The Comparative Performance of Australia as a Knowledge Nation

Report to the Chifley Research Centre

By

Mark Considine
(University of Melbourne)

Simon Marginson
(Monash Centre for Research in International Education)

Peter Sheehan
(Centre for Strategic Economic Studies, Victoria University)

With the assistance of

Margarita Kumnick
(Centre for Strategic Economic Studies, Victoria University)

as revised, June 2001

Table of contents

This first issue of this report was completed in April 2001 and released on 14 June 2001. The release of the 2001 edition of the OECD annual publication *Education at a Glance* has provided an opportunity to update some of the international comparisons in the report, using the one further year of data now available from the OECD. Accordingly, this revised edition has been prepared.

Preparation of this report was coordinated by the Monash Centre for Research in International Education, Monash University, Melbourne. Much of the research was planned and analysed at the Victoria University Centre for Strategic Economic Studies. The report was written collaboratively by the authors. Margarita Kumnick provided data retrieval and analysis, and assisted in report production. Our thanks to Dennis Glover from the Chifley Research Centre, which commissioned the report.

List of tables

List of figures

Executive Summary

The terms of economic development are changing under the twin impact of globalisation and the knowledge-intensification of production. This report analyses Australia's performance and potential as a global knowledge economy, comparing it with advanced economies in North America, Europe and East Asia. It focuses on performance in the three areas generally seen as key to national capacity as a knowledge economy: education, research and development (R&D), and information and communications technologies. These three areas comprise the OECD index of 'investment in knowledge'.

Despite certain favourable starting points, Australia has fallen behind most of the OECD in investment in knowledge. The ratio between investment in knowledge and investment in fixed capital assets is trending downwards, marking Australia as an 'old economy'. While other nations are moving ahead with public investment in R&D and education, Australia is stuck in the cost-cutting and privatisation policies of the previous era. In doing so it is placing its future position in a knowledge-based world seriously at risk.

Both public and private investment in research and development (R&D) have declined sharply. Private investment in education and training has increased, but this consists largely of a transfer from taxpayers to students: it adds nothing to Australia's capacity as a knowledge economy, and it has been insufficient to compensate for the long-term decline in public investment as a proportion of GDP.

There has been a collapse in the resources underpinning the quality and capacity of tertiary education, affecting both teaching and research. The preoccupation of cash-starved education institutions (especially universities) with short-term revenues has distorted the balance between fields of study, and reduced the relative importance of science, engineering and research degrees in the international education program, with negative long-term consequences for knowledge economy links in the Asian region Meanwhile investment in schooling favours only private schools, pre-school performance is lamentable, and vocational education institutions face a financial crisis.

The failure to invest in knowledge is not only limiting Australia's long-term potential, it has immediate negative economic effects. Australia ranks last among comparable OECD countries in the contribution of local information and communications industries to the national economy, and the trade deficit in knowledge-intensive goods is growing rapidly. This feeds into the expanding foreign debt and contributes to the declining position of the Australian dollar.

1. Australia in the Global Knowledge Economy

The new global knowledge economy combines two elements: the growing knowledge-intensity of production; and the globalisation of economies, communications and cultures. In the emerging environment nation-states and national policies remain crucial, but nations are open to international trends and cross-border influences to an unprecedented extent.

In the new economy, services industries and the services component of manufacturing industries, are more important than before. Technology-based products are now the fastest growing element in world trade. And innovation, the process of developing both services and technology-based products, takes on an ever-greater strategic significance.

All of these aspects of economic performance are closely affected by national capacity in knowledge, and knowledge-intensive production. In the global knowledge economy, a nation's future is partly determined by its past – that is, its short-term economic capability is grounded in the longer-term development of national capacity in education, in research and development, and in information and communications technologies.

Here smart policy can and does make a difference; and its effects multiply over time. Nations around the world are piloting and positioning their national economies in the face of the global knowledge economy. How then is Australia coping? How strong is our national capacity in knowledge, how well do we stack up in comparison to other developed economies, and how well has policy positioned us in the face of the great new challenge?

There have been and continue to be a number of reasons for thinking that this nation is well placed to adjust to the global knowledge economy. For example, Australia:

- has a relatively open economy and society: open to trade, to capital, to technology, to people and to ideas;
- has an economy that until the second half of 2000, enjoyed a long period of growth in GDP and employment, with relatively strong capital investment especially in physical assets (machinery, equipment and buildings);
- has a range of competitive industries, not only in agriculture and mining but in the service sector and in certain nodes in manufacturing industry;
- has already undertaken one of the most substantial processes of adjustment, of both industry structure and of economic institutions and attitudes, of any of the developed countries;
- has a relatively strong knowledge base, relative to the size of its population;
- has a record of rapid uptake of new technologies and is in a strong position to embrace the online economy; and

- can benefit from its use of the English language, the dominant language of the knowledge economy, from its position in the Asia Pacific region (Sheehan and Tikhomirova 1998).

The Problem

Yet in a number of crucial respects Australia has been slow to respond to the challenge of the global knowledge economy. Knowledge economy indicators developed by the Organisation for Economic Cooperation and Development (OECD) indicate that while most developed countries have been moving forward, Australia's knowledge capacity has actually been *declining*, especially since 1995. This report draws on the most recent national and international statistics to investigate how well Australia is performing as a knowledge economy. The conclusion is clear. *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*.

On all three of the OECD indicators of investment in knowledge – education, R&D, and domestically-generated software – Australia's performance is now poor relative to other OECD countries. For example, in 1985 Australia's level of investment in knowledge was at 85.1% of the level applying in the USA. In 1998 the Australian level was 70.5% of the US level. Between 1996 and 1998 investment in knowledge increased in most OECD countries but it weakened in Australia. Australian investment in both education and R&D is significantly worse than in the past.

Australia has failed to capitalise on its opportunities in the new economy. There were some promising starting points: public investment in education in the 1960s and 1970s, the growth of R&D and knowledge-intensive exports between the mid 1980s and mid 1990s. But the trend data show a failure to thrive. The story is one of weak investment, halting commitment and a fatal preoccupation with defining efficiency only in terms of cost-cutting, especially in the last few years.

