the HEEF announcement was regarded as big enough in headline terms to make redundant the need for a BAA3 statement, given that technically there is another year for BAA2 to run before out-year commitments are due to be renewed. That was a fair assessment — it hit the headlines. And politically it may have been a smart tactic for the Government. But it is a risk for universities. The first Budget after an election is not necessarily a bountiful one.

Without a pre-election commitment to research infrastructure renewal, we don't know where we will be, or even where political thinking is heading.

It means for the 'worriers' that HEEF looms as a possible substitute for several current funding schemes such as the Capital Development Pool, the National Collaborative Research Infrastructure Scheme, the Institutional Grants Scheme, even the Research Infrastructure Block Grants Scheme.

In other words, the annual formula-based schemes could be replaced, in full or in part, with periodic submission-based schemes and new conditions attaching to payments, including matching funds and other compliance requirements. We are presently told that this will not happen. But...

Additionally, I have no doubt that the pressure will build for HEEF proceeds to be spread across all universities for all manner of capital works; or to be skewed towards certain, say regional, institutions. At around \$8 million per annum per university on average, the potential benefits of HEEF will not be what they seemed they might be at first blush – and what they need to be.

It follows that, in a worst case scenario after a short while, we could be worse off financially in net terms and worse off strategically in real terms.

I want to remind everybody, including the Government and the Opposition, that the higher education job is not complete — it is not yet all done. And if anybody thinks otherwise, they need to think again.

As university leaders, we would be remiss in our duties if we did not press for better outcomes. The Government needs to make clear before the election its funding commitments over its next term in respect of research, research infrastructure and research training — and its policy commitments.

The Opposition too has been silent on higher education since the Budget. Perhaps the Government's partial deregulation of funding arrangements along with the HEEF initiative took wind from the sails of the good ship Education Revolution. Nevertheless, given the broadly positive reception to its White Paper on higher education released in 2006, Labor's quiescence about future policy intentions is curious.

At this stage I don't necessarily expect the Opposition to be filling in the numbers on funding commitments, such as the substance of 'adequate indexation', but I do expect clarity about its policy intentions, and we are not getting clarity on fundamentals.

For example, in relation to some key elements of their White Paper:

- Does Labor remain committed to ending the rigidity of the (now improved) funding clusters?
- Does it still support the more flexible and mission-based funding arrangements referred to as 'compact funding' in the White Paper?
- Does it continue to support funding for 'third stream' activities, such as community service and knowledge transfer, not linked to funding for teaching or research?
- Does Labor support increased block funding for university research?

- Does it continue to support concentration of research capability and 'hub & spokes' modes of shared access to critical mass of expertise and state-of-the-art infrastructure?

Australia cannot afford to go into the second decade of the twenty first century without a firm commitment to building the knowledge base for the future. Both sides of politics have a duty to address this challenge, and those of us in the university community have a responsibility to help them understand why – and what is required. Tonight I want to lay down some markers for research investment as a guide for both the Government and the Opposition.

First, I want to explore the paradox that, while the research performance of Australia's universities is improving, Australia's research capability is slipping behind the world's leaders. That is, the productivity gains of the last decade or so cannot be sustained under conditions of deteriorating research infrastructure and loss of expertise.

Second, in this context I will point, on the one hand, to the widening gap between Australia's leading universities and the others in terms of research performance, and on the other hand, to anomalies in government financing whereby resources for research training are being distributed disproportionately to institutions that perform least well in research.

Third, I will outline the essential elements of the necessary renewed investment in research, research training and research infrastructure.

The context for these remarks in the emerging global knowledge economy is that of rapidly increasing investment in scholarly expertise and research infrastructure by developed and developing countries of the northern hemisphere.

To start:

By all international comparisons Australia's total investment in Research and Development lags the world's leaders. With Gross Expenditure on R&D at 1.8 per cent of GDP, Australia ranks fifteenth among OECD member countries for which the average is 2.3 per cent. If Australia was

investing in R&D at the OECD average rate we would be spending \$5 *billion* more each year than we are currently spending.

Of course it is not simply the amount of R&D spending that matters but how well the amount is spent. Nevertheless, we give ourselves a big handicap if the quantum of our R&D inputs is significantly less than that of our competitors and the more so if our distribution and usage of the inputs is less than optimal.

