

On 'Bricks to Brains to Business'... Collaboration - Our Achilles Heel?

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Executive summary

In recent years, the considerable investment made in Smart State funding is resulting in a burgeoning critical mass of significant talent in to the 'R' end of the research, development and innovation (R,D&I) equation. There is now a great opportunity to leverage this investment (sunk costs) and convert it into more jobs, increased wealth and improvement in quality of life.

We have a productivity challenge confronting our nation, and our State. Innovation is recognised worldwide as a key contributor to productivity improvement. And, in turn, collaboration is acknowledged as essential to most innovation. But we have a problem. We need urgently to address our near bottom position of the OECD league table in the collaboration stakes.

This 'thinkpiece' makes the case for re-visiting the collaboration imperative, as a pre-requisite for enhancing innovation (ie ideas successfully applied).

We need to connect academic researchers more effectively with end users through obligatory early partnering for every project receiving Queensland government R&D funding. At the same time, it is vital that we continue to increase mobility and interaction between the research and business communities.

Leadership, measurement and how we utilise our funding are key.

The following **recommendations** are made to help with this challenge, which also presents a major opportunity for Queensland:

1. **Influence Federal Government**.....the Queensland Government lobby the Federal Government to review and amend 'the rules of the game' around national science, research and innovation funding allocation and evaluation to drive researcher-business collaboration harder.
2. **Measure impact**.....pilot the introduction of an impact measure as part of the selection and evaluation of R&D projects using the current round of the Queensland Government's Smart Futures Funds.
3. **Engage Industry (end-users) early**.....engage and require end-users early in Queensland Government R&D funded projects.
4. **Involve industry in funding decisions**.....embed industry and other end users in Queensland Government funded R&D project prioritisation, selection and funding decisions.
5. **Build on success**.....leverage existing (national) selection processes geared towards promoting collaboration between research and industry and invest accordingly.
6. **Encourage mobility**.....review current talent support programs (eg Smart Futures Fellowships, etc) with a view to 'upping the ante' (in selection, and review) on mobility.
7. **Understand industry-pull**.....develop, through a speedy process of consultation, a complementary paper that examines in depth the demand-side or industry-pull incentives, for forging research/industry collaboration.

Some Fast Facts

65% - the contribution of multi-factor productivity¹ to economic growth from 1964-65 to 2004-05.²

21st - Australia's 2010/11 global ranking in the Innovation component of the World Economic Forum's Global Competitive Index³; and also Australia's global ranking in INSEAD's 2011 Global Innovation Index.⁴

29 (out of 30) - OECD assessment of Australia's position in collaboration on innovation (including both large and small firms).⁵

2.4% - of innovation-active Australian businesses collaborated with our universities in 2008-09.⁶

4.4% - of innovation-active businesses collaborated with our publicly funded research agencies in 2008-09.⁶

0.4% - of Queensland businesses registered for the R&D tax concession as at 30 June 2010 (1673 out of 420,000)⁷

¹ Labour productivity is one of the prime factors contributing to economic growth. It refers to the amount of work that gets done per person per hour. Labour productivity in itself is the sum of Multi Factor Productivity (MFP) and Capital Deepening. As capital deepening increases, there is more capital per unit of labour force. As multifactor productivity increases, more work is produced with the same capital and labour. Increased MFP could be reworded as 'achieving more with the same resources' or a higher efficiency in the use of resources.

² Productivity Commission (2007) Public Support for Science Innovation.

³ World Economic Forum (2011) Global Competitiveness Report. <http://www.weforum.org/reports/global-competitiveness-report-2010-2011-0>

⁴ INSEAD (2011) The Global Innovation Index 2011: Accelerating Growth and Development.

The Global Innovation Index is calculated by INSEAD for 125 countries. It measures innovation inputs such as institutions, human capital and business sophistication, as well as outputs, such as patents, trademarks, creative goods and services. <http://www.globalinnovationindex.org/gii>

⁵ OECD Science, Technology and Industry Scoreboard (2011)

⁶ ABS (2010) Innovation in Australian Business, 2008-09, cat. No 8158.0

⁷ Phil Green, DEEDI, personal communication.

Quotable quotes of relevance

Noting ...

"In the long run, productivity isn't everything, but it's almost everything."⁸

"... competitive advantage (resides) in superior productivity in assembling resources to create valuable products and services. Countries that improve their standard of living are those in which firms are becoming more productive through the development of more sophisticated sources of competitive advantage based on knowledge, investment, insight, and innovation."⁹

And (re our challenge)...

"The 1990s productivity boom (in Australia) has disappeared and there is little reason to believe it will improve in the medium term."¹⁰

"Without productivity growth, Australia will not be able to deliver any of the dreams and hopes that people have."¹¹

"Virtually all of the economic growth that has occurred since the eighteenth century is ultimately attributable to innovation...under capitalism, innovative activity...becomes mandatory, a life-and-death matter for the firm."¹²

"Cost cutting won't get us out of the problem. We have to innovate out of the problem."¹³

And recognising...

"Independent, global surveys of business leaders show that the majority (86%) believe that innovation relies on partnerships."¹⁴

"OECD analysis shows that a major global trend in business innovation involves 'networked innovation', whereby firms increasingly seek sources of knowledge, often from the public knowledge base, and through formal collaboration."^{15,16}

"There is a strong link between collaboration and product/process innovation."^{17,18,19,20}

⁸ Professor Paul Krugman, Princeton University, Nobel Prize for Economics (2008).

⁹ Professor Michael Porter, Harvard Business School.

¹⁰ Martin Parkinson, Secretary, Federal Treasury Department, July 1, 2011, Growth Challenge Conference, Melbourne.

¹¹ Professor Greg Smith, Henry Tax Review Panel, July 1, 2011, Growth Challenge Conference, Melbourne.

¹² Professor William Baumol, Princeton University.

¹³ Steve Jobs, 1999 (paraphrased)

¹⁴ GE Global Innovation Barometer (2011) <http://files.gereports.com/wp-content/uploads/2011/01/GIB-results.pdf>, accessed 13 May 2011.

¹⁵ OECD (2009) Innovation in firms: A microeconomic perspective, OECD, Paris.

¹⁶ This view for Queensland – around the importance of networks as sources of innovation – is confirmed in the latest (2011) Brisbane Innovation Scorecard Report.

