

Asleep at the Wheel - "New" Economy in Australia

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*"Information economy? I didn't know we had one!"
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1. DEFINITION OF INFORMATION ECONOMY:

"What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention, and a need to allocate that attention efficiently among the overabundance of information sources that might consume it."

- Nobel laureate economist Herbert Simon, Scientific American, Sept. 1995.

An Information Economy is a "collection of businesses offering products whose major input is labour, are electronically deliverable, perfectly reproducible, and not consumed through use". ([The Journal of the Information Economy, unknown](#)) It places a premium on information and its presentation, repackaging and delivery ([Geiselhart, 2000](#)). In general terms, it is the global economy that has emerged from the relatively newly acquired ability to access and transfer information from anywhere to anywhere at any time. In reality it goes far beyond a simple economic state to encapsulate all aspects of everyday life in the year 2000-from government to big business to the home ([South Australia's Department of Information Economy, 2000](#)).

ICT Sector (Manufacturing and Services) + Content Industry (Manufacturing and Services) = Information Economy or Information industry ([Fenga et al, 1998](#)). Information economy is often interpreted in a narrow sense, describing the stocks and flows of information within an economy. It is often used in the same sentence as superhighway, national information infrastructure, or global information infrastructure. A broader definition incorporates the notions of information institutions, organisational capital and human capital. Information handling competencies, administrative, political and legal structures, education and training institutions and research and development facilities are all issues that need to be addressed in an assessment of the knowledge economy ([Simpson, 1997](#)).

When we talk about the new economy, we're talking about:

- a world in which people work with their brains instead of their hands.
- a world in which communications technology creates global markets.
- a world in which innovation is more important than mass production.
- a world in which investment buys new concepts or the means to create them, rather than new machines.
- a world in which rapid change is a constant.
- a world at least as different from what came before it as the industrial age was from its agricultural predecessor.
- a world so different its emergence can only be described as a revolution

However, to say simply that the new economy is about the unprecedented power of global markets to innovate, to create new wealth, and to distribute it more fairly is to miss the most interesting part of the story. Markets themselves are changing profoundly: information is easier to produce and harder to control than material stuff. For a start, computers can copy it and ship it anywhere, almost instantly and at a progressively cheaper price. Production and distribution, the basis of industrial power, can increasingly be taken for granted. Innovation and marketing are everything. So an information economy is more open - it doesn't take a production line to compete, just a good idea. Nevertheless, it is also more competitive. Information is easy not just to duplicate, but to replicate. Successful firms have to keep innovating to keep ahead of competitors. The average size of companies shrinks. New products emerge in months rather than years, and market power is increasingly based on making sense of an overabundance of ideas rather than rationing scarce material goods. Each added connection to a network's pool of knowledge multiplies the

value of the whole. The result: new rules of competition, new sorts of organization, new challenges for management. What's true is that the shift to an information economy is redefining how we need to think about both good times and bad. We don't know how to measure this new economy, because the productivity of a decision-maker is harder to grasp than the productivity of someone shearing sheep. We don't know how to manage its companies, because decision-makers can't be told what to do. We don't know how to compete in it, because information seeps so easily that supermarkets now offer ATM banking services and Amazon.com has infiltrated its virtual bookshelves into Web sites the world over. We don't know how to oversee it, or whether it ultimately needs oversight at all. We don't know if it is desirable. A final thing we don't know is where - or how - the revolution will end. We are building it together, all of us, "by the sum of our collective choices". ([Browning & Reiss, 2000](#)) The Australian writer Nieuwenhuizen would rather say "lack of choices" ([Nieuwenhuizen, 2000](#)). He presents Australia's rush to become "wired" as precipitous and likely to result in our being locked into out-dated, inappropriate technology.

