

# Australasian Science

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## Australia's Extinction Mysteries

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## Opportunities in the Information & Communications Technology Revolution

**BRIAN ANDERSON** says that Australia's ICT industries must grow.

In 1935 Australia's first international telephone link was opened. It was to the UK and 3 minutes of talk cost about £6, which was about a week's earnings.

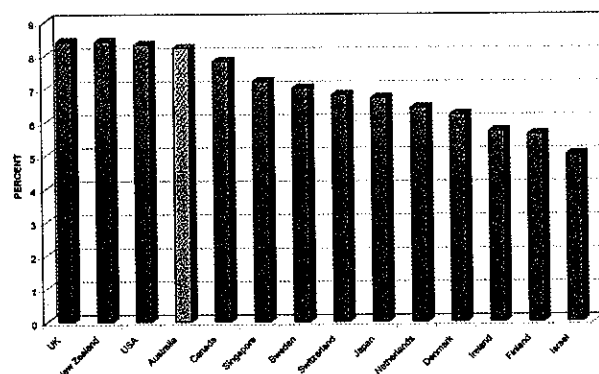
In 1945 the chairman of IBM made a forecast about the world market for computers. He predicted there might be a need for four or five computers. What revolutionary times we are living in a few decades later!

These days, information and communication technologies (ICT) are embedded in ever more products. It is possible to access the entire timetable of the Star Alliance airline group on a Palm computer, call a 1800 number and book a seat between Frankfurt and Paris, and step off that plane in Paris and immediately make a call on your mobile phone.

Those who are unimaginative might think that we have seen most of what is to come. Of course, one can envisage that computers will get faster and have more memory, but is there anything beyond faster and bigger? We can look forward to Internet access almost anywhere in the world with a wireless connection. We can look forward to natural language processing by computers, something that will truly automate directory assistance or interaction with the Australian Tax Office.

We can look forward to inspecting a new house we might want to buy in three dimensions. We can probably look forward to lawyers pleading a case in property law in front of a computer rather than a judge – a computer that has moved beyond the storage or handling of data or even information, and not only has a knowledge base in it but indeed has developed some wisdom.

Fig. 1. ICT spending as a percentage of GDP (1997).



### An Infant Industry

The fact that over the past year there has been a re-appraisal of the money to be made from high-tech stocks, especially ICT stocks, serves in no way to contradict the rich landscape of opportunities lying before us. The information industry itself is in its infancy. Australia has not missed the bus; fleets are yet to arrive. Can we catch them? Can we dare to seek to drive at least some of them?

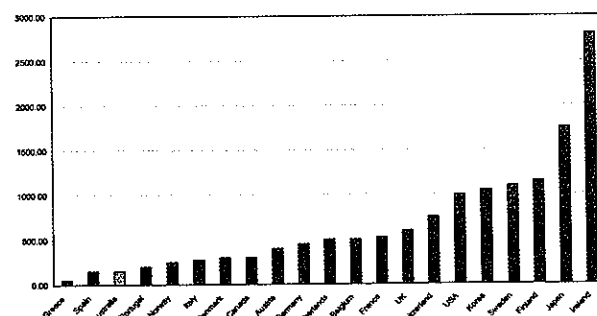
An honest self-appraisal is part of answering these questions, and the following statistics show how Australia is doing. The most positive shows Australian use of ICT products (Fig. 1). By world standards we are a leading user in terms of quantity measures. What I am less clear about is the extent to which this use derives from the consumption of video recorders, digital video discs and mobile phones compared with use for productive purposes, such as robots to build cars more cheaply or software to take some of the pain out of the GST for small businesses.

The picture is much less attractive if we move away from use to ICT production (Fig. 2). Here we were just edged out in the OECD league table by Portugal, approximately equal with Spain and only ahead of Greece, the lowest producer. Our telecommunications patents over a 5-year period increased by 5% but, on the other hand, in that same period US patenting increased by 61%.