Whereas most of the OECD cut back its public commitment to education and training (though not necessarily research) in the 1980s and early 1990s, there has now been a sea-change in international thinking, a change that is both a cause and a product of the new knowledge-based economy. Yet at a time when many other comparable countries have been increasing both public and private effort, Australia is reducing its investment or slackening its rate of improvement – in other words, it is still pursuing the old orthodoxy.

The net result has been a reduction in capacity-building at all levels, especially in those fields and sectors most directly related to research and innovation, and in those parts of occupational training most crucial for the diffusion of new techniques. One important consequence is the deepening limitations of Australia's business innovation system, ranging from the nature and performance of local firms and the mechanisms for supporting innovation in those firms, to the venture capital and other systems for growing new firms.

Australia's poor knowledge economy performance shows itself in the following:

1. Australia's outstanding recent record of investment in fixed assets actually marks us as an obsolete economy. In a global knowledge economy, investment in knowledge increases in relation to investment in fixed assets. In Australia in the 1990s, and especially after 1995, the ratio moved sharply in the opposite direction. The nation squandered the opportunity presented by the long period of economic growth.

2. Education policy has been dominated by the drive to reduce fiscal costs at the expense of national capacity. Once an above-average investor in education, Australia is now well below the OECD average. Private investment has increased sharply, but largely in the form of student fees rather than industry funding. Public funding has been depressed so effectively that total (private and public) funding has continued to fall as a proportion of GDP despite more private funding and the growth in student numbers.

3. Pre-school funding and participation are lamentable by international standards. Expenditure on schooling is just above the OECD average, but Commonwealth policy evidences a lop-sided preference for private schooling, increasingly at the expense of the public sector which educates more than two thirds of all students.

4. Participation in post-compulsory education is above the OECD average, but in the 1990s the growth of participation was slower than in most OECD countries. School retention has fallen since 1992. The participation of 15-19 year olds in vocational education has fallen, though the opposite has occurred in older age groups. In 2000 the number of domestic students in higher education fell for the first time for many years – an alarming trend for a would-be knowledge nation.

5. In higher education there has been rapid growth in a narrow band of areas sustained by fee-revenues rather than the now declining public funding – vocational courses in Business Studies and Computing, particularly for international students and domestic postgraduate coursework students. This trend has squandered the national effort in international education, reducing its potential for knowledge economy spin-offs: the role of Engineering, Science and research degrees have all declined in relative terms. It has also distorted the development of domestic education and research capacity.

6. The total per student income of higher education institutions, from public and private sources combined, has increased since 1990 (though it has declined since 1995). At the same time there has also been a part-shift from public to private income sources. Unfortunately, in terms of teaching and research functions, the new private income has failed to substitute for the old public funding. While universities' expenditure on corporate functions such as marketing and fund-raising, financial management, off-shore recruiting, quality assurance and the like have increased, the overall student-staff ratio has risen from 12 to 1, to almost 18 to 1 – constituting a major decline in the conditions underlying the quality of learning.

7. In vocational education total (public and private) funding per student and per course-hour is now declining sharply, having fallen by 11.0% in the two years 1997 to 1999. The principal cause of the downward trend, as in higher education, has been the partial withdrawal of Commonwealth financial support.

8. After significant improvement between 1984 and 1995, the share of GDP devoted to R&D has declined since 1996-97, due to reductions in business sector R&D and in direct Commonwealth spending. While a sample of comparable OECD countries increased their R&D expenditure by 4.2% between 1995 and 1998, and US expenditure increased by 5.0%, Australian R&D expenditure fell by 15.4%.

9. Australia's competitive position in the manufacture of communications and information equipment has declined in recent years; while in terms of the direct contribution of the information industries to the national economy, Australia ranks last of those OECD countries where data are available.

10. Between the mid 1980s and the mid 1990s, exports of knowledge-intensive goods increased faster than imports, but after 1995-96 the reverse occurred. Because of the nation's failure to invest in knowledge and in knowledge-based industries, Australia is now experiencing a growing trade deficit in knowledge-intensive products such as pharmaceuticals, computing equipment, telecommunications and road vehicles. This deficit in knowledge-intensive products alone is sufficient to explain the negative trade balance overall, and the dramatic growth of foreign debt, and arguably has played a significant role in global perceptions of Australia as an 'old economy' which have fed into the weakening market position of the Australian dollar.

To summarise all of this in a single concept: Australia is undergoing an investment crisis in a range of factors of production in the knowledge economy. If this crisis continues unabated, not only will Australia fail to become a leading producer of knowledge economy products and services; the nation will become increasingly dependent upon others for these things, leading to further adverse consequences for the trade position, for the level and character of jobs and opportunities, and for the accumulation and distribution of wealth.

The Report

To consider Australia's knowledge economy performance, the Report examines changes over time against different baselines (1990, 1995) and against the OECD economies in North America, Europe and East Asia (Japan and Korea). The data enable us to track those countries that appear to be doing better at tapping the potential of the new economy and those that have increased their investment in knowledge in recent years.

While countries such as Finland and Ireland have used new industries such as telecommunications and software production to drive improved economic performance overall, in many respects the benchmark remains the United States. The USA is in the forefront of information and communications, biotechnology, pharmaceuticals and other knowledge-intensive industries. It is also one of the highest

spenders on R&D in the world; and it leads the world in both public and private per capita outlays on higher education.

The remainder of the Report falls into three sections, each supporting by tables and figures (the Appendix contains further data on national performance in education):

Section 2 – Investment in Knowledge: this summarises the national performance in broad terms presenting comparative international data in the three core areas of education, R&D and software, and setting down the trend in Australian performance over time.

Section 3 – Education: this covers participation in, funding of and balance of activities at all levels of education, with the main focus on tertiary education. Again, it looks at both where Australia stands in relation to other countries; and more detailed trends in Australian education and the implications of those trends for the knowledge economy.

Section 4 – R&D, New Technology and Trade in the Global Knowledge Economy: this identifies Australian R&D over time and in comparison to other countries; the state of Australia's information technology and communications industries; and Australian trade in knowledge-intensive products, tracing the relationship between poor investment in the knowledge economy and Australia's trade deficit, foreign debt and currency instability.