¹⁷ Ahuja G (2000) Collaboration networks, structural holes, and innovation: A longitudinal study, *Administrative Science Quarterly* 45: 425-455.

¹⁸ Pittaway L *et al* (2004) Networking and Innovation: A Systematic Review of the Evidence, *International Journal of Management Reviews* 506(3-4): 137-168.

¹⁹ Huang K & Yu C (2010) The effect of competitive and non-competitive R&D collaboration on firm innovation, *The Journal of Technology Transfer*.

Yet we have a problem...

"Collaboration and networking have (long) been cited as consistent weaknesses in the Australian innovation system, compared with other OECD countries."^{3,21,22,23,24}

"Networking and collaboration remains (sic) the most significant flaw in the Australian innovation system....There is a problem with research-industry partnering....."²⁵

And we are not alone...

"We found few direct relationship between universities and our firms – we conclude that much of UK science and innovation policy rests on (some) mistaken assumptions (number one of which is) that university research is the key source of innovation."²⁶

But there is hope...

"Neuroscience shows that a reward circuit is triggered in our brains when we cooperate with one another...we are more cooperative and less selfish than most people believe. Organisations should help us embrace our collaborative sentiments."²⁷

Noting (around the importance of focus)...

"When people try to collaborate on everything, they can wind up in endless meetings, debating ideas and struggling to find consensus."²⁸

²⁰ Loof H & Brostrom A (2008) Does knowledge diffusion between university and industry increase innovativeness? *The Journal of Technology Transfer* 33(1): 73-90.

²¹ Department of Industry, Science and Resources (1999) Shaping Australia's Future: Innovation Framework paper.

²² Roos G *et al.* (2005) Nation innovation systems: Finland, Sweden & Australia compared: Learning for Australia. Report prepared for the Australian Business Foundation.

²³ Scott-Kemmis D & Matthews J (2010) Australia's Innovation System, *Encyclopaedia of technology and innovation management*, John Wiley & Sons, London, UK.

²⁴ Australian Industry Group (2011) Innovation: New thinking, new directions. A report to the Australian Industry Group by the Innovation Steering Committee, Sydney.

²⁵ Department of Innovation, Industry, Science and Research (2011), Australian Innovation System Report -2011, pp 1-4.

²⁶ Connell D & Probert J (2010) Exploding the myths of UK innovation policy, UK Innovation Research Centre, University of Cambridge.

²⁷ Benkler Y, "The unselfish gene", *Harvard Business Review*, July-August 2011, pp.77-85.

²⁸ Ibarra H & Hansen M.T, "Are you a collaborative leader?" *Harvard Business Review*, July-August 2011, pp.69-74.

Collaboration – Our Achilles' heel?

The productivity - innovation - collaboration link ... The thesis is a straightforward one:

1. We are faced with a serious productivity challenge in this country. Years and years of labour productivity decline. (Fig.1)
2. Innovation - "ideas successfully applied" - is a major key to productivity growth.
3. Our universities and our publicly funded research agencies (PFRAs) are rightly considered engines for bright new ideas.
4. BUT - and it is a big but - effective collaboration between the 'academic' environment and business is a pre-requisite for effective application.
5. And we are lousy at the 'game' of collaboration. (Fig. 2)

Our poor collaboration record... A recent ABS study found that only 2.4% of innovation-active businesses collaborate with our universities, and 4.4% in the case of PFRAs (Fig. 2a). How could we increase this to 20% or 30%, and in so doing move from our current lowly position of 23rd out of 25 OECD countries, in a league topped by Finland?

Here in Queensland, recent data suggests we are doing a little better, with 6% of innovation-active businesses sourcing their innovation from universities or research institutes between 2009 and 2011.²⁹ This might actually be as good as it gets since "innovating firms - making up approximately 45% of the total³⁰ - are far more active collaborators than non-innovating firms."³¹ And, correspondingly "OECD econometric analysis shows that collaborating businesses spend 20% to 50% more on innovation than non-collaborating firms."^{32,33}

And we probably need more research into levels of collaboration and associated success factors: for example, a study in Tasmania showed considerably more local firms collaborated with the university there than was officially recorded (including by the university itself).³⁴

It should also be noted that our researcher-to-researcher collaboration, locally and internationally, is pretty good. Thus, 45% of Australia's publications have an international co-author (2010 data), similar to Canada, the UK and Finland³⁵ and Australia ranks 11th on the internationally co-authored scientific articles league table.³⁶ The corresponding number for Queensland is 41%.

This will continue to be important, of course, not least for keeping at the quality forefront of research quality. Thus, for example, looking at Australia, those articles that involve co-

²⁹ Queensland Innovation Survey, UQBS, 2011.

³⁰ DIISR (2011) Australian Key Innovation Indicators.

³¹ ABS (2010) Selected Characteristics of Australian Business 2008-09, cat. No. 8158.0. The Australian Bureau of Statistics innovation survey defines collaboration as "active participation in joint innovation projects with other organisations", but excludes the pure contracting out of work.

³² OECD (2009) Innovation in Firms: A Microeconomic Perspective, OECD, Paris

³³ OECD (2010) Innovation and Firms' Performance: Exploiting the Potential of Microdata (working title), OECD, Paris, forthcoming.

³⁴ Keith Smith & Keiran O'Brien, "Innovation in Tasmania – an innovation census in an Australian State", University of Tasmania (2008).

³⁵ SCImago (2007), SJR – SCImago Journal & Country Rank. Retrieved August 09, 2001, from <http://www.scimagojr.com>

³⁶ OECD (2010) Measuring Innovation: A New Perspective 2010.

authorship (international or domestic) are 15 times more likely to be in the most highly cited (ie top 1%) category than single authored articles. This ratio is larger for other OECD countries.³⁶

But a key problem remains researcher to business collaboration....

Lost in Translation... With Queensland's share of world R&D expenditure standing at approximately 0.16%³⁷, we have to seek to leverage maximum benefit from this. We must therefore accelerate 'discovery to delivery', and the rapid transfer/diffusion/exchange (both ways) of technology and ideas between research and the market - ensuring that we just don't do great science but that it gets taken up, rapidly and effectively, creating jobs, wealth, and improvement in quality of life.