China spent 1.3 per cent of GDP on R&D in 2005 and is aiming for the OECD average by 2020. At end 2006 China became the world's second highest investor in R&D, spending some \$170 billion, compared with Japan's \$160 billion. R&D spending by the EU15 totals \$290 billion. The US leads with \$410 billion. Australia is spending \$16 billion — less than one tenth that of China. Australia is also more dependent than other countries on university research. The Higher Education Sector accounts for 18 per cent of R&D for the OECD on average but 27 per cent for Australia.

The Productivity Commission has recently reminded us that “universities core role remains the provision of teaching and the generation of high quality, openly disseminated, basic research.”

Australian universities must perform at the highest international standards and, through scholarly exchange, enable the nation to access the world's advances in science and technology.

[Parenthetically, I remind you that an important issue that must be addressed is whether all universities in our 'small' country can operate at the highest level, or whether some can; the direction adopted has serious implications for policy, financing and funding.] Australia conducts 1 per cent of global R&D. Given the relatively free flow of knowledge and data between universities across different nations, research universities provide a key interface through which the global R&D effort can be accessed.

But there are issues: as noted by my ANU colleague Professor Steve Dowrick:

"A country like Australia cannot rely on a strategy of passive absorption to maintain strong productivity performance. In order to benefit from the global public good of world knowledge, countries need to have well trained scientists, a technologically capable workforce and active

engagement in cutting edge research.”¹

It is the knowledge obtained from basic research that makes practical applications possible. Practical problems also can give rise to basic research questions. A simple linear distinction between basic and applied research cannot be made. Basic research capacity is essential for attracting business investment in R&D.

Increasingly, international corporations are seeking out centres of strong basic research capability as sites for their global investment. In Australia, basic research represented two thirds of university R&D spending in 1990-91. By 2004-05 only half of university spending on R&D was directed to basic research. There has been a significant shift in university spending towards applied research over just fifteen years.

Australia is pretty much alone in having both Business and Higher Education R&D directed heavily to applied research. It is a big risk for a small country to have such a limited approach – or to let drift happen. While it may be true that we cannot yet see the consequences of running down our investment in basic research, the danger is that by the time we do it may be too late.

Other countries are increasing their investment in basic research capacity to attract inwards investment as well as to capture the broader benefits that flow from university research, including the production of new knowledge, the training of skilled graduates, the development of scientific instruments and techniques, the formation of networks for sharing know-how, and the creation of new businesses.

International research collaboration is a rapidly growing component of research activities for all research performing countries. According to a recent study conducted for the UK Office of Science and Innovation, over the last ten years the volume of international collaborations (as evidenced by co-authored papers) increased on average by 30-50% across the nine countries studied. Cross-national co-authored papers represented 40% of all Australian publications produced

¹ Dowrick, S. (2003), “A Review of the Evidence on Science, R&D and Productivity”, Paper prepared for the Department of Education, Science and Training. Canberra.

between 2001-2005, up 31% on the preceding period 1996-2000.²

[SLIDE 1] The gap is widening as Europe, North America, China, India and others accelerate their investments in research capability — expertise as well as infrastructure — on a very large scale. Australia too has made selective investments in new platforms to support leading research, for instance in biosciences. However, this country faces the serious risk of becoming a backwater if we squander the opportunity to invest in significant upgrading of domestic research facilities and participate in strategic international research infrastructure partnerships.

Here are some examples:

- The **ITER Organisation** for fusion R&D has seven members: the European Union, Japan, the People's Republic of China, India, the Republic of Korea, the Russian Federation and the USA. The construction of ITER, at Cadarache in southern France, is estimated to cost five billion Euro (\$8.4 billion) over 10 years.
- The **Large Hadron Collider** at CERN, Switzerland. to begin operation in May 2008 will be the world's largest and highest energy particle accelerator. The LHC is being funded and built in collaboration with over two thousand physicists from thirty-four countries, universities and laboratories.
- The **International Space Station** being assembled in low Earth orbit will complete 15.7 orbits per day. The ISS is a joint project between the space agencies of the US, Russia, Japan, Canada and several European countries.
- The **Galileo** global network of 30 satellites providing precise timing and location information to users on the ground and in the air. Costing some 3.4bn Euros of public and private investment it represents the biggest space project yet undertaken in Europe.
- **Project Constellation**, a NASA program to create a new generation of spacecraft capable of performing a variety of missions, from Space Station resupply to lunar landings.