### A Shocking Trend

If we look at the strength of our ICT scientific R&D base, the first problem is to find adequate indicators. There are at best

Fig. 2. ICT production per capita (1997).



surrogates. One of them is called citation intensity (Fig. 3), which measures how much Australia's published work is considered relevant by the rest of the world. In the computer science area, Australia's intellectual endeavour is rated as having 28% less relevance than the world average. There is no other area of science and technology in Australia that is as poorly rated by this measurement.

What about our imports and exports? The knowledge intensity of world-manufactured exports has been growing for about 25 years. High-tech exports have been growing faster than low- and medium-tech exports. In 1997 the ICT share of Australia's exports was 5% and the ICT share of our imports was 13%. In the OECD league, the ratio put us 24th out of 28 nations. Several years later there has been a large fall in exports and a big rise in imports because our ICT industry has been weakening.

Do we really have a problem? After all, we have had some fine figures for GDP growth, no doubt reflecting the benefit of competition policy, deregulation of electric power, interest rates, telecommunications, aspects of the labour market, microeconomic reform, tariff reform and the like. But if we were to express our national balance sheet in US dollars, the trend looks shocking.

If we were to correct it by our trade-weighted exchange rate rather than the US dollar exchange rate we would not see a pretty picture. Australia Inc is a stock that has been marked down because our future prospects look so unexciting to the rest of the world.

In my work as a Director of Cochlear Limited I visit a number of countries, and in more than one I have heard the comment: "Isn't it surprising that Australia can produce a product as sophisticated as a cochlear implant". That sums up the world's view of Australia, in the same way that our exchange rate does – a technological backwater and thus a future economic backwater.

## Prizes Beckon

Is there a prize for Australia for doing ICT better, or for doing more of it? Yes, there are a number of prizes.

- ICT is a tool to enable us to differentiate our low technology and medium technology products from those of our competitors. We might be able to produce iron ore of more uniform particle size than our competitors if we used ICT.
- We would be able to export more high-tech products, both pure ICT ones and those containing significant ICT. World trade in high-tech goods has been growing 50% faster than trade generally.
- We would be able to make more intelligent purchases of ICT products from abroad. Not only would we be taken advantage of less often, but we could also exploit the opportunities that ICT offers to improve industries in Australia much more effectively.

- We would certainly create jobs; many with high intellectual content and low adverse environmental impact, and the world might start to think of the Australian dollar as an attractive growth stock.

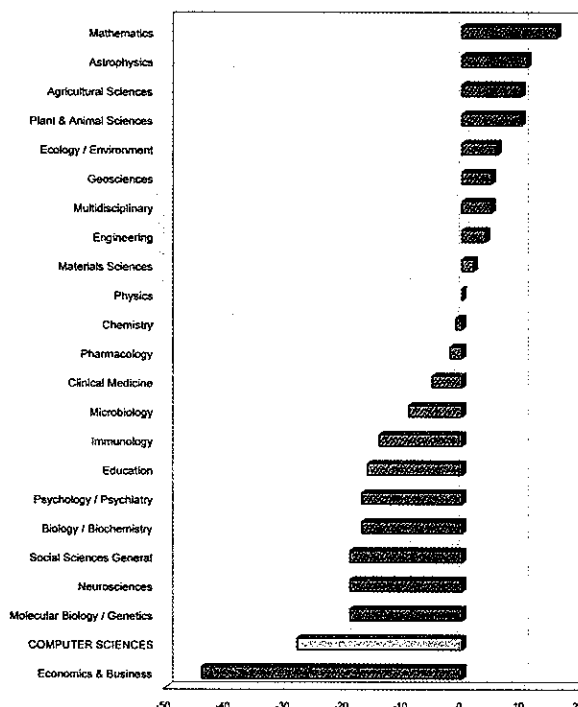
The prize affects all industries, especially high-tech ones. About 8% of the US economic output in the year 2000 was due to ICT, but one-third of the real growth between 1995 and 1999 came from ICT, much of it from ICT production and the rest from use. In The Netherlands, ICT is about 4% of economic output, but 17% of the growth over the 1996–98 period was attributable to ICT.