One mischievous thought in this space, developed a few years back by Geoff Garrett and Robin Batterham (former Federal Chief Scientist) while members of the Prime Minister's Science, Engineering and Innovation Council, is the 'Stop all research for a year in Oz' provocation. Not literally, of course, but we were making a point to this erudite Council. Specifically, notwithstanding the obviously big gap between what we know and what we don't know (hence research), there is also a major gap between what we know and what we actually apply. Basically it's a crying shame that there is so much great stuff around, in journals, on shelves, in heads, etc which is not getting utilised, or built upon.... as per the Bill Murray film, it gets 'Lost in Translation'.

And we're not just talking loss to the commercial world. Former APS Head Peter Shergold made the same point in his recent (4 May, 2011) article in the Australian Literary Review, entitled 'Seen but not heard'. For the social/economic policy environment, he elegantly described the void between policy academics and policy practitioners.

Harnessing connections... So, how might we harness the competitive advantage of a small country (in number of people terms), mirroring the Finnish example "Finland isn't a country, it's a club" (Erkki Leppavuori, Chief Executive, VTT, Finland's National Labs.)

A side-effect of the (small) size of the Australian system is that many of the key players already work together on various initiatives and probably know one another. And we have some notable examples where this is being translated into a real strength when harnessed correctly - proactively building a culture of 'boundarylessness': within institutions and across institutions, across disciplines and across regional and international boundaries, developing more critical mass, shortening chains of communication, facilitating sharing (people and facilities) and investing in focused innovation 'hubs'.

But, more broadly, are we adequately cultivating (Harvard's) Rosabeth Moss Kanter's 'collabronauts' - a space-faring analogy - who make these connections between the different parts of the system, rewarding those who are comfortable with some ambiguity and who work well across boundaries?

Collabronauts at the top: Leadership is key... In their research on top-performing CEOs, INSEAD Professors Ibarra and Hansen²⁸ have examined what it takes to be a collaborative leader. They found it requires connecting people and ideas outside an organisation to those inside it, leveraging diverse talent, modeling collaborative behavior at the top, and showing a strong hand to keep teams from getting mired in debate.³⁸

³⁷ Phil Green (DEEDI): Australian R&D expenditure is 1.25% of world expenditure. Queensland R&D expenditure is 13% of Australian expenditure. Therefore $0.13 \times 1.25\% = 0.16\%$

³⁸ Harvard Business Review, July-August 2011, pp.164.

Are we surprised?

“Publish or perish”? On the power of metrics... Last year, as a (part-time) Visiting Fellow in Innovation at the ANU, I had, probably for the first time for quite a while, real quality time for conversation. To sit with the bright minds with which that university is replete, and converse - about their career journeys, their work, their aspirations. This year, as a new immigrant to Queensland, I've had similar opportunities in my also part-time(sic) role, in discovering and evangelising, for the brilliant science happening in Queensland.

My concern is that the performance pendulum is swinging out too far ... the overarching metric - and "what gets measured, gets done" - still seems to be driving journal publication, almost to the exclusion of everything else. My observation, and indeed fear, is that we are steering a generation of young academics away from the effective application of their research findings.

The positives, re progress in research excellence... It is self-evident, of course, that we need to continue to compete at the forefront of top-flight research. The recent ERA 'benchmarking' exercise - 'Excellence in Research for Australia' - has done much for making transparent where our science is world-class, and where it isn't. And in this domain the performance of the Queensland University establishment - a good deal underpinned by Smart State funding it should be said - is noteworthy, and laudable.

In addition, we neglect at our peril 'conventional' academic reputational indicators, in the context of the reality, and mechanics (inc. funding!), of international academic 'league tables' - and the corresponding attraction (and retention) of top-flight academics, and students.

What we should be arguing for, however, is balance.

On knowledge exchange mechanisms: No one size fits all... There are a variety (plethora?) of possible ways for university-industry interactions, and it is important to consider deploying the full range^{39,40}, recognising the primacy from the typical company perspective of informal contacts, recruitment and access to publications^{40,41}. In this latter regard, in building a more open innovation system, perhaps we need to stimulate more ready access for entrepreneurs and businesses to published material (e.g. through university libraries?).

On metrics/targets (cont)... The Federal Government's response 'Powering Ideas' to the 2008 Cutler National Innovation Review included the target 'to double the collaboration by 2020'. From 2% to 4% ?? Big deal! We need much more stretch than this. An order of magnitude, more like, and by next week please. This is urgent. And people are like rubber bands...correctly motivated, they often have an unbelievable capacity for stretch.

Correctly structured, another measurement maxim "tell me how you're gonna measure me, and I'll tell you how I'm gonna behave" will swing in... IF the rules of 'the game' change, for example by...

³⁹ Knowledge exchange mechanisms (after Cosh, Hughes and Lester, 2006) include the following: (a) Educating people – training skilled undergraduates, graduates and postdocs. (b) Increasing the stock of 'codified' useful knowledge – e.g. publications, patents, prototypes. (c) Problem solving – e.g. contract research, cooperative research, technology licensing, consulting, access to specialised instrumentation and equipment, incubation services. (d) Providing 'public space' – meetings and conferences, hosting forums, entrepreneurship centres, alumni networks, internships, faculty exchanges, advisory committees, etc.

⁴⁰ Jamie Merrick, personal communication.

⁴¹ Alan Hughes et al, Cambridge-MIT International Innovation Benchmarking Survey. Courtesy Jamie Merrick (DEEDI).

- (a) linking substantial (20+%?) national grant money to the collaboration imperative - linking researchers with end users, from Day 1- whether in commerce or the policy environment.⁴² (The UK's '3rd Stream Funding', at a considerably lower level than this, has had considerable success.)

Relatedly - and a most appropriate suggestion from a recent (May 2010) ATSE Workshop⁴³ - changing the universities' funding formula to (much) better reward collaboration would also drive behaviour change.⁴⁴

- (b) changing our advancement/promotion, plus rewards and celebration criteria in the research environment, to put collaboration and the successful application of ideas right up there with the equally-important 'research excellence'. It's not 'either/or', by the way - it's 'and'.
- (c) introducing a separate, scalable measure of innovation 'impact'. Indeed, a complementary Smart State Council thinkpiece, by DEEDI's Jamie Merrick, presents an exciting opportunity to take a lead here.