2. Investment in Knowledge

The Knowledge Economy

As noted above, fundamental changes are taking place in the global economy. Many believe that forces are at work that will reshape national and regional economies, and the societies that they serve, to an extent comparable to the original Industrial Revolution. Governments around the world are responding urgently to this perceived fact, often with a vigorous round of new policies. The implications for sub-national regions are also widely held to be profound (Dunning 2000).

All economies, however simple, are based on knowledge about how, for example, to farm, to mine and to build, and this use of knowledge has been increasing since the Industrial Revolution. But the degree of incorporation of knowledge into economic activity (knowledge intensity) is now so great that it is inducing major changes in the operation of the economy, and is transforming the basis of competitive advantage. The rise in knowledge intensity has been greatly accelerated by the role of computing and communication systems in the creation, storage, dissemination and application of knowledge.

These recent trends in knowledge intensity have been accompanied by a widespread movement to economic deregulation, including:

- the reduction of tariff and non-tariff barriers on trade in both goods and services;
- the floating of currencies and deregulation of financial markets more generally;
- the reduction of barriers to foreign direct investment and other international capital flows, and of barriers to technology transfers, and
- the deregulation of product markets in many countries.

Together these policy changes, in conjunction with IT developments, have led to increased globalisation of economic affairs over the past decade or so.

These two interlinked factors – the rise in the *knowledge intensity* of economic activities and the increasing *globalisation* of economic affairs – are in our view the defining features of the emergence of the global knowledge economy. However, it is important to note that this term refers to the overall economic structure that is emerging, not to any one of these phenomena, or a combination of them (OECD 1996; Sheehan and Tegart 1998; DTI 1998). The knowledge economy is the quite new set of economic activities, structures and relationships which is emerging in a world of high knowledge intensity and globalisation.

Measuring Investment in Knowledge

In traditional economic thinking, the central focus is on investment in fixed assets such as buildings and equipment, and elaborate procedures have been established to measure such investment. These procedures relate both to the accounts and balance sheets of companies and to aggregate data compiled by national statistical agencies. In the knowledge economy much increased attention must be placed on investment in knowledge, and this poses difficult measurement problems, for both firms and economies. Firms need to measure the extent of their investment in knowledge, and the value of their knowledge and other intangible assets, if their accounts are to be meaningful and their management decisions informed. Equally, governments, and the constituencies to which they report, need viable and comparative measures of investment in knowledge if they are to be able to assess their performance in relation to other nations.

The OECD Secretariat has played a pioneering role in providing statistical definition of the knowledge economy, and has also taken the lead in developing an aggregate measure of investment in knowledge by an economy (OECD 1999a; OECD 1999b; see also Croes 1999). This section of the report uses the OECD measure of investment in knowledge, and some variants of it, to study comparative trends across countries. By investment in knowledge we here mean spending on both the creation and application of knowledge and the development of the knowledge capabilities of individuals. Hence the OECD has created a measure of investment by a nation in knowledge, defined as the sum of expenditure on education, spending on software and expenditure on R&D (OECD 1999a). This measure excludes the equipment component of R&D (to focus on intangible investment) and the R&D component of educational spending (to avoid double counting), and also makes certain adjustments to software spending (OECD 1999b).

This measure must be regarded as an interim one only, for there are a number of acknowledged limitations in both its coverage and application. In particular, spending on software can be taken only as proxy for a wider range of knowledge investment in the information industries, and the focus on R&D excludes the broader innovation activities of organisations. Further, because of data limitations, the published OECD measure uses public spending on education, although the OECD authors acknowledge that a more complete picture should include private spending on education and training (OECD 1999a, p 16). Nevertheless, this is an important measure, which throws new light on the relative performance of countries.

Investment in Knowledge and Fixed Assets, 1995

The best data on national investment in knowledge are for 13 OECD countries for 1995 (Table 1). This table shows, in the right hand column, the published OECD estimates, and some adjusted estimates which include OECD figures for educational expenditure from both public and private sources for educational institutions in place of the data for public spending only. On this broader measure, for the 13 OECD countries covered, total investment in knowledge is estimated at 9.2% of GDP, of which about two thirds occurs through public spending on education. A number of countries spent close to or above 10% of GDP, with France, UK and Canada all at 9.8% of GDP in 1995. The highest level of investment was in Sweden, with 11.5% of GDP, with spending well above average levels in each of the three areas. Investment in knowledge in the USA was also at a high level in 1995, accounting for 10.5% of GDP.

These data illustrate clearly the relatively low level of investment in knowledge in Australia in the mid 1990s, by the standards of comparable countries. In 1995 investment in knowledge in Australia was at 8.0% of GDP, at the lower end of the range of countries shown in Table 1. It was about 13% lower than the OECD 13 average and Australia was placed 11th out of 13 countries. Perhaps more important than these rankings is the size of the gap between Australia and the leading countries. In particular, Australian investment in knowledge in 1995, as a share of GDP, was 30.4% below that in Sweden, 23.8% below that in the USA and 18.4% below that in a group of countries including Finland, Denmark, France, UK and Canada.

As noted above, Table 1 also includes in the right hand column the original OECD (1999a) estimates, using public spending on education only. While the inclusion of private spending is conceptually more appropriate, it is evident that its exclusion in the OECD publication does not change the relative position of Australia among the countries covered in Table 1, nor the extent to which Australian investment in knowledge falls well below that of leading nations.

It is also valuable to examine levels of investment in knowledge in relation to investment in fixed assets, to obtain an assessment of the extent to which a country's investment activities remain concentrated on physical assets or have been partly shifted to the creation of knowledge assets. Data on two approaches to this issue are provided in Table 2, with full data for a somewhat smaller group of countries than those covered in Table 1. The split of investment in fixed assets between equipment and other assets is not available in the OECD data for Finland, Denmark and Japan.

