

Not waving, but drowning

The Pearcey Oration, 11 September 2008

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Today we gather to honour and recognise distinguished Australians for their contributions to the information and communications industry. I congratulate the recipients of this year's Pearcey Medal and other awards, and commend the Pearcey Foundation for its work in promoting the wider recognition of information and communications technology within Australian industry and society.

As an Australian community, what do we value? In 2003 a Centenary Medal was issued to commemorate the anniversary of our Commonwealth. It is instructive to scan the citations for the 15, 916 Australians recognised with this medal. The medal tally is as follows:

Innovation	4 or 0.03%
ICT	23 or 0.1%
Medical technology and biotechnology	23 or 0.1%
Sport	769 or 4.8%
Trade	68 or 0.4%
Exports	4 or 0.03%
Industry	421 or 2.7%

When it comes to recognition through the Order of Australia, we value sport 54 times more highly than innovation, and 144 times more highly than information and communications technology.

So it is clear why we need organisations like the Pearcey Foundation "to promote and encourage Australian ICT achievement" and "to promote the industry and its role and positive contribution to the whole of the Australian economy". In 1948 Trevor Pearcey designed Australia's first computer, and one of the first computers in the world. He did this the year I was born, and he helped shape the world in which I have worked and lived. It is also appropriate to recognise, as a member of the Board of CSIRO, that Trevor Pearcey was a CSIRO scientist, reminding us of the important role that CSIRO has played, and continues to play, in Australia's industrial development. Today, fortunately, CSIRO continues to be an Australian icon and an institution highly trusted by Australians. Outside the ICT industry, however, few people remember the work of people like Trevor Pearcey. Unlike Donald Bradman, Trevor Pearcey was not part of the citizenship quiz devised by John Howard's government.

Trevor Pearcey and the Foundation's medallists remind us that innovation and advances in technology and industry are fuelled by talented and creative individuals. Creativity, in science, industry, or the arts, is the ability to envision alternative futures and new possibilities for our society. Science, technology and the

arts all provide us with “windows into realities under construction”¹. Trevor Pearcey was not only a member of small global elite who created the foundations of today’s digital era but he was also one of the rarer cadre of people who were driven to such achievement through a bold vision of how technology could transform society. In 1948 he wrote:

"It is not inconceivable that an automatic encyclopaedic service, operated through the national teleprinter or telephone system, will one day exist"

In this he was on the same wave length as Vannevar Bush, the architect of post war science policy in the US, who a couple of years earlier had anticipated a Memex machine, or memory extender, which now looks uncannily like the search engine Google². This other Bush said, in 1945, *“in the application of science to the needs and desires of man, it would seem to be a singularly unfortunate stage at which to terminate the process, or to lose hope as to the outcome”*. Today we might comment that it would be a singularly unfortunate moment to ignore the crucial role of information and communications technology as one of the key drivers of innovation and productivity.

This week the Government released the report of the Review of the National Innovation System which I was privileged to chair. Tonight provides me with an opportunity to share a few of the insights I draw from an intensive six months of engagement with thoughtful people across Australia.

The first thing we need to do is to actually make innovation a priority. It is unfortunate that innovation has become such a woolly and overused word. We spray the word around, but seldom step back and ask ourselves what innovating and being innovative really means, and what sort of culture and behaviours it calls for. Put simply, innovation determines whether our firms and industries stay competitive and productive. It is, and must be, a national priority because the competitiveness and productivity of our firms determine, in aggregate, our national prosperity, the quality of our jobs, and the amenities we enjoy as a community.

Reviewing our recent innovation performance does not inspire confidence in Australia’s future. Over the past few days I have been rehearsing our innovation scorecard many times. In starting to construct such a scorecard it is important that we look both at innovation output and outcomes, as well as inputs and the level of investment in supporting innovative capability. On both sides of the ledger we are not doing well. In fact, we are doing very poorly. As a share of GDP we are investing less in education, talent development, and R&D than we were more than a decade ago. Meanwhile the global goal posts keep shifting, and the global hurdle rate for competitiveness keeps rising.

Here is the summary version of my personal innovation scorecard for Australia:

Productivity growth. After strong performance in the 1990s, productivity growth has now stalled. Even in the 1990s, the sources of productivity were highly concentrated (1992-2004) in agriculture, wholesale trade,

¹ I owe this wonderful phrase to Peter Sellars, the controversial Director of the Adelaide Festival in 2002.

² Vannevar Bush, “As we may think”, *Atlantic Monthly*, July 1945

communications and finance³. (It is important to note that most of the productivity growth in services has been fuelled by ICT deployments). Multifactor productivity growth has stalled since 2003.

The number of innovating firms. ABS surveys tell us that only a third of Australian firms invest in innovation and R&D. But only 7.7% of these innovating firms are pursuing 'new to world' innovation. Australia ranks poorly for 'capacity for innovation' in surveys by the World Economic Forum, and worse in the World Bank's assessment of the 'value chain breadth' of Australia's firm base.

Of the 8 Australian firms in the Fortune 500, only one is a truly global enterprise (BHP Billiton).