And far from 'reluctant brides', being dragged kicking and screaming to the 'altar' of collaboration with the dark side, long experience suggests that top-class researchers are really keen on their work having impact. And noting the previously-mentioned reputational drivers, recent evidence also suggests that user-informed research actually *enhances* academic standing.⁴⁵

But beyond 'classical' incentives – the (new) science behind collaboration... A very recent Harvard Business Review issue (July-August 2011), fully devoted to collaboration, comments (p.164) as follows, quoting Harvard Law School Professor Yochai Benkler²⁷ who has observed that, for generations, we have operated on the assumption that human beings are fundamentally selfish, and so we have built systems and organisations around monetary incentives, rewards, and punishments. This hasn't always worked very well.

Evidently now the tide is starting to turn in fields such as evolutionary biology, psychology, sociology, political science, and experimental economics, researchers are seeing evidence that human beings are more cooperative and behave far less selfishly than we have long assumed.

The success achieved by such collaborative offerings as Wikipedia, Craigslist, Facebook, and open source software has, in fact, a scientific basis. Dozens of field studies have identified highly successful cooperative systems which are often more stable than those based on incentives. Moreover, researchers have found neural and possibly genetic evidence of a human predisposition to cooperate. Evolution may actually favour people who collaborate and societies that embrace such individuals.^{27,38}

⁴² Encouragingly, 16% of the past 10 years of ARC funding (\$914m from a total of \$5,622m) has been allocated to the ARC Linkage Grants scheme; noting that ARC funding in 2011/12 is 8.6% (\$810m) of the total Federal Government's support for science, research and innovation (\$9,384m) in 2011/12. Correspondingly, Cooperative Research Centres' funding represents just 1.75% (\$165m) in 2011/12. Source; the Australian Government's 2011-2012 Science, Research and Innovation Budget Tables.

⁴³ Australian Academy of Technological Sciences and Engineering (ATSE): "Strengthening Links Between Industry and Public Sector Research Organisations", 17-18 May, 2011, Sydney.

⁴⁴ "Put out the cream and they will come", p 106, Garrett GG & Davies GJ (2010) Herding Cats: Being advice to aspiring academic and research leaders, Triarchy Press (UK).

⁴⁵ Ternouth P & Garner C "What works in business – university exchange", ATSE Focus August 2011, pp. 9-11.

Reinforcing this, Adler et al.⁴⁶ have emphasised the importance of creating an atmosphere of trust that knowledge work requires, together with coordinating mechanisms to make it scalable; and, importantly, to cultivate an ethic of contribution in which the highest value is accorded to people who look beyond their specific roles and advance the common purpose.³⁸

There is no need for wheel reinvention... There are, of course, a number of 'levers' we can, and should, pull to drive the innovation agenda but getting us 'holding hands' better is much needed.

This is not rocket science: as the great US strategic thinker and Nobel laureate, Herb Simon once said, paraphrased: "Innovation is about borrowing." There's no need for wheel reinventing, there are good approaches around.

For example, the UK's experience with "what works in business - university knowledge exchange" has recently been very well summarised by Philip Ternouth, Associate Director of the UK Centre for Industry and Higher Education (CIHE), and his CIHE colleague, Cathy Garner.⁴⁵

And there are, of course some great role models around (suitable for 'borrowing') where, as but one example, AMIRA International – the Australian Minerals Industry Research Association – comes to mind. Here, for quite some years, this independent association of minerals companies has effectively brokered and facilitated collaborative research projects – with the best researchers around the world – through to implementation.

Thus, cognisant of the pitfalls of "the only thing we learn from history is that we learn nothing from history"⁴⁷, we have our own (Australia, and Queensland) program experience to (re)evaluate (Appendix 1), as well as internationally (Appendix 2).

Innovation is about borrowing ...

K.I.S.S.... Research institution to business linkages are regularly frustrated - and some times defeated - by over-complicated governance arrangements and legal (IP) negotiations.

I recall an early conversation in Australia (circa 2001) with a project leader bemoaning the fact that he had just concluded a 2+ month negotiation resulting in a 30+ page legal contract for an assignment that took him 1/2 day to complete at an invoiced cost of \$900!⁴⁸

In this highly competitive world, speed and simplicity are often core to success.

One key is enhanced people mobility... Technology transfer is a contact sport (like rugby). And "technology travels on two legs."

As such, and as mentioned, there are - and see Appendices 1 and 2 - a number of schemes that have been, and are being tried.

Continuing to focus, appropriately resource, and incentivise the most effective of these programs will be central to doing better in collaboration, and therefore enhancing innovation, and in turn improving productivity.

⁴⁶ Paul Adler, Charles Heckscher and Laurence Prusak, "Building a collaborative enterprise", Harvard Business Review, July-August 2011, pp.95-101.

⁴⁷ Friedrich Hegel (1770-1831)

⁴⁸ A problem subsequently fixed through the introduction of a one-page template (model) contract, 'FastTrack' typically requiring 48 hour turn around for projects under \$25K.

Not all of such programs have been, or will be successful, as Paul Greenfield has well articulated.⁴⁹ We need to 'learn from history', not re-invent it.

What is key, however, is the singular importance for both 'sides' to get to know each other better, and build trust: "Trust is the air that relationships breathe" – and collaboration is all about relationships. And they take quality time to develop (as in life).

So, in the scientific and technological fields, having academics spend time in industry would seem highly desirable. And vice versa – as, for example, the new Queensland Government's 'Commercialisation Champions' seeks to catalyse. Students (particularly postgraduate students) should also perhaps not graduate without being required to address an industry problem as a case study, as evidently happens in Sweden.⁵⁰ And the State government could profitably provide a significant prize(s) for the best efforts, etc etc.

As we say elsewhere, it's not rocket science to fix this thing.

Encouragingly, colleagues in DEEDI are already advanced in preparing for Treasury a 'Partnering for Growth' initiative, aiming to "drive cultural change amongst Queensland business as well as research organisations and government, to embrace collaboration as a core business tool and strategy to solve business and sector issues, and to open up new market opportunities."⁵¹

On geography... Effective collaboration is, as we have emphasised, about relationships, and trust, where – despite our 'virtual world' – evidence (and experience) suggests 'eyeballing' remains very important. This in part underpins the motivation of 'precincts' development, and the so-called 'science parks'. Embedding businesses, particularly in incubation spaces, within research enclaves has some demonstrated success. Correspondingly, there is a good argument for building in more 'collaboration spaces' and 'design laboratories' into research environments.^{52,53}

Innovative experiments that address the challenge of 'translation' / knowledge exchange / technology transfer should also be encouraged. For example, the still-new round of 'clinical research fellowships', sponsored by the Queensland Office of Health and Medical Research (OHMR) evidently, is a first for Australia. These provide 'backfilling' clinical support to research-oriented clinicians to open up time for them to "do research in the morning and transfer it to the bedside or operating theatre in the afternoon". And it's working. Technology travels on two legs.