2. WHAT ARE THE COMPONENTS OF AN INFORMATION ECONOMY?

- research and development (whereby knowledge is created)
- flexible manufacturing automation (whereby knowledge is implanted in machines, thus reducing the need for unskilled workers)
- higher education (whereby knowledge is transplanted in minds)

3. AUSTRALIA'S SITUATION

When I started writing this report a few weeks ago, the material on "information economy" in Australia available online through both Australian and USA search engines was predominantly government publications. Governments are highly wary of criticising their performance, more so in democratic settings. So it was natural to find that between 1995 and today, the Australian Government produced report after report, and created endless committees and organisations (the worst offender being the National Office for the Information Economy [www.noie.gov.au], with which to soap everybody's eyes and pretend they were doing something about it (and IT). For the latest examples, see ([PMSEIC, 2000](#) and [DOCITA, 2000](#)). Other industrial bodies, such as the Australian Information Industry Association [www.aiaa.com.au], which is all industry, mind you, not information, have also jumped on the wagon with their own agendas ([AIIA, 2000](#)).

The fact is, they did not. Far from promoting Australia into a producer of IT, the current Liberal Government has excelled at shooting itself in the foot. One of the first things that it did - being as it is oriented towards creating a budget surplus - was to cut funds from public libraries, universities, research bodies, schools and community information providers. Hundreds of library staff were laid off, researches fight for almost non-existent funding, scholarships are reduced to paltry remnants of what they should be, and places at "high tech" colleges are allotted to full-fee paying overseas students. The results are appalling. Australia has slid down the list (see attached OEUC ratings ([Colebatch, 2001](#))), becoming the worlds top user and producing nothing. It is worth comparing the OEUC ratings mentioned above with the Australian Bureau of Statistics report from 1999 ([ABS, 1999](#)). The Australian government, instead of encouraging Australian citizens to train in the new technologies, is now encouraging these same overseas students who paid through their noses for IT degrees to apply for permanent residence and man the country's posts. The local ITC industry (small as it is) is striking back, by refusing to employ them. Australian-born IT specialist are migrating in hordes to the USA and Europe, where wages are twice what they are in Australia ([Fitzsimmons, 2001](#)). And most embarrassingly, we are talking here about "comparative" - not "competitive" advantage.

The government has also been active in further self-damage by privatising public telecommunications systems. Telephone lines in Australia are expensive as is, more expensive than USA by far. However, Telstra was a public sector giant, heavily subsidised - and that permitted it to provide services to vastly isolated rural areas, no matter how bad these services were. With privatisation, the servicing of these rural communities has become unprofitable, and Telstra promptly removed itself from the area - first by disconnecting its analog mobile service, then by reducing staff to the minimum, and finally by increasing connection fees.

In the publishing sector (I strongly believe that publishing, in whatever form it takes, is a vital aspect of the information economy), the government has imposed GST taxes on services, effectively killing a few smaller publishing houses. It then passed a bill through the Parliament that allows overseas publishers to import

books into Australia without consulting local publishing bodies, or having the permission of local copyright holders.

Finally, the government cut millions of dollars in funds from two major broadcasting giants (Joy, 1999): the Australian Broadcasting Corporation (ABC) [<http://www.abc.net.au>] and the Special Broadcasting Services (SBS) [http://www.sbs.com.au/sbs_front/index2.html]. These two high-quality, non-commercial broadcasters have been forced to re-adjust. ABC has stopped its South-East Asia service (which kept the East Timorese aware of what was happening to their country last year, and which is Papua New Guinea's only window onto the outer world). SBS, the respectable winner of 2000 Walkley Award the most prestigious prizes in Australian journalism, is a multicultural broadcasting company specialising in educating and informing the non-English speaking communities in Australia. It was sad to see it slotting advertising clips in between its educational programs.

In July 2001, Australia's opposition party, the Australian Labour Party (ALP), published two very important documents. Although both have to be taken with a grain of salt, since they are pushing the political platform of the ALP, the Chifley Report (Considine, 2001) and the Knowledge Nation Report (Chifley Research Centre, 2001) are both worth reading. The ALP is going into the next elections on the strength of making Australia a "knowledge nation". Lots of stress is put on the technology; mentions of "knowledge" as the tacit but essential element of this economy are rare.