Only 90 of our top exporters by value have a trade intensity greater than 10%, and *only* 49 have a trade intensity greater than 50%. (Trade intensity is exports to turnover).

No Australian firm features in *Business Week's* annual global survey of the top 50 innovative firms; but two Indian firms scored this year (Tata, and Reliance).

Our terms of trade in knowledge are negative. In 2007 Australia had an intellectual property trade deficit of \$2.5b, and rising. We are innovation and IP price takers, because the cruel fact of life is that 98% of new knowledge and innovation is developed elsewhere in the world. We need trade and IP policies that address this brutal reality. We are a 2% economy, and need global strategies that recognise this challenge.

Next we need to turn to the absorptive capacity of our firms. That is, their ability to take up new technology and innovation and apply it innovatively. Australian firms invest heavily in ICT. But I was shocked to see Australia rank 24th out of 28 OECD countries on the measure of firms with own website.

We have a declining number of researchers and technically literate people as a proportion of our workforce

Australia ranks OECD last for employer investment in vocational education and training

Business expenditure as a percentage of GDP is half the OECD average. Government support for science and innovation has fallen from 0.76% of GDP in 1993/4 to 0.58% in 2007.

Surveys of companies investing in R&D show that the most attractive foreign R&D locations are now non-OECD countries, and Australia is scarcely on the radar.

³ A. Hughes and V. Grinevich, (2007). *The Contribution of Services and Other Sectors to Australian Productivity Growth 1980-2004*, Australian Business Foundation and Centre for Business Research Cambridge, UK, 2007.

Australia ranks last among OECD countries for firms with cross-border collaboration in innovation.

I find this a depressing scorecard, and one that should serve as a wake up call.

The Pearcey Foundation prepared one of the 740 submissions to the Review of the Australian Innovation System. A number of the other ICT submissions also provide thought leadership. It is invidious to single out specific submissions, but several provide a platform to open up some general observations.

First, the Pearcey Foundation submission proposes the establishment of an ICT economic studies institute. This underpins the general observation we make in the Report that we do not have enough of an evidence base about innovation on the ground, especially compared to other countries like the US and UK. We need to invest in survey and industry data about our innovation performance, and track trends over time.

NICTA provided a important overview of the industry and the challenges - it is a very good read - and spelled out how a research agenda around platform applications and horizontal specialisations is not a 'second best' approach but, rather, one where leading edge breakthroughs can be secured.

Google Australia made strong representations about the need to preserve an 'open Internet', and highlighted the extent to which local applications from Australia fed into Google's global offerings.

IBM, and IBM's Nic Donofrio (Executive Vice President of Innovation and Technology) who assisted as an international adviser to the Review, stressed the need to focus on services science and the importance of open innovation models, especially in a small country like Australia.

Mark Dodgson from the University of Queensland was a special adviser to the Panel, and he and his colleagues highlighted the importance of a new class of *innovation technologies* - data mining, rapid prototyping, simulation, design - which all depend on ICT and advanced skills in their use.

Finally, the Centre of Excellence for the Creative Industries and Innovation, hubbed out of QUT, highlights the importance of the creative industries within innovation systems. This Centre is providing thought leadership around information policy and the need to rethink legal frameworks around innovation processes. The law, technology, and national policies are inextricably enmeshed. Our Report notes that we need to see intellectual property as an economic rather than a legal matter.

One important observation from the Review and the analysis of the 740 submissions is just how many of them raise issues bearing on ICT and a digital agenda. In the work on systems theory, which spills over to the discussion of innovation systems, analysts talk about points of *systemic* failure, as somewhat super ordinate to the more familiar recourse to market failure as the rationale for government intervention. It is worth taking some of the commonly identified potential points of system failure and examining what submissions had to say about them. This overview is indicative, not exhaustive.

The first area is the adequacy or otherwise of infrastructure. Submissions raised issues such as:

- Lack of world competitive broadband (this was widely seen as a threshold issue)
- Inadequate funding of national facilities (including high performance computing)
- Neglect of national collections, and their digitisation
- Underfunding of research infrastructure
- No statutory requirement for the legal deposit for digital publications
- Policy neglect and underfunding of metrology and standards functions
- Slow development of eScience and eResearch platforms

A second area of potential system failure is industry and firm 'lock in' to established modes of production. Professor Keith Smith, an adviser to the Review explained:

there is considerable evidence to suggest that even relatively minor shifts [in technology] can provide serious problems for firms who have no background in the new technology. This is particularly a problem for small economies which possess relatively small numbers of players in many sectors; relatively minor discontinuous shifts can provoke major changes in the industrial structure.