Table 1. Investment in knowledge, selected countries, 1995 (% of GDP)

	Education	R&D	Software	Total	Total (excluding private educational spending)
Sweden	6.7	3.3	1.5	11.5	10.6
USA	6.7	2.3	1.5	10.5	8.4
Finland	6.6	2.1	1.2	9.9	9.5
Denmark	7.1	1.6	1.1	9.8	9.6
France	6.3	2.2	1.3	9.8	10.2
UK	6.5	1.8	1.5	9.8	8.5
Canada	7.0	1.4	1.4	9.8	8.8
Germany	5.8	2.1	0.9	8.8	7.1
Japan	4.7	2.7	0.9	8.3	6.6
Netherlands	4.9	1.9	1.3	8.1	7.8
Australia	5.6	1.4	1.0	8.0	6.8
Austria	5.5	1.4	0.8	7.7	7.2
Italy	4.7	0.9	0.8	6.4	6.1
OECD	5.9	2.1	1.2	9.2	

Source: OECD (1999a) and OECD (2000). Column 2 consists of educational expenditure from public and private sources for educational institutions, all levels combined, as a percentage of GDP, from the OECD (2000) database. The figures in columns 3 and 4 are from OECD (1999a), and column 6 contains the estimates of investment in knowledge published in OECD (1999a). These include only public spending on education.

Australia has a relatively high level of investment in fixed assets, by international standards, particularly in terms of investment in buildings and other non-equipment assets. Of the thirteen OECD countries shown in Table 2, in 1995 Australia ranked third, after only Japan and Sweden, in terms of fixed asset investment as a share of GDP. But, given this fact and the low level of investment in knowledge, Australia's investment activities remain heavily skewed to fixed asset creation rather than to knowledge creation. Australia is a member of a group of four nations – also including Italy, Austria and Japan – where the relative focus on knowledge investment is low. Only Japan is substantially lower than Australia. (Given the difficulties which Japan is experiencing in adjusting to the knowledge economy, this may be an ominous precedent.)

It is sometimes argued that one way of investing in knowledge is to invest in equipment or machinery with substantial embedded knowledge, and there is some limited truth in this claim. It is thus useful also to look at investment activities through another lens, by examining the ratio of investment in knowledge and in equipment to investment in buildings and other assets. This ratio measures the extent to which national investment activities are still focused on buildings and related assets. As shown in the final column of Table 2, Australian investment activities were in 1995 still heavily concentrated in this direction, to an extent almost double that of many major countries.

Table 2. Investment in knowledge and fixed assets, selected countries, 1995

	Investment (% of GDP)				Selected ratios (France = 100)	
	Knowledge	Equipment	Buildings and other assets	Total	Knowledge to fixed assets	Knowledge plus equipment to buildings
France	9.8	11.2	8.4	19.6	100.0	100.0
UK	9.8	10.9	8.5	19.4	101.0	97.4
Canada	9.8	11.1	9.4	20.5	95.6	88.9
USA	10.5	11	10.3	21.3	98.6	83.5
Italy	6.4	11.6	8.1	19.7	65.0	88.9
Sweden	11.5	9.1	15.2	24.3	94.7	54.2
Germany	8.8	9.4	12.5	21.8	80.7	58.2
Netherlands	8.1	7.7	14.4	22.1	73.3	43.9
Austria	7.7	10.5	13.7	24.2	63.6	53.1
Australia	8.0	9.1	14.9	24.0	66.7	45.9
OECD 10	**9.2**	**8.6**	**13.8**	**22.4**	**82.1**	**51.6**
Finland	9.9			18.6	106.5	
Denmark	9.8			20.2	97.2	
Japan	8.3			28.8	57.6	

Source: OECD (1999a) and OECD (2000).

Trends in Investment in Knowledge, 1985-1998

In the mid 1990s, then, Australia had a relatively low level of investment in knowledge by international standards, and its investment pattern was much more heavily concentrated on fixed assets in general, and on buildings and structures in particular, than most major countries. Given this conclusion, it would clearly be useful to be able to examine trends in these indicators over time, both prior to and subsequent to 1995.

Work has been undertaken in the project to construct data examining investment in knowledge over time for a number of countries. This faces a range of difficulties, about the availability and comparability of data and the availability of full data for recent years. The estimates that we have constructed, and which are presented in the Table 3 below, are based as far as possible on the OECD measure but differ from it in several respects. In particular, they do not exclude either the equipment component of R&D or the R&D component of education spending, and use a more limited measure of spending on software. In constructing the data for 1998, it is assumed that, for each country in 1998, educational spending represents the same share of GDP as in 1997. In spite of the release of the publication *Education at a Glance 2001* (OECD 2001), the CD ROM data source providing time series consistent with this publication has not yet been released, so these figures cannot be updated. In addition, consistent data on private spending on education is difficult to assemble for OECD countries for a period of years, and so only public spending on education is included in Table 3, as in the published OECD figures (OECD 1999a) Our measure here is direct public expenditures for educational institutions, for all levels. In spite of these limitations, we believe that this measure can be used as a reasonably reliable indicator of trends over time for the countries considered. While the exclusion of private expenditure on

education did not significantly affect the relative position of Australia in 1995 (Table 1), it may lead to some understating of Australia's relative position of Australia.

This measure suggests that, as well as being at the lower end of the range of OECD countries in 1995, investment in knowledge in Australia has fallen further relative to international trends since 1995. Between 1995 and 1998 the weighted average level of investment in knowledge in the 12 OECD countries increased significantly from 7.90% of GDP in 1995 to 8.22% in 1998, with a steady increase in each year.

Table 3. Investment in knowledge, selected countries, 1985-1998, (% of GDP)

	1985	1992	1993	1994	1995	1996	1997	1998
Sweden	8.72	9.97	10.00	10.00	10.15	10.39	10.59	10.83
France	7.05	7.95	8.17	8.18	8.41	8.40	8.32	8.38
Denmark	7.47	7.92	8.58	8.39	8.46	8.73	8.84	9.06
Finland	7.29	9.93	9.57	9.00	9.11	9.41	9.26	9.62
Norway	6.64	8.86	8.82	8.92	8.90	7.97	8.67	8.80
Canada	7.52	8.55	8.10	7.94	7.58	7.41	7.25	7.38
UK	7.18	7.16	7.08	7.05	7.11	7.03	6.81	6.79
USA	7.60	8.26	8.16	7.86	8.17	8.39	8.63	8.73
Netherlands	8.31	7.02	7.09	7.00	6.92	6.88	6.78	6.95
Austria	6.87	7.32	7.07	7.12	7.10	6.96	7.88	8.03
Germany	7.26	7.19	7.09	6.97	7.07	7.13	7.11	7.27
Australia	6.47	6.14	6.42	6.22	6.11	6.30	6.24	6.15
Weighted average	7.46	7.96	7.90	7.71	7.90	8.00	8.12	8.22

Sources: Author estimates based on *ANBERD Database* (OECD, 2000b); *Education at a Glance* (OECD 2000a); unpublished software estimates based on IDC data; and ABS (2000d) *Research and Experimental Development, All Sector Summary*, *1998-99,* Cat. No. 8112.0.