It (ALP) believes voters are now seeing the costs of the \$6 billion spending cuts for which the Coalition won such credit in 1996: plunging business spending on research and development, shrinking manufacturing in information and communications technology (ICT), stagnating school retention rates, slow growth in university enrolments, and a brain drain of research talent overseas.

The Chifley report concludes that, "Australia is falling well behind most of the major developed nations in investing in knowledge. As a result, Australia is putting its future position in a knowledge-based world seriously at risk." Labor's Knowledge Nation Taskforce, chaired by former science minister Barry Jones and including CT business leaders, proposed in their report short-term and 10-year priorities for a Labor government to make Australia a producer and not just a user of new technology. The taskforce proposed a list of growth industries that ALP should focus support on, as its chairman did with such extraordinary prescience 20 years ago in his book *Sleepers, Awake!* (Jones, 1984). Jones' proposals then were largely ignored by the government in which he served. With the deteriorating budget surplus limiting Labor's spending options, it remains to be seen whether this report will have more luck.

The Chifley report, drawing on work by Victoria University's Professor John Houghton (Houghton, 2001) argues that Australia is falling behind in developing information industries, while other countries are surging ahead. Houghton's work contains alarming findings. The information industries added 73,100 jobs in Labor's final term, but only 683 in the Coalition's first term. The number of ICT firms employing more than 100 people, and hence enjoying critical mass, grew by 84 percent under Labor, but just 7 percent under the Coalition, as domestic producers' market share slumped. From 1996 to 2001, the nation's trade deficit in ICT hardware has almost doubled from \$7.2 billion to \$13.6 billion. Exports have slumped, yet imports are booming, fuelled by raging demand for manufactures such as mobile phones and semiconductors not made here.

4. ROLE OF EDUCATION IN THE "NEW" ECONOMY

In the new economy, innovation drives technological change, and new technology, in turn, drives business success and new business creation. In today's knowledge-based economy human capital is business capital. In addition, staying close to the source of knowledge creation is not just a good idea; it is a business necessity. If we are to remain preeminent in transforming (new) knowledge into economic value, the U.S. system of higher education must remain the world leader in generating scientific and technological breakthroughs and in preparing workers to meet the evolving demands for skilled labor. Universities are powerful engines that drive economic development, and they do so because they play three major roles:

- The first and perhaps the most widely understood economic development role of universities is in workforce development. Whether by taking what they have learned in our classrooms and laboratories

and applying it in their new jobs, or by moving from one workplace to another after college, people bring what they have learned into the workplace.

- The second role that universities play in economic development is the leveraging of new dollars into the economy.
- The third way in which universities are engines for economic development is through research and the production of new knowledge. Indeed, economists agree that creation of new technological knowledge through research is our most direct economic avenue for acquiring added value. When that new knowledge is quantified in a market environment, it creates fuller employment, capital formation, growing profits, and surpluses for reinvestment. In other words, it is from research that new companies are born; that new jobs are created - it is from research that new wealth is created and the economy expands. ([Proenza, 2000](#))

Success in the new economy will belong to those regions that create and nurture the human resources of intellectual capital -- the people that create new knowledge and new technologies and quickly translate research discoveries into marketable products and services.

To succeed, universities, regional business, industry, and government must work in partnership to support clusters of innovation that will ensure an increasingly stronger and larger source of human capital ([CIE, 2001](#)).

Ideals about institutional autonomy for universities and other research institutes often come under assault these days, sometimes through the imperative of the bottom line, sometimes from an over-zealous "quality" assurance process, even through party ideology and acts of political opportunism. More and more, a belief in the independence of research and scholarly inquiry is overtaken by a belief in the need for centralised control to deliver the all-important short-term returns on investments, investments which themselves are cast in short terms. Unless we grant to our learning institutions the capacity to develop broadly-based interdisciplinary research, can we really ensure continuing social, scientific and technological innovation and sustainable national wealth creation - at least in a world where our competitor countries give research a chance? We might want more industrial applications, but this will be unsustainable without the proper foundation and that foundation entails the intellectual *frissance* generated in a freewheeling intellectual community. Bureaucracy and knowledge breakthroughs hardly go hand in hand. ([Niland, 1999](#))