## Impediments to Clear

If there is a prize to be gained, what are the impediments that we need to clear away in order to gain that prize? We have had unfriendly taxation structures, aversion to risk-taking, shortage of venture capital, a UK-inherited culture sustaining a gulf between much of the R&D community and industry, a low level of technological literacy in Parliament and sometimes company managements, and certainly a lack of will, skills and incentives to commercialise on the side of our public sector institutions.

Governments of both political persuasions started some years ago to address these problems, and the commitment by the Coalition government in January of \$2.9 billion to "Backing Australia's Ability" is quite properly focused on the goals of wealth generation or other improvements in our lives through innovation.

Fig. 3. Impact relative to the world (%).



# Science Careers



**Brian Anderson says that the world's view of Australia is as a technological backwater and thus a future economic backwater.**

But in the ICT area there are some particular aspects of the situation that have to be flagged. First, there is the industrial structure. With the exception of Telstra and perhaps News Ltd, we have no really large players in the ICT area that are Australian-owned. The problem with the non-Australian-owned multinationals operating in Australia is that all too frequently they just see Australia as a sales target. We have many indigenous small players and very few medium ones. What the small enterprises desperately need is help to go global or even to be born global. They also need access to infrastructure such as supercomputers and microelectronic design facilities.

What about the impediments on the public sector side, the sector responsible for education, basic research, and that we hope will produce some ideas for commercialisation? The first issue is one of balance. Approximately one-third of R&D workers in industry are working on ICT. On the other side, the government is spending only 5.5% of its R&D budget on ICT. It is spending no more on all the Cooperative Research Centres per annum than it is spending in grants to firms in the textile, clothing and footwear areas for new plants and buildings, R&D etc. Figures now a few years old show CSIRO was spending more on textiles, clothing and footwear than ICT.

Next, there is the issue of the quality and resourcing of universities, especially in the computer science area. I have already indicated that, according to one quality measure, computer science is the weakest area of science in Australia. You might think that universities should go out and hire some high performers. But where is the money?

## **Teaching Computer Science on the Cheap**

The price for the universities' principal product – a trained Australian student – is not theirs to set. Instead it is set by

the Commonwealth Department of Education, Training and Youth Affairs (DETYA). Economists call this a "monopsony" and they are about as keen on monopsonies as they are on monopolies. Not surprisingly, the monopsony power has led to a situation where staff members are leaving computer science departments in droves, and the departments cannot replace them.

The problem is accentuated by the quaint view of DETYA that it should be cheaper to teach computer science than electrical engineering or chemistry, so the official price paid per student is lower. Not surprisingly, universities are not keen on taking more Australian computer science students, despite everything you read in the newspapers about there being a shortage of trained individuals.

The public sector's greatest problem is its inability to supply the human capital that the private sector so desperately needs. Even worse, not only is there a quantity problem, reinforced by DETYA policies, but there is a quality problem among the trainers. This is why the decision by the government in January to fund a world-class ICT centre, outside the funding parameters of DETYA, has been so welcome.

There is no single initiative more important in the public sector than this. Such a centre will need to create much human capital, and in particular train many trainers, and it will necessarily have to be staffed to a significant degree by people imported to this country. It is simply not practical to imagine that one could assemble such a centre from existing talent in Australia and create a world-class enterprise in the process.

Australia must find a new path to ensure the GDP statistics continue to look great, a path that ensures they will look still good when denominated in US dollars or euros. Intelligent use of ICT across our society will be critical, but at the moment the amount of ICT intelligence we have is too small. ICT production itself can play a major role in securing growth, but we need to focus on growing our own Australian-domiciled companies rather than hoping for favourable boardroom decisions taken in Tokyo or Silicon Valley. Such domestic ICT production has the potential to underpin trade growth, as mineral prices and Australia's terms of trade fall off the bottom of the graph.

As we move towards an election I hope there can be bipartisan acknowledgment of the problem and measures taken to address it, for many of the measures are ones for governments to take. With World Trade Organisation-friendly industrial support, and with policy and financial repair of our over-stressed education system acknowledging the priority status of ICT, all Australians can share in the winnings.

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Brian Anderson is President of the Australian Academy of Science and Director of the Research School of Information Sciences and Engineering at the Australian National University. This is an edited version of his Telstra Address to the National Press Club on 25 July 2001.