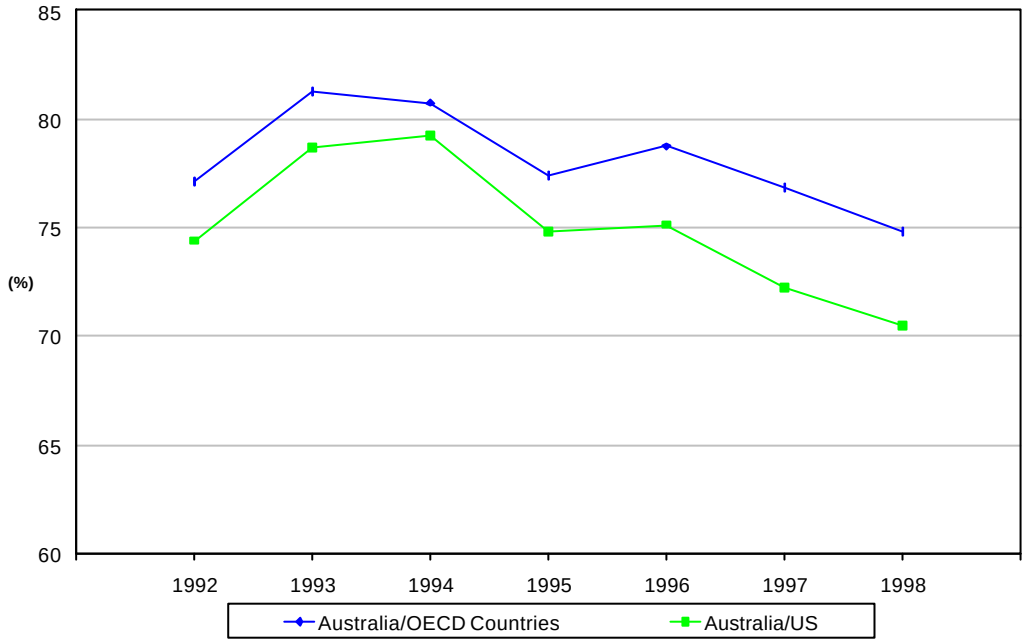
Table 4. Investment in knowledge, Australia, USA and OECD, 1985-1998, (% of GDP)

	1985	1992	1993	1994	1995	1996	1997	1998
USA	7.60	8.26	8.16	7.86	8.17	8.39	8.63	8.73
Australia	6.47	6.14	6.42	6.22	6.11	6.30	6.24	6.15
11 OECD countries	7.46	7.96	7.90	7.71	7.90	8.00	8.12	8.22
Ratio: Australia/OECD Countries								
Level	86.7	77.2	81.3	80.8	77.4	78.7	76.8	74.8
Index 1985=100	100	88.9	93.7	93.1	89.2	90.8	88.6	86.2
Ratio: Australia/US								
Level	85.1	74.4	78.7	79.2	74.8	75.1	72.2	70.5
Index 1985=100	100	87.4	92.4	93.1	87.9	88.3	84.9	82.8

Source: Same as Table 3.

This increase was driven substantially by the strong growth in the USA (from 8.17% in 1995 to 8.73% in 1998). By contrast, Australian investment in knowledge has increased only marginally since 1995, and has fallen significantly since 1996. By 1998 Australia was about 25% lower in terms of investment in knowledge than the weighted average of the 12 countries, and nearly 30% lower than the US. About half of this gap existed in 1985, but the decline has been particularly marked since 1993, and especially since 1996.

Figure 1. Investment in knowledge: Australia's *comparative* performance



Source: Derived from data in Table 4.

Trends over time in Australian investment in knowledge, relative to the two benchmarks of the USA and the OECD 12 countries, are displayed in Table 4 and Figure 1. Given the role of the USA as a pacesetter in economic change this comparison is particularly important and, for Australia, particularly disturbing. On this measure, the share of US GDP devoted to investment in knowledge rose by just on 15% between 1985 and 1998, and by 4% between 1996 and 1998. By contrast, Australian investment *fell* by 5% between 1985 and 1998, with about half that fall after 1996. A continuing, and perhaps even accelerating, decline in Australia's investment in knowledge relative to the performance of the world's leading economy does not bode well for the nation's continued prosperity in a knowledge based economy.

Trends in Investment in Knowledge and in Buildings and Structures, Australia

Finally, it is useful to examine trends over time in Australian investment in knowledge, using the data in Table 3 on knowledge investment, and private sector investment in buildings and structures from the national accounts. Australia has traditionally had a high level of private sector investment in fixed assets, and Table 2

showed that Australia had virtually the lowest ratio of investment in knowledge to investment in buildings and in other non-equipment assets of any of the OECD countries for which data were available. Focusing only on Australian trends, we can provide data on investment in buildings and structures only (Table 5), thus allowing analysis of trends in the relative importance of these two investment activities.

Table 5. Investment in knowledge and private investment on buildings and structures, Australia 1992-1999 (% of GDP)

	1991-2	1992-3	1993-4	1994-5	1995-6	1996-7	1997-8	1998-9
Private investment in buildings and structures	7.4	7.4	7.9	8.1	7.8	8.2	9.1	9.4
Investment in knowledge	6.14	6.42	6.22	6.11	6.30	6.24	6.15	n.a.
Ratio: Investment in knowledge to investment in buildings and structures	83.0	86.8	78.8	75.4	80.8	76.0	67.6	n.a.

Source: For knowledge investment, as for Table 3; for private investment in fixed assets, Australian Bureau of Statistics, National Accounts, 5206.0, Canberra.