Since the coming into power of the Liberal Party in 1996, the notion of 'economic rationalism' has been the bread and butter of Australian economy. 'Economic rationalism', as it is more commonly known, is defined as the '*domination of social policy by the language and logic of economics*'. ([Welch, 1996](#)) In practice, it has meant doing more with less, in a context where public resources are being redirected away from social welfare toward the primary goal of enhancing economic competitiveness. For universities, this rationalisation has meant an erosion of resources and a decline in monies from the public purse, amid calls for enhanced productivity or efficiency. Junor reveals the effects of economic rationalism in education:

Wherever politically possible, the Commonwealth is reining in educational spending. Where this is not possible, it is trying to do more with the same money. One way of doing this is rationalising or consolidating existing services. ([Junor, 1991](#))

In conjunction with the wide-ranging effects of 'economic rationalism' within the social policy context, within education there has been a re-emergence of the Human Capital theory. This theory states that individuals, and their skills, are an economic resource for the nation. In addition, it assumes that individuals act simply according to self-interest, in an unregulated market. Education is perceived as an investment, rather than a consumption item; and, since the benefits of education and training accrue to the individual alone, it is the individual who should bear the cost of their education. ([DETYA, 1998](#)) How is such "rationalist" attitude going to support an "information economy" is highly questionable.

5. POLITICAL IMPLICATIONS OF THE NEW ECONOMY

To quote the South African Minister for Education, Kader Asmal: "These days, a great deal of money is being made by smart people who are a little ahead of the rest of us in electronic or wireless communication skill, or financial derivatives trading, for example. Some of the wealth that has been generated by 'new economy stocks' is no doubt spurious, but there is also a great deal of money being made through genuine advances in networking technology, wireless protocols, intelligent software applications and a host of biological, chemical, telecommunications, financial or other advances. The electronic and communications

revolution is real enough. We should avoid claiming too much for this brave new world, and be prepared to learn something about the trajectory of this economic transition by reflecting on historical trends.” ([Asmal, 2000](#))

On a global scale, there is a growing gap between the rich and the poor in access to information. The technological developments of the last 50 years have made more information available to more people than at any other time in human history. At the same time, however, the cost of those technologies, and the cost of gaining access to information through them, has made it often difficult and sometimes impossible for information to be obtained by its potential beneficiaries. This is the central paradox and the central political dilemma of the information revolution. As in the industrial revolution, the benefits to the majority, encompassed in the abstraction of ‘society’, are being achieved partly at the expense of weaker and poorer individuals whose skills are becoming outmoded and whose earning power is consequently declining.

The revolution in the communication of information has created what is sometimes called a ‘global village’. Yet instant access and instantaneous transmission depend upon a vastly expensive infrastructure of telecommunications and broadcasting systems on the part of the providers, and the acquisition of appropriate equipment (and sometimes skills) on the sides of the consumers. Those who are excluded are the majority of the populations of most of the Third World and significant minorities even in richer countries. The image of instantaneous worldwide access to information is deceptive. Behind the information revolution lies an industry even more capital intensive and competitive than those of the agricultural and industrial revolutions. Instant information would be available if its owners made it so, and if the seekers were able to gain access to it. There is a huge infrastructure cost involved in installing the necessary computer systems and training/retraining staff. These costs are passed on to the users. Far from generating wealth, the ITC industry has actually absorbed much of surplus capital in Australia. The results are far from what was anticipated: no computer or software is 100% reliable, although things are improving. Where available, instant information still costs a lot of money. Access to information is increasingly dependent on wealth and skills to an extent that has not been true in the world of printed or broadcast media. This threatens to reverse some of the democratizing effects that printing and telecommunications have had.