All business is people business... MIT Professor and innovation guru, Richard Lester, has written an important book around succeeding in the 'business' of innovation. He has observed, over many years, that wherever successful innovation happens you almost always can identify the key presence of what he calls 'cocktail party hostesses' - with lots of EQ as well as IQ - who "draw the critical actors together, encourage them to talk to one another, and introduce new members or new topics to the group when conversation lags."⁵⁴

A review I once made in CSIRO of 20+ years of successful innovations (as well as unsuccessful ones) led me to exactly the same observation.

⁴⁹ Greenfield P, "Explore, listen and persist for better research links", ATSE Focus August 2011, pp 12-14.

⁵⁰ Professor Chris Fell, personal communication.

⁵¹ Phil Green, DEEDI, personal communication.

⁵² Mark Dodgson, UQ Business School, personal communication.

⁵³ David Edwards, "The lab: creativity and culture", Harvard University Press (2011).

⁵⁴ Lester R & Piore J (2004) Innovation- The Missing Dimension, London: Harvard University Press.

By the way, while mostly 'individual', the above-mentioned AMIRA success over the long-term demonstrates that 'institutions' can also act in this 'hostess'-like capacity.

Knowledge exchange and technology transfer is a contact sport.

Relatedly, in this space, "in helping build mutual trust and shared understanding to seed collaboration between industry and research,⁵⁵ the 'trusted intermediary' approach spearheaded by, for example, Queensland's Australian Institute of Commercialisation - now a Division of QMI Solutions - has had some considerable success in facilitating good innovation-directed 'cocktail parties' ... a 'wheel' not requiring re-invention (or disposal).

'Greedy gobblers' (on absorptive capacity)... A final – and critical point: 'it takes two to tango'. Telstra Chair Catherine Livingstone notably lamented some time back: "If only Australia knew what Australia knows".

Not least in this regard, and inter alia, adversely feeding the 'cultural divide' (between research organisations and business) is the fact that "the focus of much of the commercial world is so short-term that mismatches with external research providers are inevitable."⁴⁹

Furthermore, some would say that industry-research collaboration – and indeed the corresponding capacity to innovate - is made more complicated by the structure of our business sector, specifically the relative high proportion of SMEs. However, we need to be cautious in stating that Queensland is really that different on firm size than many other state/regional/national economies. There are only 3,000 firms in Australia with more than 100 employees.⁵⁶

What is true, though, is that the 'branch office' perspective (to Queensland/Australia) of many multi-nationals doesn't help. We lack the R&D intensive, large-scale anchor companies (a la Nokia, for Finland) who can have stimulating effects.^{40, 52}

And in terms of the (Queensland) Government facilitating better collaboration through to innovation, one thought in this space⁵² is around the manifold opportunities to leverage the 'muscle' of government procurement expenditure – perhaps no major government contracts awarded unless there is internal research expenditure and research collaboration with universities?

But the bottom line...

Unless - and broadly across business, government(s) and the community - the 'absorptive capacity' is ready, willing and able to take up the fruits of the research sector's labour as 'greedy gobblers' of these research findings/technology solutions, a lot of good R&D dollars are headed down the drain as far as benefiting Australia is concerned.

So while the locus of this thinkpiece has been more around the 'supply side' (research end) of the knowledge exchange imperative, this fact – i.e. that 'greedy gobblers' are essential - will require more detailed attention (and possibly research) around demand-side incentives, and corresponding key success factors.

Such a study could also usefully include, for example examining how the Queensland Government might assist Queensland SMEs to improve their benefiting under the new

⁵⁵ ATSE Focus August 2011: Can small Australian companies work with universities?, Gilmore R, pp. 17.

⁵⁶ Robin Batterham, personal communication

Commonwealth R&D Tax Credit scheme, possibly in collaboration with universities and PFRAs: currently as noted at the beginning of this paper, only 0.6% of Queensland's 420,000 businesses are registered for this scheme.⁷

This overall point may be illustrated through a food metaphor.⁴⁰ Thus we need to recognise that restaurant customers can choose from a whole range of food outlets; and universities, though not always, are often 'Michelin starred' - and therefore are expensive, you have to dress up, it's often difficult to get a table, and it's like a degustation menu in terms of the time you need to allow!

So, shifting some resource into demand-side pull approaches - for example, the innovation vouchers approaches in the UK; or the Small Business Innovation Research, SBRI, program in the USA - to complement supply-side push (in essence, universities seeking out end users) can make a major, complementary difference here.

In Conclusion - Partner or Perish?... I'm a probably a broken record. This thinkpiece has its origins back nearly 30 years⁵⁷, and the experiences of all the years in between. It also builds upon a personal submission back in April 2008 to the above-mentioned national Innovation Review and a recent invited 'Op Ed' piece (in press) written for The Australian newspaper's Inaugural Australian Innovation Challenge.

The previously-mentioned (and valuable) ATSE Workshop⁴³ drew similar conclusions, the outputs from which are well-summarised in their pithy, one-page 'Communique' (Appendix 3).

And since the early part of this decade we (in CSIRO) began to preach "if the old mantra was 'publish or perish', the new mantra is 'partner or perish'." Regrettably, the old mantra still seems to dominate the agenda.

I hope I'm not flogging the proverbial dead horse. But I'm fearful our Innovation Racehorse might just be heading that way... and that our "Bricks-to-Brains" steed won't get past the finishing (starting?) post labeled "To-Business".

⁵⁷ Garrett GG, Inaugural Lecture: *Ideas on ID (Some Sacred Cows get a Glimpse of the Abattoir)*, University of Witwatersrand, Johannesburg, Witwatersrand University Press, 1982 – Profiling, and illustrating the importance of 'interdisciplinary dialogue', from pure and applied, science and engineering, academia and industry, and of future competitive advantage through boundary crossing and collaboration.

Recommendations

At the outset I indicated that this is a 'conversation piece'. Thus it aims to stimulate debate, possible focus for further work (e.g. on 'demand-side' drivers) and even, hopefully, garner Smart State Council support for some specific recommendations.