² Adams J. Gurney K & Marshall S, (June 2007), Evidence Ltd. *Patterns of international collaboration for the UK and leading partners (Summary Report)*, A report commissioned by the UK Office of Science and Innovation, UK, USA, Canada, Leeds.

In response to data indicating that US research competitiveness was slipping against world comparators, the US Budget for the 2008 financial year has doubled over the next 10 years the amount of funding for the National Science Foundation, the Department of Energy's Office of Science and the Department of Commerce's National Institutes of Standards and Technology.

For the National Science Foundation alone the Budget provides USD 6.43 billion "to energize the nation's leadership in fundamental research and education."³ Priority is being given to discovery research for innovation. Because the most fertile ground for discovery is often to be found at the interface among disciplines the decision has been taken to keep all disciplinary fields healthy and strong while providing for new and emerging fields that have the potential to overturn accepted paradigms. Concurrently, the NSF is investing in international partnerships with research communities around the globe "to detect movements at the frontier and capitalize on new concepts", in a set of initiatives to prepare the next generation scientific workforce, and in cyber-enabling systems and tools for managing the vast amounts of data that can be generated.

Where is the Australian equivalent in understanding the imperative to join with the world's strength in research and committing the resources needed to do so?

We need to replenish the supply of new researchers as the academic workforce is ageing. Career options are uncertain for early and mid-career researchers who depend largely on grants for short-term research projects, typically three years in the case of ARC grants, three to four years for NHMRC grants, and even shorter grants for industry funded and contract research. Too many talented researchers, who could form the base for the next generation of Australia's research capability, are being lost to the system. Australia cannot afford to be so narrow and mean-spirited about developing the next generation of intellectual leaders. There is a high-end skills shortage emerging that will cost the country dearly as the global knowledge economy expands.

Australia is producing only 2.3 new doctorates per 100 university graduates, compared with 3.9 in Canada, 10.1 in Switzerland and 11.2 in Germany. And we are falling further and further behind.

³ Dr Arden L. Bement, Jr. A. Director, National Science Foundation, Testimony before the Senate Commerce, Science & Transportation Subcommittee on Technology, Innovation, and Competitiveness. 19 April 2007.

There has been no growth in the number of research training places since 1999, when there were some 21,500 places funded.

In 1994 there were 10,258 HDR commencing students, of which 14% were international students. In 2005, the total number of HDR commencers had risen to 11,008, of which 21% were international students. The actual number of domestic HDR commencers fell by 2% over the period.

The available evidence suggests that there have been substantial productivity gains in the performance of Australia's university sector over the last decade or so. Teaching productivity has increased, as indicated by higher student-staff ratios, higher rates of student completion and increased levels of student satisfaction.

Meanwhile the level of public funding per student has eroded. The overall effect has been a sizeable return on the public investment notwithstanding concerns within the sector about aspects of the student learning experience as well as staff workloads.

Research productivity has also risen sharply. The volume of research output has increased, as has output per researcher, and contrary to a view within some circles, the indications are that the quality of the greater output has improved. Let me provide some illustrations.

If we look at the HERDC data reported by universities annually to DEST (Slide 2), we see weighted publications increasing by 188% from 15,191 in the year 1995 to 43,853 in the year 2005. On this measure, total research output per academic staff FTE has risen from 0.5 to 1.3 over the decade.

If we take Thomson ISI publications over the two five periods 1995-1999 and 2001-05 we also find a substantial though lesser increase of 28% from 82,164 in the former period to 104,922 in the latter.

Of course there are significant differences in the performance across universities, as there are within universities by field of research. Clearly, there are within universities like Wollongong, Griffith, James Cook or Flinders fields of research that are among the best performing in the country, and it is important that these strengths not be diminished.

[SLIDE 3] The differences in the scale of output growth are particularly interesting. The Go8 universities increased their share of total output from 25% in 1995 to over 50% in 2005, notwithstanding very high percentage rates of growth off a lower base in the smaller research institutions. That is, the performance gap in volume terms is widening, despite a considerable diversion of effort in favour of research activity across the sector, much of it funded through cross-subsidisation from teaching activities themselves subject to squeeze.

[SLIDE 4] It is important to note that the quality of output, as measured by citations per publication, has been improving across most of the sector. Here we are looking at the university sector as a whole. Within the aggregates will be found different areas of strength by field of research, with some universities being much more comprehensive in their strengths than others.