Submissions and consultations identified examples such as:

- Australian manufacturing (exemplified in the parallel automotive and textile reviews)
- Australia's dependence on coal fired energy
- Incompatible information systems
- Proprietary standards and IP lock-up
- Weakening firm technical skill base
- Global "innovation gravity" - and Australia's 2% handicap

The flipside here is the role for government around emerging market or technology areas. As other international advisers, Professors Alan Hughes and Stan Metcalfe commented:

As it cannot be presumed that the prevailing distribution of private resources to innovate (based on past successful innovation) will correlate at all closely with emergent innovation opportunities (future successful innovation), the role of new firms in the innovation process in emergent technologies and the difficulties they face is well known in this regard. In these circumstances innovation policy will be required to identify and address key factors which are limiting the ability of actors in the system to respond effectively.⁴ (emphasis added)

Here there is probably a strong case for incentivising early innovators - as argued by Ross Garnaut in the case of climate change responses - rather than promoting the less risky strategy of being a global follower. Here, even if a firm fails in emerging markets, there are the public benefit spillovers of new capability and expertise created.

⁴ Alan Hughes and Stan Metcalfe, *Market systems failure - a technical note*, 23 July 2008

A third area of systemic failure is inadequate institutional development and evolution. There is where institutions, and especially legal frameworks and regulatory agencies, get out of kilter with market developments. The classic example is the mismatch between media regulation and the Internet in the 1990s. But submission also highlighted the inadequate skills for and awareness of, in many institutions, emerging IP policy issues and the demands of next generation cyberlaw. Australia also lags the rest of the world in developing policies for open access to public sector information.

A final area to mention, for now at least, is where there are inadequate linkages and information flows within the innovation system. This is the problem of systemic blockages and missed connections. In general, government programmes and initiatives will focus on formal, contractual collaborations at the expense of informal, trust-based relationships. We tend to neglect the role of social networking in innovation systems. Another point of blockage is the way we tend to create data and information silos (too often in incompatible formats and not interoperable or exchangeable) as a consequence of the walls we build around disciplinary, sectoral and bureaucratic specialisations. The digital environment provides the means to break down these barriers if we have the will.

The Review Panel's Report argues strongly for increased attention to better information flows. In support of this we argue the case for a National Information Policy because flows of information, our ability to access and use information, go to the heart of the innovation challenge. Information flows are the nerve system of innovation, especially in an era when models of 'open innovation' are being adopted in more and more areas of business.

Open innovation models recognise that one person's trash is another person's treasure. There is, however, an inbuilt asymmetry between the owners or custodians of information, and potential users in terms of the *uses* of information and the *value* of those uses. We need better search and discovery tools, and informed intermediaries to help make the connections.

The National Science Foundation in the US speaks of cyberinfrastructure as a new *fifth dimension* and shared space. In thinking about emerging information and collaboration infrastructures, it strikes me that many of the access issues we are debating around digital information have already been addressed in other domains, especially around open access to physical infrastructure. In my view there are clearly lessons to be learned from the principles established for access to, and the interconnection of, deregulated telecommunications networks and other forms of networked infrastructure⁵.

Access regulation for telecommunications networks is based on two major premises:

1. The utility and benefits of networks are promoted by 'any to any' connectivity (inter-operability); and
2. Dominant players should not be able to create 'bottlenecks' to access.

⁵ I was personally involved in the early debates on these issues during the liberalisation of telecommunications markets in Australia and Asia in the early 1990s. Much of the clarity and sharpness of the principles then established has been eroded over time.

A number of access principles⁶ follow from these premises and include the propositions that:

- arrangements should promote efficiency;
- there should be reciprocity in rights and obligations;
- the economics of arrangements should be clear and unbundled, promoting:
 - the desired level of investment in infrastructure (without wasteful duplication)
 - the lowest possible transaction costs;
- obstacles to users accessing services should be minimized; and
- redundancy should be supported.

Network 'interconnection and access' principles are clearly applicable to information infrastructures and content networks. **Content is the new access bottleneck.** The access challenge escalates as functional interdependencies increase massively in a digital environment. As a principle, networked information flows should aim to support 'any to any' connectivity. This seems especially apposite in the case of public sector information.

Bob Bishop, a great Australian expatriate and a member of the Pearcey Hall of Fame, talks about today's innovation challenge in ways that Pearcey would thoroughly approve of. Bob Bishop notes that computer and simulation based R&D gives us:

a tool to accelerate innovation;
a technology to invent technology; and
tools for rapid exploration and discovery

These provide keys to the formation of a knowledge society. Pearcey's vision of an "*automatic encyclopaedic service*" is today's cyberinfrastructure. As another colleague, John Wilbanks the CEO of Science Commons in the US, puts it, industry competition today is about exploiting *shared* information better than others.

As a country we can no longer afford to lead relaxed lives where success is "the survival of the least uncompetitive". In a globalised and networked world our remoteness and smallness no longer provides a *de facto* protectionist shield for uncompetitive firms and industries. Without advanced network infrastructure, without broadly based capabilities and skills in ICT, we will continue to go backwards in the innovation stakes. The one point, the one phrase, I hope might all remember from my comments tonight is that **information and communication technology is innovation technology**. We need a coalition of the willing to make sure everyone understands this.

A venturesome Australia needs a venturesome ICT industry - enterprising, bold, and brave enough to mix it with the best. We need to follow in the footsteps of Trevor Pearcey and the Pearcey medallists.

⁶ Austel, *Study of Arrangements and Charges for Interconnection and Equal Access*, Melbourne, 1991