Three areas for possible action noted earlier, viz: (i) national funding changes to drive collaboration; (ii) rewards and incentives; and (iii) an overarching impact measure – each require Federal Government consideration and decision making. As such, they would seem largely beyond the mandate of the State Government - with the exception of the important leadership and influencing role through COAG =

Recommendation 1: The Queensland Government to lobby Federal Government to review – and amend – 'the rules of the game' around national funding allocation, and evaluation, to drive researcher-business collaboration harder.

The introduction of a relatively easy to use measure of 'impact' is required to balance 'against' the (still very important) research excellence metrics. Our complementary Smart State Council paper⁵⁸ describes such an approach, based on the UK's Impact Evaluation Framework (IEF). This can - and should - be run in Queensland as a country-leading pilot =

Recommendation 2: Pilot the introduction of an impact measure as part of the selection and evaluation of R&D projects using the current round of the Queensland Government's Smart Future Funds.

Equally, long experience has demonstrated that 'end users on board', from Day 1 (or preferably Day -1, in the pre-planning stage) in a project's life, both enhances the focus and substantially increases the chance of effective 'translation'. Thus - and particularly as there are manifold, albeit pretty competitive⁵⁹, opportunities for the research community to access 'untied' (to end user participation) funds, eg from the ARC and the NHMRC⁶⁰ - let's not spend a cent of Queensland Government money without end users being in the mix. (Presently, the words 'strongly encouraged' are used in certain Smart Futures Fund programs, eg Partnerships.) This is...

Recommendation 3: Engage and require end-users early in Queensland Government R&D funded projects.

In making this (strong) recommendation there are three riders:

(a) Firstly, I am referring to projects' funding. There will, of course, be the need to continue to support 'infrastructure' development opportunities leveraging Australian Government funding (like 'Super Science' and successors to NCRIS etc);

⁵⁸ Jamie Merrick: "Evaluating the economic impact of research and development – lessons from the UK", October 2011.

⁵⁹ ARC Discovery grant success rates are approximately 20%, for example.

⁶⁰ ARC plus NHMRC budgets for 2011/12 exceeds \$2 billion (\$2,157 million precisely).

(b) Secondly, in the full knowledge of the talent that has been assembled over the past decade of Smart State investment, albeit somewhat closer to the 'pure' science domain, it is essential to maintain this momentum since, as I have said in other forums, "You don't turn this sort of capacity on and off like a light switch." Happily, the considerable success of 'new' institutes, like UQ's IMB for example, are making them increasingly independent of Queensland Government funding⁶¹ but still requiring what we might call 'transition funding' over the medium term to ensure that we don't 'turn off' some very important, and productive 'lights'.

(c) Thirdly, we obviously need to be imaginative around the 'with business from day one' proposal. This has similarities to the current Rural R&D Councils' model, the performance of which has been very strong on adaptive and development research and industry uptake to support productivity at the industry level, but perhaps not quite as good where public and private benefit outcomes are intertwined. They are also good at maximising productivity gains inside 'established boxes' but perhaps somewhat less good at establishing 'new boxes'.^{62,63} We certainly need to make sure that an outcome of this Recommendation is not only to assist existing businesses but to support new businesses/future businesses as part of Queensland's innovation activity, through better linking with the university establishment.

Further to recommendation 3, let us not allocate any such Queensland government monies without meaningful contributions from significant industry players being part of the decision making processes =

Recommendation 4: embed industry and other end users in Queensland Government-funded R&D project prioritisation, selection and funding decisions.

A final couple of recommendations...

In the paragraphs above I have talked about the importance of not re-inventing wheels, and about innovation being about 'borrowing'. One of the current valuable programs requiring researcher-business interaction as a proverbial 'sine qua non' is the ARC's Linkage Scheme. Successful projects are intensively reviewed, and (relatively) well resourced⁶⁴. Why not play the leverage game, piggy backing on to this program and getting more bang for our (limited) buck? A reasonable component (20%? 30%?) of our project funds could be allocated to build on/beef up already allocated Linkage Grant funded projects - as long as (a) the "benefit to Queensland" test is passed, and passed well; and (b) only after interrogating the precise detail of their 'industry partner': it is probably not appropriate that government departments play this role (as is the case in some ARC Linkage contracts). Furthermore, while Queensland universities have done relatively well in securing Linkage Grants over the decade-long lifetime of this program,⁶⁵ we could usefully review how the Queensland Government might prioritise its support to maximize Queensland universities' success in this program.

⁶¹ The current annual budget for the Institute for Molecular Bioscience (IMB) includes a 14% contribution (\$10 million p.a.) from the Queensland Government (c.f. 30% in 2000/01). It currently employs close to 400 staff plus over 130 research students.

⁶² Productivity Commission review of Rural RDC's; and the National Rural R&D Investment Plan

⁶³ Beth Woods (DEEDI), personal communication.

⁶⁴ Queensland universities have been awarded a total of \$160.5 million in ARC linkage funding since 2001, 17.5% of the total awarded (\$914 million to date).

⁶⁵ Queensland universities have secured 726 ARC Linkage projects with a total value of \$160.5 million (17.5% of total) since 2001.

In this same vein, re-visiting our current commitment in Queensland to the Cooperative Research Centres (CRCs) would play to the same objective.⁶⁶ So...

Recommendation 5: leverage existing (national) selection processes geared towards promoting collaboration between research and industry, investing accordingly.

And finally, let's again ensure - for all the reasons noted in the preceding paragraphs - that our limited funds actively nurture and prioritise mobility... researchers into business, and vice versa. And at all levels - undergraduates, eg on final year project assignments as well as well-funded cadetships, together with early- (inc PhD), mid- and late-career researchers. This is...

Recommendation 6: review current talent support programs with a view to 'upping the ante' (in selection, and review) on mobility.

As previously indicated, this paper has focused around the challenges of researcher-to-business collaboration predominantly from the research end. As noted, it is critical to clearly understand our 'greedy gobblers' perspective.

Furthermore, business listens to business. Queensland's potential and existing entrepreneurs are far more likely to be enthused about the benefits of collaboration by their business colleagues than by governments or researchers...

Recommendation 7: develop, through a speedy process of consultation, a complementary paper that examines in depth demand-side or industry-pill incentives, for forging collaboration.

On implementation...