It is well known that investment in buildings and structures has a pronounced cyclical trend, but nevertheless one striking message of Table 5 is the extent to which the economic boom after 1996 saw an increased diversion of national investment into buildings rather than to investment in knowledge. Knowledge investment fell as a share of GDP after 1996, but the share of GDP devoted to private investment in buildings and structures rose from 7.8% in 1996 to 9.4% and to 9.6% in 1999-2000. This illustrates the extent to which the late 1990s was associated with a massive shift in the use of national resources to buildings and structures, rather than to the creation and application of knowledge and the development of the knowledge capabilities of individuals.

3. Education

Education is one of the primary engines driving innovation. Though by itself a world-class education system does not guarantee prosperity; it has become an indispensable element of a nation's economic and cultural capacity. In the global knowledge economy, educational strategy is a core element of global strategy; and sustained long-term economic prosperity is unimaginable without an ever-improving education system. As with other globally-significant industries such as communications, functions related to education and research can be expected to absorb an increasing share of public and private investment.

The growing importance of education shows itself in three different ways:

- The new economy requires ever more sophisticated applications of knowledge to the production of products and services. To perform well in this environment, in

emerging areas that cannot always be foreseen in advance, a country requires a literate, numerate and inventive workforce.

- The education system, especially the higher education sector, provides much of the research for breakthrough innovations. It also provides the basic research capacity and the research training underpinning innovations that are located in industry.

- Through partnerships with government and industry, the education system serves as a primary 'node' in the new systems of industrial networking which allow new decisions, plans and processes to be effectively implemented (Lundvall 1992). This includes industrial networking across national borders. Education, especially higher education, is a primary site for the development of global knowledge economy links with long-term potential, for example relationships in East and Southeast Asia.

Unfortunately education in Australia, once relatively strong, is falling off the pace set by competitor countries. The key problem is the declining state of public investment at all levels – government schooling, vocational education, and higher education. This faltering in the production of public educational goods has undermined the long-term capacity of the knowledge economy in Australia, while reducing the immediate capacity of education to underpin private knowledge goods in industry. It has created an unbalanced set of incentives whereby education institutions, particularly at tertiary level, have been forced to give priority to the expansion of short-term market revenues at the expense of the quality and capacity of education and research infrastructure. Compared with the renewed emphasis on public investment and public policy objectives in many OECD countries, Australia's education policies are disappointing: still focused on cost-cutting with little regard to the creative potential of education and research in a knowledge economy.

Education in Australia has a history of modest achievement up to the 1990s, followed by decline, especially after 1995. The pattern of modest achievement relates firstly to participation in education: this is low in pre-primary education (where Australia's record is poor despite the importance of early learning), but about OECD average in the teenage years and above average at tertiary stage. Second, Australia has done reasonably well in science and maths literacy.

Literacy and Numeracy

Comparing 8th grade student achievement scores in mathematics and science, Australia is just below the average of 12 OECD countries in Mathematics and just above the average in Science. Between 1995 and 1999, the Australian scores improved faster than in most other OECD countries (Table A15). The standard deviations of student scores also fell, indicating that in Australia student achievement became more even. The greatest improvements were registered in the bottom 25 per cent.

In Mathematics and Science Australia has moved from a country where the dispersal of achievement was highly uneven, to one where inequalities are slightly greater than the norm in Western Europe, Korea and Japan. The low achieving group is smaller

than in other English-speaking countries. Both the level and distribution of achievement have implications for Australia's capacity as a knowledge economy.

Educational Participation

Educational participation is one of the crucial tests of national performance in the knowledge economy environment – though a simple comparison of numbers-in and numbers-out is apt to be misleading. Few commentators would argue that we need a less educated workforce to confront the challenges of the new economy. Rather the argument is that we need both more education *and* better quality programs.

Pre-School Participation

First, the bad news: pre-school participation. The importance of early learning, in determining both educational achievement and the universal distribution of that achievement, is well documented (see for example Hill and Russell 1994). This has also been recognised – in theory at least – in policy circles in Australia. A 1996 the *EPAC Interim Report on Future Child Care Provision in Australia* noted a number of studies which had demonstrated 'a range of both transitory and lasting benefits from children being involved in a well-run, quality preschool program'. Pre-school 'can have a significant impact on student readiness and educational outcomes in the first few years of schooling', and some studies have detected 'lasting impacts' such as a reduced likelihood of school failure (p. 73). The 1996 Inquiry into early childhood education by the Senate Employment, Education and Training Reference Committee referred to the body of research which shows that in the case of children with 'disadvantage or disability', 'quality early education…has a measurable impact upon their intellectual performance upon entry to school', and on 'their social achievements, self esteem and task orientation' (p. 138).

Comparison with other OECD countries shows that Australia has lower expenditure and lower participation, especially at age 3 years. In 1998 Australia spent 0.1% of GDP on pre-school education compared to an OECD country average of 0.4%, the level applying in the UK and the USA, and much less than the 1.1% allocated in Denmark, 0.7% in France and 0.6% in Norway and Sweden (see Table A1). In 1999, pre-school participation in Australia was 33.8 per cent compared with an OECD average of 60.0% and much higher levels in France, Belgium, Italy and Spain.

Post-compulsory Participation

Looking at participation in the older age groups, compared to all the other OECD countries Australia once looked good, and is still above the OECD average. However this relative advantage is shrinking and if present trends continue, it will disappear. There are worrying signs in the slow rate of tertiary enrolment increase since 1995, compared to other OECD countries, and in particularly the decline last year in the number of domestic students enrolled in higher education. Further, Australia has been unable to follow the trend in Western European countries to universal completion of schooling. In international terms Australia has a relatively high number of university

graduates (even though others are beginning to catch up) but also a relatively high number of early school leavers.

In the ten years between 1982 and 1992 the number of Australian students reaching Year 12 of high school doubled (from 36.3% to 77.1%). This was undoubtedly one of the most impressive changes of the postwar period. Unfortunately the achievement was not sustained and by 1996 the rate had slipped backwards to 71.3%. In 1998 it was still only 71.6% (ABS 2000a). The decline in participation was sharper for boys than for girls, especially boys from families with lesser levels of parental income and education (Lamb 1998), providing an important early warning that young men were at risk of becoming a casualty in the new economic order.