[SLIDE 5] The most significant point is that despite the improvement in Australia's overall research productivity, only 10 universities are performing above the world average for citation impact in 2001-2005: the Go8 plus Swinburne and Charles Darwin. The latter are smaller institutions with a focus of a few fields in which they do very well in at least one field. Swinburne, for instance, wisely concentrates on five of the (Thomson) fields of research and performs on a par with the world average in three fields, is below on one, and is well above on one other with an outstanding performance in astrophysics and supercomputing. By contrast, the ANU has a broader research orientation, performing across 24 of the Thomson fields. ANU performs well above the world average in 18 of those fields and is on par in 4 others.

[SLIDE 6] When we put output volume alongside output quality we see a significant gap between the leading eight and others. We can also see broadly four types of institution in terms

of research performance: (i) those that are comprehensively strong, albeit with some areas of relative weakness; (ii) those that have focussed niche strengths; (iii) those that are comprehensive but have strengths in only a few areas such that their overall performance falls below world average; and (iv) those that are comprehensively weak.

Now let us look at the distribution of public resources for research, research infrastructure and research training.

In 2005 research income from national competitive, peer-reviewed grants totalled some \$625 million, of which Go8 universities obtained a share of 74%. The Go8 also shared 74% of Research Infrastructure Block Grant (RIBG) funding. However in the same year, Go8 universities received only 64% of Institutional Grant Scheme (IGS) funding and 60% of Research Training Scheme (RTS) funding. In the case of the international research scholarships (Endeavour IPRS) the Go8 share was puzzlingly less than 60%.

Through the RIBG scheme, the scheme directly linked to competitive grant success, universities received on average 21.6 cents for every dollar of competitive research income. Go8 universities happened to get exactly the average - 21.6 cents.

Through the IGS, (distributed according to the formula: 10% publications, 60% research income total and 30 % HDR load) universities overall received on average 34 cents per dollar of competitive research income. However, 14 universities received in excess of 60 cents per dollar, the top four among them being the University of the Sunshine Coast (\$1.06), Southern Cross University (98c), Central Queensland (90c) and Edith Cowan (87c). All Go8 universities received less than 34 cents. Clearly, if IGS is to be linked to research quality, the formula needs to be changed.

[SLIDE 7] Through the RTS universities received on average 65 cents for every dollar of competitive research income. However, all the Go8 universities received less than 60 cents, with ANU getting merely 33 cents. Seventeen universities received more than \$1, with the same four institutions mentioned before getting more than \$2. Sunshine Coast won \$176,000 in research

grants but received \$696,000 for higher research degree places. Southern Cross got more than \$3 million for research training places when it won \$1.4 million in research grants.

I think it is valid to compare funding for research training with success in the national competition for research funding primarily through the ARC and NHMRC. Through those mechanisms the available funds are allocated to those researchers who are deemed by their peers to be the most meritorious.

It would be hard to sustain the proposition that quality research training can be provided in the absence of quality research (although it does not automatically follow that, in every case, quality research training is provided within a quality research environment – we all know a horror story or two). You will simply not find a quality research culture in an institution whose researchers are not competitive nationally let alone internationally.

So what explains the inverse relationship between research performance and the allocation of HDR places? The RTS formula has three elements: student completions (50%), research income (40%) and publications (10%). Annual changes in allocations through the formula are buffered through caps on winnings and safety nets against losses, and these buffers result in disconnects between shifts in performance and funding. Attention has focussed on the publications factor as a diluting influence on the allocation of RTS funds, but the data I have presented suggest those concerns are overstated.

Similarly, research income is not the problematic element of the formula. Indeed, if funds for PhD places were allocated in proportion to all research income, then the strongest performing universities would have received \$44 million more in 2005. If funds for research training places were allocated on the same basis as RIBG, the strongest performing research universities would receive \$75 million more than they are currently receiving through the RTS formula.

[SLIDE 8] That leaves the most highly weighted element - HDR enrolments and completions. A number of universities appear to have larger HDR enrolments and rates of HDR growth than their

research performance would predict, and it seems a few with less distinguished research track records are drawing disproportionately off the international student market, perhaps to increase their completions count for the RTS formula. The growth in international HDR commencements does not appear to correlate well with strength in research.

Not only are we dissipating the shrinking investment by skewing the allocation of scarce domestic resources away from our performance peaks but we are also allowing signals to be sent to the world about Brand Australia through PhD offerings that may not withstand basic scrutiny. Are all PhD's of the same standard? I do not believe that it is remotely possible that they are.