In his recent book⁶⁷ Tim Harford writes engagingly of the "randomisters": policy makers who undertake random trials of policy measures to explore their intended and unintended consequences. He argues that trial and error is a tremendously powerful process for solving problems in a complex world. We have to make mistakes and, rather than covering them up, learn from them.⁶⁸

As management guru, Tom Peters, has written, innovation requires us to "Do it, test it, fix it."

Let us therefore learn from past (and current) policy 'experiments', - local, national and international – in the 'enhancing collaboration' space (Appendices 1 and 2) and continue what science and most successful innovation is all about – experimentation.

⁶⁶ Currently (2011), 6 out of 42 CRCs (14%) are headquartered in Queensland. In 2003 this was 19 out of 80 (24%).

⁶⁷ Tim Harford, "Adapt: why success always starts with failure", Little, Brown (2011).

⁶⁸ Mark Dodgson, "Wicked ways to wisdom", The Australian, July 6 2011.

A Postscript

A couple of my favourite, and hopefully very relevant, quotes to finish – continuing as I started, in 'conversation' mode...

1. From the best selling book by Robert Fulghum – 'All I ever need to know I learnt in kindergarten':

As very young kids we are told by our teachers, on a visit to the chocolate factory or fire station, "Line up, hold hands and stick together – there's a lot of heavy traffic out there".

So too in the frenetic, fast-changing and intensely competitive world of business and innovation – there's a lot of heavy traffic out there, and holding hands (with key partners) is critical for survival, and our growth.

2. The Italian poet Luciano De Crescenzo once wrote: "We are all angels with one wing, and we can only fly by embracing one another."

Acknowledgements

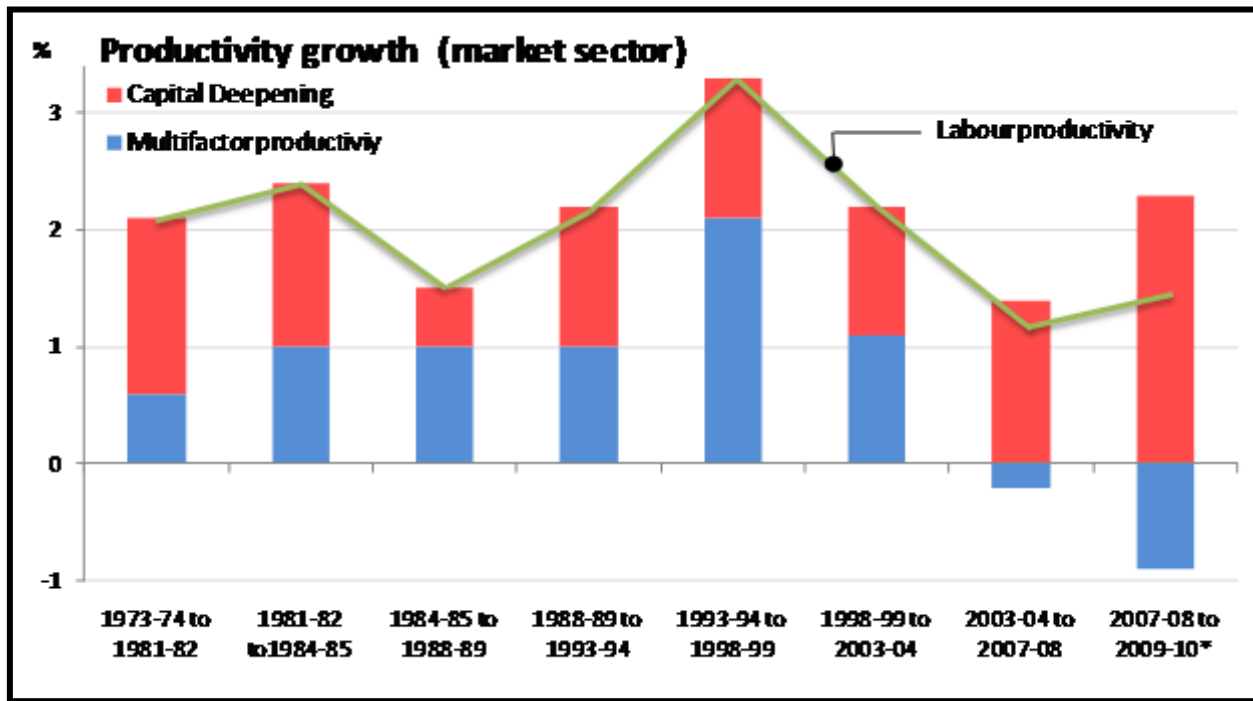
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Paul Greenfield (UQ), Mark Dodgson (UQ), Phil Greene, Jamie Merrick and Beth Woods (DEEDI), Robin Batterham (U Mlbn and ATSE) and Chris Fell (formerly DVC of UNSW), the author of a recent document for the May 2011 ATSE Collaboration Workshop, probably the best review I have seen in recent times on this topic, the appendix of which is reproduced here, with permission, as Appendix 2.

I also have much appreciated the terrific support and assistance of both Milena Gongora and Sebastian Dimech in the preparation of this paper.

Figures

Figure 1: Australia's productivity growth in the market sector (1973/74 – 2009/10)⁶⁹



⁶⁹ ABS, Treasury.

Figure 2a: Collaboration by innovation-active businesses within Australia, by type of organization collaborated (2008/09)².