The creation of an information superhighway, a common-carrier network for digital signals, has been on the Australian political agenda since early 1990s. It opens up a number of possibilities (online banking, shopping, travel booking, etc.) But the real revolution will be in communications, and in all those things that communication will permit, including already visible changes in patterns of work and leisure even greater than those that have already happened.

The fragmentation of the information market place is a necessary condition of this expansion and continuing growth. Although print continues to predominate, it now contains a multitude of competing and complementary sectors, often supplementing and sometimes even replacing printed materials. This competition has introduced a sharper edge to the commercial element that has always been intrinsic in the process of information transfer. The new technologies all need massive investments, but because of the speed with which they develop, any investment is of relatively short-term value. This pace of change will not in any probability diminish over the next decade, and will probably increase. This has given a raise to a whole new set of issues. Although information has never been “free”, it can now be realistically priced, meaning that the temptation to pass the cost to the end-user is often irresistible and may become mandatory. The new competitors in the information market do not share, or perhaps even understand, the benevolent desire to inform which is the common heritage of the traditional information providers, the librarians.

In today’s information market, both the information itself and the use of the communication system are valorized, so that the charge for access includes both the cost of information and the cost of telecommunications. Whereas in the past 500 years the price of the information product was related to its material production, it has now extended from the product to the content and the means of accessing that content. This is a critical shift in the structure of the information market. When the information resides in electronic databases, there is an additional twist to charging. The user pays for the right to access the content, not for the content itself. What is sold is service, the charge deriving from the value that is added to the information by the way it has been collected, sorted, analysed and presented.

Therefore, information is a commodity, which is bought and sold. However difficult it may be to define how it acquires value, the fact that it has been commodified cannot be denied. Value can be assigned to the means

of supply, to the medium, to the construction and maintenance of provision and access systems. Value can be estimated of processing information, in terms of time and materials used, equipment and consumables, etc. However, how can value be assigned to information?

If we take the stance that information can not be utilised fully until recorded, then information is inseparable from our ability to record it. This does not mean that it is inseparable from the medium of the record. On the contrary, information is characterised by its transferability between various media without any significant loss of content. Using this separability from the medium and inseparability from some form of recording system, information can be defined as a sub-set of knowledge which is recorded in some symbolic form ([Feather, 2000](#)) It is only in this state that value can be assigned to information (what about tacit knowledge valuing?) It is the user, rather than the producer, who determine the value of information, as opposed to its cost; this value will be perceived differently by different people, or even by the same person in different situations.

The other paradox about valuing information is that it has no scarcity value. Up to a certain optimal point, any additional piece of information adds to the total value of the information sub-set acquired. Beyond that point, value still increases, although at a slower rate, until there is an information overload and there is too much information to use effectively. The value of information depends on its suitability and availability – it may be an economic value, or a social, or cultural one.

Since information has a value, it can be now postulated that there are situations when the lack of information is disadvantageous. The issues of information wealth and poverty underpin the most important issue of the information economy: who has it, and who does not.

Technology has improved the potential for access, but at the same time, it has also provided the means for restricting it. The restriction can be determined by technical skills, technological infrastructure, political decisions and financial capacity. However, we are only at an early stage in the information revolution.

As important as the infrastructure and training are in accessing information in the new economy, there are other lurking dangers that potentially divide the society into info-haves and info-have-nots. One is the neglect of the more traditional means of accessing information (print and broadcasting). TV and radio overcome problems of literacy, print problems of technical skills and affordability of equipment. There is also the general population apathy when it comes to "knowing". Ignorance about current affairs in Australia is endemic, despite the fact that almost all urban homes have a TV set, and majority has a radio receiver. In rural areas, the problem is far more serious – many rural communities are deprived of the basic infrastructure, and the Australian government is actively sponsoring sale of the main telecommunications carrier, Telstra, meaning that access to even the basic phone services in the rural communities will be even more expensive. The 1999 move to switch off services to analog mobile phones also had detrimental effect on the most isolated of these rural communities. The government has also effectively cut funds to multitude of multilingual public information projects, denying access to vital information to hundreds of thousands of non-English speaking citizens. This has further disadvantaged these minorities by depriving them of financial, educational, social and professional benefits they could have otherwise obtained, and of the ability to make rational and informed decisions about their everyday life.