The participation rate for 15-19 year olds is round about the OECD country average. The most recent edition of the OECD's *Education at a Glance* provides two separate comparisons of participation rates, collected on differing bases. On one measure, 80.3% of Australian 15-19 year olds participate in either full-time or part-time education, compared to an OECD country average of 76.9%. On the other measure, 78.2% of Australian 15-19 year olds participate in education compared to an OECD average of 81.3%, and 82.2% in the USA. The persistence of an educational 'under-class' feeds into long-term unemployment. Of the Australian population aged 25-34 years, 65% have attained upper secondary education, compared to an OECD country average of 72% and the figure of 88% in the USA (OECD 2001).

More Australians now hold tertiary qualifications than ever before: and the proportion of the 25-64 year-old population with higher education is 18% in Australia compared to an OECD country average of 14% - though the level in the USA is much higher at 27% (OECD 2001). Tertiary education is obviously good for graduates since they are significantly more likely to obtain employment than those without such qualifications. But while there was continued growth in the numbers of Australians going to university in the 1990s, this was at a slower rate than the growth of university places in most OECD countries. Between 1990 and 1995 domestic student load (i.e. the number of effective full-time students) in Australian universities rose by 19.2%, but in the next four years to 1999 the rate of increase slowed, producing growth of 10.2%.

In the year 2000 slow growth in domestic student load became negative growth for the first time for many years. The number of domestic students in Australian higher education dropped from 603,156 in 1999 to 599,878 in 2000 (a decline of 0.5%), while domestic student load fell in similar proportion, from 466,193 to 464,435 (0.4%). The decline in the domestic student population received little attention because it was partly disguised by a further sharp rise in international student numbers (15.0%) and international student load (19.7%), so that total student numbers continued to grow. But the slowdown in the growth of domestic enrolment after 1996, and especially the decline in 2000, constitute a very worrying trend for a would-be knowledge nation (Table 6).

Table 6. Students in higher education, domestic and international, 1990 to 2000

	Number of students			Change from previous year		
	Domestic	International	Total	Domestic	International	Total
1990	460,068	24,998	485,066	---	---	---
1991	504,880	29,630	534,510	+ 9.7%	+ 18.5%	+ 10.2%
1992	525,305	34,076	559,381	+ 4.0%	+ 15.0%	+ 4.7%
1993	538,464	37,152	575,616	+ 2.5%	+ 9.0%	+ 2.9%
1994	544,941	40,494	585,435	+ 1.2%	+ 9.0%	+ 1.7%
1995	557,989	46,187	604,176	+ 2.4%	+ 14.1%	+ 3.2%
1996	580,906	53,188	634,094	+ 4.1%	+ 15.2%	+ 5.0%
1997	595,853	62,996	658,849	+ 2.6%	+ 18.4%	+ 3.9%
1998	599,670	72,183	671,853	+ 0.6%	+ 14.6%	+ 2.0%
1999	603,156	83,111	686,267	+ 0.6%	+ 15.2%	+ 2.1%
2000	599,878	95,607	695,485	- 0.5%	+ 15.0%	+ 1.3%

Source: DETYA (2001).

One reason for the fall-off in the growth of domestic student participation in higher education has been the above-mentioned decline in retention to year 12 of schooling, from the highpoint reached in the early 1990s. Another is that universities have a much stronger incentive to enrol fee-paying international students and fee-paying domestic postgraduates, than to enrol government-funded and Higher Education Contribution Scheme (HECS)-funded domestic students in undergraduate courses. This is further discussed below.

Taken overall, between 1995 and 1999 tertiary participation (including Vocational Education and Training as well as higher education) increased much slower in Australia (6%) than in the average OECD country (23%), as Table 7 shows.

Table 7. Change in tertiary enrolment attributable to change in enrolment rate 1995-1999, OECD countries

	Change in tertiary enrolment rate (1995-1999)
Poland	+ 73%
Hungary	+ 72%
Korea	+ 50%
Austria	+ 44%
Greece	+ 35%
Czech Republic	+ 32%
Spain	+ 22%
Denmark	+ 20%
Portugal	+ 20%
Turkey	+ 20%
UK	+ 19%
Belgium	+ 15%
Finland	+ 14%
Mexico	+ 14%
Ireland	+ 10%
Italy	+ 10%
Norway	+ 9%
Germany	+ 7%
AUSTRALIA	**+ 6%**
France	+ 5%
Canada	- 10%
OECD country average	+ 23%

Source: OECD (2001).

Quality of Participation

Also of concern is the fact that Australia's high participation rate has been achieved by what in international terms is a very high proportion of part-time enrolments (Table A2), and a growing proportion of full-time students who work while they are studying.

For the most part, full-time students who work do so in order to provide themselves with basic income support while studying. Only a small minority of working students are in jobs which dove-tail with their studies: most are in low-paid low-skill functions in hospitality, tourism, retail and the like. The ABS Labour Force data show that between 1987 and 1999, the proportion of 18 year olds who were both full-time students in higher education, and working part-time or full-time, rose from 34.9% to 55.2%. Two thirds of this whole group stated that they wanted to work, compared to less than half in the late 1980s (ABS 2000b).

When added to the fact that Australia has fewer tertiary places that are supported by residential scholarships and stipends than is the case in some other countries; plus student assistance that is now harder to get and sits below subsistence levels; these trends suggest a weakening of the formative power of the university experience and its steady replacement by a more limited commitment on the part of both institutions and students.

Despite this caveat, the overall growth in tertiary education might suggest a case of the right policy being pursued at too conservative a rate. Or is it? When we look more closely at what underlies educational participation in Australia, we see that the problem is not just in a failure to match the investment strategies of our competitors, but also that in the last decade and a half – and especially in the last five years – we have achieved growth in tertiary participation by means of a strategy to 'thin-out' the resource base of this sector.

Government policies have pushed many more students through the system, without funding these places at anything like the previous levels. Now it may be argued that this simply represents good management, and that we now have an education system which produces more output for the same (or less) dollars. While there is some indication that this might have been true of the government-led economisation of the late 1980s, by the end of the 1990s the picture is different. We find very large increases in staff-student ratios, far greater casualisation of teaching and research jobs, and a significant reduction in the proportion of resources being devoted directly to teaching the larger numbers of new students. These trends point to a sharp decline in the resources underlying the quality of participation: a serious depletion of national educational capacity.