The problem here is not just the formula but the policy mindset it reflects — a view of a 'fair average system' with 'parity of esteem' of degrees, rather than the reality of a sector having diverse institutional characteristics and differentiated quality.

I am not suggesting, and I would not suggest, that resources should be taken away from any university. Indeed, I would argue the opposite – fund properly what we do and what we need to do to keep Australia competitive.

My concern is that we fall into traps: 'Brand Australia' and the implication that standards and quality are common across the sector, if not identical; that by suggesting that funding is inappropriately allocated we are, in fact, fuelling the notion that the quantum of funding is acceptable when it is not, and that it is only it's distribution that is a concern.

My point is that in the absence of adequate national investment in higher education and research, and a set of policy incentives encouraging all universities to dance to the same tune and chase the same few discretionary dollars, a number of institutions are distorting their missions and eroding their effectiveness yet not matching up nor catching up in the competitive world of research. And we are simultaneously reducing the capacity of the higher performers.

We have to be mature enough to recognise the fact that some will never catch up and we should not spend scarce resources in the false belief that it can happen.

The rest of the world is not waiting for Australia to catch up, and if our leading universities fall behind, because we persist in diverting resources away from sustaining our strengths, while we build on them and others, then Australia will pay a high cost into the future.

It would be much better to permit universities to direct their use of the available resources to what each can do best. That means expanding institutional flexibility and discretion, and in many ways that means government getting out of the way and reducing the counterproductive controls its exercises at the micro operational level. Above all it means government recognising its responsibility for helping to build competitive research capability through adequate and appropriate investment.

So I come to the future investment priorities for research, the basis for a BAA3 or its equivalent.

The top priority is research infrastructure. While people are the most important factor we cannot attract the people we need if we cannot offer them at least reasonable conditions for undertaking research. We are losing talent overseas frequently because others are providing research infrastructure of capacity and quality we cannot match.

It is true that in several areas of research in a number of Australian institutions the research fabric is state of the art. However, across the sector there are serious deficiencies in the capital stock, in buildings that are decaying and do not comply with contemporary building standards and regulatory requirements for the conduct of research, and in the water & sewerage, gas & electricity and communications infrastructure.

The backlog maintenance costs for the Go8 universities alone leaves little change from the whole

of HEEF. Additionally, there are many areas where scientific equipment has been band-aided together from bits and pieces collected from various sources of research income over time. In too many areas it is embarrassing to have international visitors in our laboratories.

The second priority is to attract more students into doctoral programs and develop the next generation of researchers. That involves expanding the number of HDR places with stipends, and not only for Australian students but also for international students to study in Australia. It also involves expanding programs for the development of early and mid career researchers. Above all, it involves ensuring quality in research training.

The third priority is to increase funding for basic research. That involves providing a higher level of funding on a block-funded basis for longer-term research, rather than short-term instrumental research. We must be strategic in our approach.

The fourth priority is to increase the proportion of research costs covered by competitive research grants. Currently ARC grants on average cover only 70 per cent of the costs – and there is inadequate support for the additional indirect costs. Australia currently puts a price on success – as we cross-subsidise our successes from other activities.

The fifth priority is to develop funding programs to enable international research collaboration through shared infrastructure investments, researcher exchanges and collaborative research projects.

Finally, there is a great need to fill a gap in the innovation system by expanding access to proof of concept funding. This was a major gap identified by the National Innovation Summit seven years ago, and it remains a major gap.

To conclude: what I am talking about is the need for a new policy setting for Australian higher education.

We can argue for ever that Dawkins did this or Dawkins did that. Twenty years ago he did, indeed, do something. And there is no point in lamenting what he did, and what we are.

Nor is there much value in arguing that we should let it run plus occasional tinkering for another twenty or more years so that 'the others' can catch up. An unlikely outcome; with only one near certainty – a settling for something less than fair average quality as we level down in the hunt for equality.

If we had a policy setting that made the best use of the institutions as they have developed; if we encouraged the differences between them; if we funded quality outcomes where they wherever they might be found; if we focused more on real outcomes and less on process and even less on the easily measurable, therefore judgment – eschewing, minutiae; and if we accepted that there will be different costs in being different, we might get somewhere.

And if it is policy genuinely in the national interest, occupying the high ground, so high indeed as to be above the politics because it is that important, then Australia might well be able to keep up with what the founders of ANU were then able to call the 'enlightened nations' of the world.