6. THE INFORMATION PROFESSIONALS

In the public libraries sector, the issue of access to information is revolving around the definition of 'core services' which are supposed to be provided free at the point of delivery. Since the majority of basic services is slowly moving out of the dimension of public provision, the implication is that the private sector will provide what the market will sustain, but only to those who can afford it at that price. Public libraries are responding to this changing environment in different ways: some compete in providing information to businesses and local government, partnering with public sector agencies which provide high quality services to those who can afford to pay. Among these is the State Library of South Australia Bizline [<http://slsa.sa.gov.au/research/bizline/index.html>], BRISQ at the Queensland State Library [<http://www.slq.qld.gov.au/bsd/brisq/>] and the Business Information Service at the State Library of Victoria [<http://expressinfo.com.au/>]. A few no longer provide information services, retaining only lending and reference services. A number of federal and state government bodies are now providing information through their own agencies, often to the detriment of the quality of this information. Thus it is inevitable that

those who cannot afford access to information through the services provided in the private sector will have difficulty in obtaining certain kinds of information at all. The development of systems that link scholars together, moreover, calls into question the role of libraries in the academic sector.

Libraries are no longer defined as “location”, but as “resource”. With networked systems, access to such services as catalogues, databases, news and user services have become totally de-centralised. Digitalisation and electronic transfer have accelerated and reduced the costs of much document delivery, raising serious issues of copyright and “fair dealing”. Availability of electronic scholarly resources has reduced the cost of subscriptions and the need for storage of hard copies. On the other hand, they have created a problem of over-printing, since the display technology is still in its infancy, and majority of users prefer reading materials in print.

The role of the librarian has changed perceptibly over the past few decades. Whereas there is an explicit recognition that it is the provision of information – regardless of source – that is vital to the end user, quality of service is measured by the speed and accuracy of fulfillment of user’s demands, not by the amount of material stocked by a library. The custodial role of the librarian has become irrelevant. The tools of trade (catalogues, databases, etc) have changed beyond recognition, giving the librarian access to vaster quantities of information than ever before, at a much faster speed. However, it also necessitated constant training and re-training of information providers. From custodians to skilled guides, librarians are increasingly seen as people with special skills in retrieving information and teaching others how to do so effectively. This has in no way lowered their status, as increasing number of corporations and firms are beginning to get swamped under an information overload and look to “information professionals” for a filtering, organising panacea.

7. A PERSONAL POINT OF VIEW

'Knowledge is like light, weightless and intangible, it can easily travel the world, enlightening the lives of people everywhere. Yet billions of people still live in the darkness of poverty, unnecessarily'
([World Bank, 2000](#))

In 1992, Shell Ltd. ([Shell, 1992](#)) predicted a Europe divided by a digital gap into “layers” and “pockets”. The “layers” were the new technological priesthood, with high salaries, freedom to work where they wanted, social prestige and high mobility. The “pockets” were the technologically disadvantaged minority: migrants, urban poor and – in the current case of Australia – isolated native rural communities.

The Shell prediction has been fulfilled. While in 1992 I was a radical educator running around the African countryside with UNESCO officials, trying to teach women how to boil rain water before mixing it with Nestle milk and feeding it to their newborn babies, today I am a novice in the theo(techno)logical seminars of ITC. And although for me IT is still more ‘information’ than “technology”, I am slowly but surely sucked in by the financial and purely egotistic social benefits of belonging to the topmost caste. I am beginning to lose interest in issues once extremely important to me: social justice, rights for the under-dog, egalitarianism, etc. After all, if everybody knows how to do it for themselves, I won’t be able to charge \$80.00 an hour to empty some unsuspecting solicitor’s overflowing Recycle Bin.