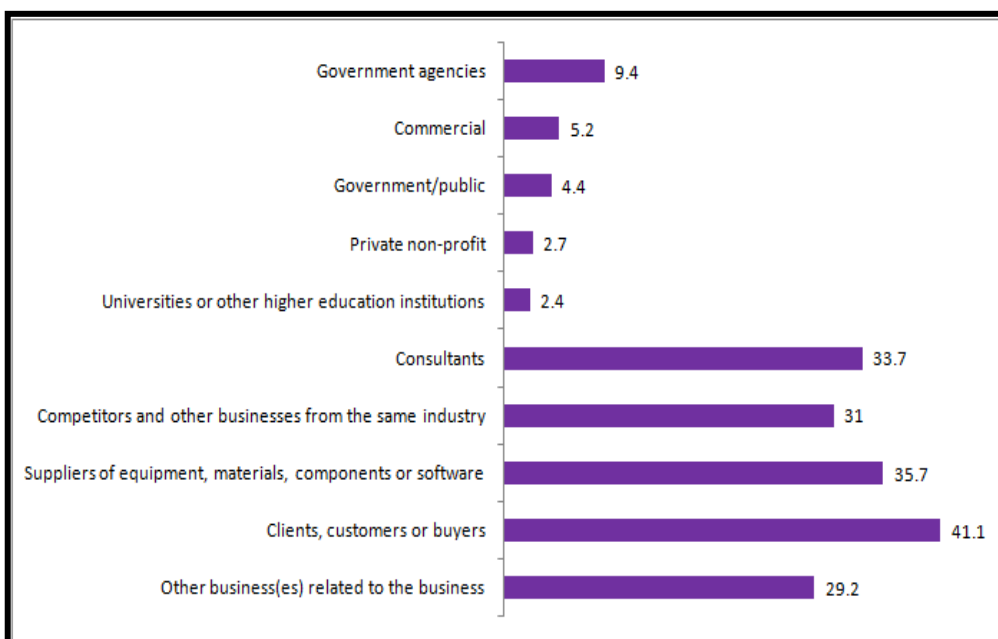
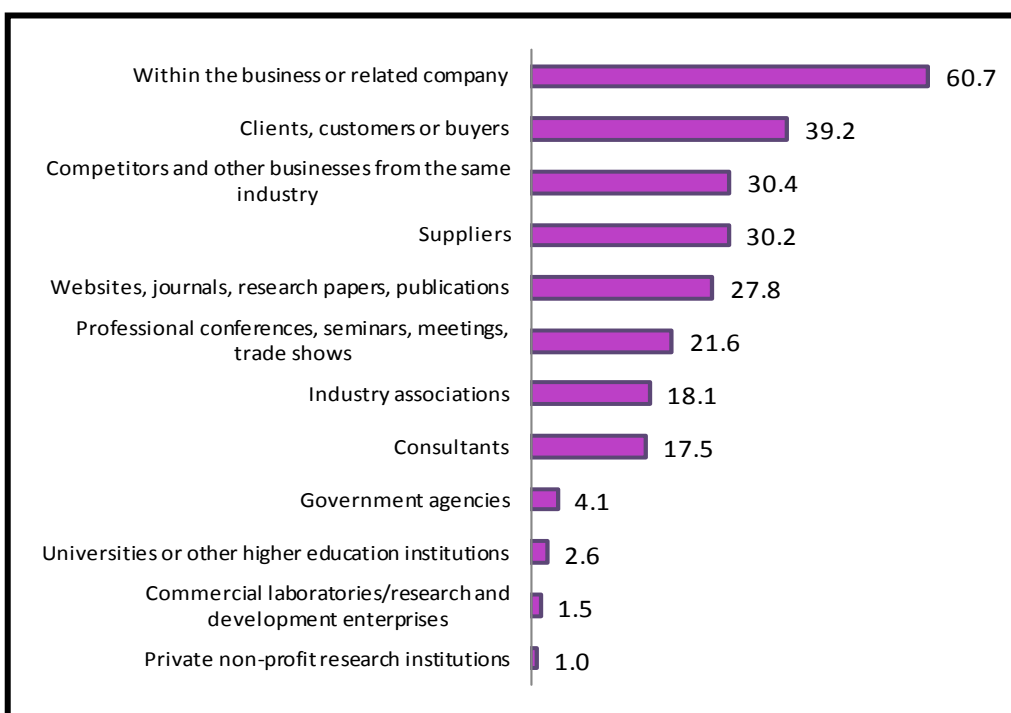
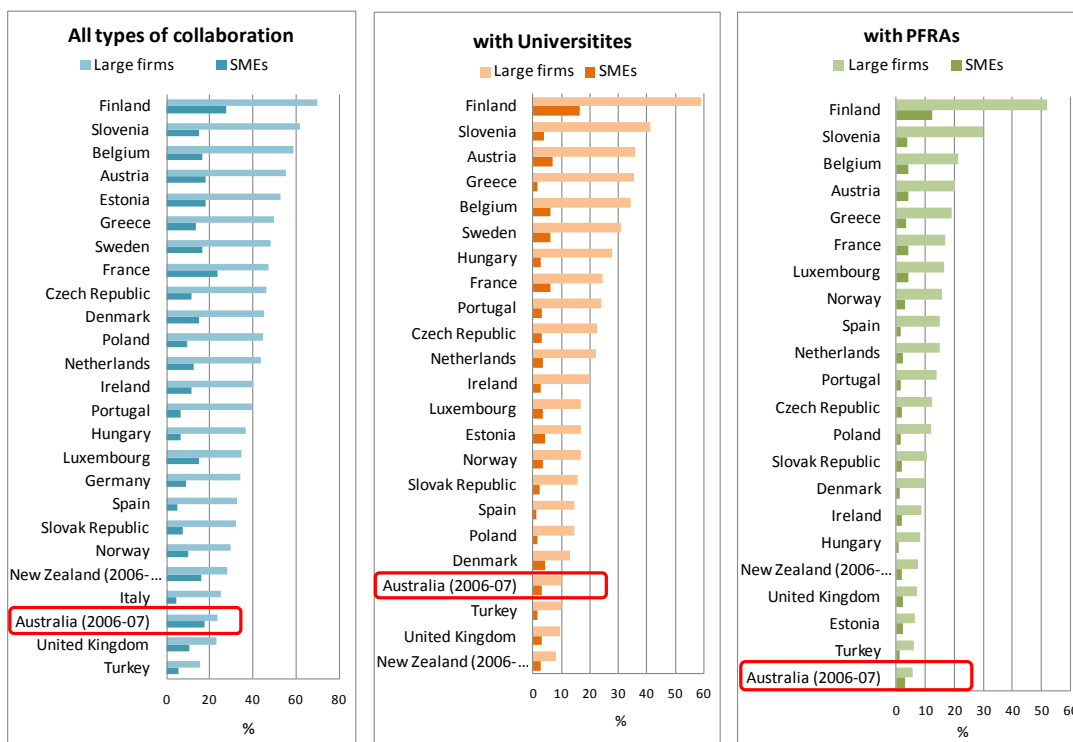


Figure 2b: Sources of ideas or information for innovation for innovation-active Australian firms (2008/09)⁷⁰.



⁷⁰ ABS (2010) *Innovation in Australian Business 2008-09*.

Figure 2c: Firms collaborating on innovation by size & sector (Australia data 2006-07, all others 2004-2006)⁷¹.



⁷¹ OECD Science, Technology and Industry Scoreboard (2009)