And yet, the “information revolution” like any other, is far from being bloodless. It has left in its wake victims – those who could not, for myriad of reasons, catch up with its pace. It has also created a new set of problems, from the “productivity paradox” ([Whelan, 2000](#)) (instead of more being done by fewer people, we have more being done by more people, and most of it does not add real value to the economy), to infringements on intellectual rights, electronic espionage and digital warfare. It has failed to solve humanity’s most pressing problems: ecological deterioration, wars, poverty, child abuse, minorities rights, etc. It is actively perpetrating capitalism’s greatest “sin”, once more creating a class-society, this time on access to information lines. It is creating social problems, as well as re-shaping the notion of what “community” means – from children so “hooked” on IT they have no time to exercise and develop spine curvatures, to one of my Muslim clients who used e-mail to divorce his wife. By making us totally dependent on knowing “how to find something” instead of “knowing something”, it has also lowered our concentration span and analytical ability.

However, as I said above, I am not in a position to talk about this. I am already lost to the cause, having been lulled into a sense of false security (how false I discover every time my Microsoft Windows crashes) by the

IT. I am a member of the new Information Age, a participant in the new Information Economy. And I would loath to see it go, although the better sense in me is still kicking back as I see the world moving from production into servicing, from education to information retrieval, and from analysis and creativity to blurry-eyed reiteration of the same bit of information from one more – useless – search engine.

Australia should be an interesting place to work in, provided that the ALP wins the coming elections. If they don't, it may be expedient to ponder the possibilities of applying knowledge management strategies to sheep shearing.

8. APPENDIX: THE OECD RATINGS

The knowledge nation: how the OECD rates us

	Australia average %	OECD %		Australia average %	OECD %
Investment in knowledge: near the bottom of the class			As per cent of GDP per head %		
Knowledge investment/GDP	6.8	7.9	Primary	16	19
R&D spending/GDP	1.5	2.2	Secondary	24	26
Business spending (Per 1000 people)	0.7	1.5	Tertiary	48	44
Scientific papers	.65	.44	Education outcomes: year 8 testing		
US patents	.04	.08	Mathematics	525	529
Education spending: an average performer			Science	540	534
Education spending/GDP	5.46	5.66	Information and communications technology: consumers, not producers		
Public funding	4.34	5.00	Spending on ICT/GDP	8.1	6.9
Private funding	1.13	0.66	Telecommunications	4.2	2.8
Spending on			IT spending	3.9	4.1
Preschools	0.10	0.40	IT manufacturing	0.1	2.5
Schools	3.80	3.71			
Tertiary institutions	1.59	1.33			
Spending per student \$US					
Primary	3981	3940			
Secondary	5830	5294			
Tertiary	11,539	9063			

REFERENCES:

AIIA (Australian Information Industry Association (2000) Setting the Agenda. [Online] Available WWW: www.aiia.com.au/iBriefing

ABS (Australian Bureau of Statistics). (1999). The information society and the information economy in Australia. [Online] Available WWW: <http://www.abs.gov.au/ausstats/ABS@.nsf/94713ad445ff14.../485fd68c254fd5eeca2569de0028de90!OpenDocumen>

Asmal, K. & Kahn, M. (2000) "The knowledge economy – fact or fiction?" South African Journal of Business Management. 31(4) p.131 [also available WWW: http://education.pwv.gov.za/Media/Articles_Lectures/Knowledge_Economy.htm]

Browning, J. & Reiss, S. (2000). So What is the New Economy? In Encyclopaedia of the New Economy. [Online] Available WWW: <http://hotwired.lycos.com/special/ene/>

Chifley Research Centre. (2001) An Agenda for the Knowledge Nation: Report Of the Knowledge Nation Taskforce. [Online] Available WWW: http://www.alp.org.au/download.html?filename=federal/reports/kn_report_020701.pdf

CIE (Centre for International Economics). (2001) Breaking the Skills Barrier: Demonstrating the benefits of investment in ICT higher education in Australia. [Online] Available WWW: <http://www.aiaa.com.au/study/pdf%20files/Breaking%20the%20Skills%20Barrier.pdf>

Colebatch, T. (2001) Don't Call Us, We'll call You - When We Find the Right Button. The Age, June 30, p.2

Considine, M. et al. (2001). The Comparative Performance of Australia as a Knowledge Nation: Report to the Chifley Research Centre. [Online] Available WWW: http://www.alp.org.au/download.html?filename=federal/reports/chifley_kn.pdf

DETYA. (1998) Learning for Life: The Review of Higher Education Financing and Policy. Australian Government Publishing Service, Canberra. [also available WWW: <http://www.detya.gov.au/archive/highered/hereview/herr.pdf>]

DOCITA (Department of Communications, Information Technology and the Arts). 2000. E-Commerce Beyond 2000. [Online] Available WWW: http://www.noie.gov.au/publications/NOIE/ecommerce_analysis/beyond2k_final_report.pdf

Feather, J. (2000) The Information Society: a study of continuity and change. Library Association Publishing, London.

Fenga, L., et al. (1998). ICT Supply Side: An Analysis of Some Statistical Sources for Italy. Paper presented for the 13th Voorburg Group Meeting, Rome. [Online]. Available WWW: <http://www.istat.it/voorburg/download/3ricfenpertro.PDF>

Fitzsimmons, C. (2001). Politicians 'undermining digital future'. The Australian IT, July 5, p. 4

Geiselhart, K. (2000). *Why I have a Librarian Fetish*. Journal of Australian Academic and Research Libraries. [Online]. Available WWW: http://www.bf.rmit.edu.au/kgeiselhart/html/librarian_article.htm

Houghton, J. W. (2001). Information Industries Update 2001. Centre for Strategic Economic Studies, Melbourne.

Jones, B. (1984) Sleepers, Awake! Technology and the Future of Work. Oxford University Press, Melbourne.

Joy, Tim. (1999). Australian community television in crisis. [Online] Available WWW: <http://www.wsws.org/articles/1999/jul1999/cmtv-j07.shtml>

Junor, A. (1991). 'Education: producing or challenging economic inequality.' In *Inequality in Australia*, J O'Leary and R Sharp (Eds.), William Heinemann, Sydney: p. 177

Nieuwenhuizen, J. (2000). Asleep at the Wheel: Australia on the superhighway. ABC Books, Sydney

Niland, J. (1999) Australia Needs Australian Research. Address to the FASTS Symposium on the Research Green Paper. [Online] Available WWW: <http://sunset.avcc.edu.au/avcc/speeches/jn140799.htm>

PMSEIC (Prime Minister's Science, Engineering and Innovation Council). (2000) Driving the "New Economy". [Online] Available WWW: <http://www.isr.gov.au/science/pmseic/mtg6itc.pdf>

Proenza, L. M. (2000) "Economic Development In The Knowledge Economy". **Vital Speeches of the Day**, 67(15), p. 459.

Shell (UK) Ltd. (1992) Management Matters. Unattributed

Simpson, M. (1997). Knowledge economy and information economy. [Online]. Available WWW: <http://www.istis.sh.cn/istis/zsjj/gwzl/concept/%D6%AA%CA%B6%BE%AD%BC%C3%B6%A8%D2%E5%28Simpson%29.htm>

South Australia's Department of Information Economy.(2000). Information Economy 2002: Delivering the future. [Online] Available WWW: <http://www.ie2002.sa.gov.au/plan/statement.htm#ie2>

The Journal of the Information Economy. (unknown). "What is Information Economy?" [Online]. Available WWW: <http://www.thejoie.com.au/newsHome.html>

Welch, A. (1996). "Reform or crisis in Australian education?" In *Australian Education: Reform or Crisis?*, A Welch. Allen & Unwin, Sydney: p. 4

Whelan. K. (2000) Computers, Obsolescence and Productivity. Federal Reserve Board paper. [Online] Available WWW: <http://www.federalreserve.gov/pubs/feds/2000/200006/200006pap.pdf>

World Bank. (2000). Entering the 21st Century: World Development Report 1999/2000. [online] Available WWW: <http://www.worldbank.org/wdr/2000/fullreport.html>