For example, university staffing trends are alarming. In Australian universities, between 1990 and 1999, the overall ratio of effective full-time students to effective full-time staff in teaching-related positions rose from 12.8 to 17.8. The increase in student-staff ratios has been across the board, affecting all disciplines, including

Business Studies and Computing which in the present policy environment are relatively strong in financial terms.

At the same time, the proportion of teaching that was carried out by casual labour rose to 21.1% in 1999; while the proportion of total university labour that was employed in teaching functions fell to an historic low of 37.6% (Table 8). Casual staff rarely carry out sustained research programs, and often teach at more than one institution, being only poorly integrated into specific teaching programs. At the same time, surveys of academic staff have found an increasing proportion of the time of this – in relative terms – shrinking group of teaching-related staff is in fact devoted to administration and resource raising, rather than teaching and research (McInnis 2000).

These changes have undoubtedly acted as a disincentive for young scientists and scholars considering a career in research. For these people, who should be an essential part of the core of Australia's global knowledge workforce for many years into the future, there have been few jobs, and those jobs that do exist are less attractive than before. The deterioration in staff provision has also impacted adversely upon those already established in their careers. Greater casualisation has invariably meant that the smaller pool of continuing staff are required to shoulder a larger burden of administration and to divert time from research to other activities. Adding in the effect of rapidly rising undergraduate numbers, plus the fact that a larger and larger share of this cohort is made up of international students, it can quickly be seen that staff have had to spend much more of their time than before upon a variety of support functions which have had little to do with either teaching or research.

Table 8. Teaching resources in Australian universities

	Student load (EFT students)	EFT staff in teaching positions	Ratio of EFT students to EFT teaching	Proportion of staff time provided by casual labour		Proportion of EFT staff in teaching
				Teaching staff *(%)*	All other staff *(%)*	*(%)*
1990	383,838	29,967	12.81	n.a.	n.a.	42.79
1996	487,977	31,877	15.31	17.49	9.41	38.36
1997	514,727	30,731	16.75	18.10	10.29	37.72
1998	528,838	30,424	17.38	19.35	10.49	37.68
1999	544,146	30,548	17.81	21.06	11.13	37.56

EFT = Effective full-time. Academic staff in teaching/ research and teaching-only positions; excludes research-only staff.
Source: DETYA (2001).

While the effect of this informal diversion of effort has been somewhat different in each discipline field, the impact is severe in areas closely associated with high technology enhancement and research. This was confirmed by the report of the Anderson Working Group, reporting to the Prime Minister's Science, Engineering and Innovation Council in December 2000. They identified the same pattern reported here, rising undergraduate numbers and falling levels of full-time staff, 'causing a loss

of capacity… to train the next generation of Information and Communication Technology (ICT) specialists.'[1]

Another element that affects the picture is Australian academic salaries compared to those in other English-speaking countries, principally the USA. The data in Table 9 provide a comparison between academic salaries and remuneration in Australia, and in the United States, over a twenty-year period. The full data are included in Tables A10-A13. As the notes to those Tables indicate, the comparison is complex because of the different employment arrangements that apply. Note that purchasing power parity, rather than exchange rates, is used to interpret the comparison. However, the overall trend line is clear. At the end of the 1970s Australian academic remuneration was at 85-90 per cent of the American level. During the 1980s there was a sharp fall in the remuneration to Australian academics, relative to their American colleagues, to about 60-65 per cent. In the 1990s there was little change in the relative position between the beginning and the end of the decade. The 1990s saw an improvement in real terms in both American and Australian academic salaries, and some improvement in the relative position of Australian salaries at below professorial levels. Nevetheless, average Australian academic salaries remained at about two thirds of those applying in the USA, in terms of purchasing power equivalence.

Table 9. Australian academic salary as a proportion of US salary and part of compensation, 1979-80, 1989-90 and 1999-00

	Australian salary as proportion of US salary + compensation (both expressed in US$)		
	Professor %	Level C %	Level B %s
1979-80	90.90	87.16	86.03
1989-90	65.14	63.68	60.94
1999-00	65.05	65.12	64.33

Notes: Each of the national data used in the comparison exclude some elements of total remuneration. US salary plus compensation excludes summer term earnings plus minor further remuneration, while Australian salary excludes part of remuneration. The exclusions from the American data are probably larger, suggesting that if anything, the data over-estimate Australian remuneration relative to American, i.e. the disparity between academic earnings in the two nations might be slightly greater than suggested here (see Tables A10-A13 for more details). OECD purchasing power parity ratios.

Sources: Annual Survey of Faculty Remuneration in *Academe*, American Association of University Professors ; National Tertiary Education Union.

This means that Australian academic staff whose work and career are mobile – which includes most of those working near or at the cutting edge of change in the global knowledge economy – have a *prima facie* reason to transfer from Australia to the USA, all else being equal. In real life all else is not equal and people decide where to live and work on the basis of many considerations, of which income is only one. Nevertheless the difference between Australian and US salary and remuneration is of

[1] *The Australian*, 'New economy short of funds', 17 January 2001, p. 21.

concern; the more so if other conditions of work (such as teaching workloads, or demands of administration or fund-raising), or the decline in resources to support research, also prompt a desire to move.

Areas of Growth in Participation

Where growth did take place in higher education in the 1990s, it was obvious in two related areas. The expansion in the number of international students was staggering, particularly in undergraduate programs and coursework postgraduate courses. The field that benefited most from this, and also from the much smaller rate of the domestic student expansion, was Business Studies. The other field which saw comparatively rapid growth was Computing, again partly driven by the internationalisation of enrolments.

For reasons mostly associated with changed federal funding requirements, the higher education sector undertook a massive international marketing program throughout the 1990s. The results are unequivocal whichever measure is used: student numbers, student load, or graduates. Between 1990 and 1995 domestic student load grew by 19.2%, while international student load grew by 78.6%. Between 1995 and 2000, the gap between the trend lines widened. Domestic student load grew by 9.9% (as noted, it actually fell in 2000), while international student load grew by an extraordinary 137.1% in this five-year period.

Between 1995 and 2000 international student load in coursework Masters (virtually all of these students were paying fees) jumped from 4049 to 19,480, while the equivalent group of domestic student load rose from 18,649 to 19,160 (Table A4). International student load in Business and Law increased from 15,747 to 40,732, a growth of 158.7%, while domestic Business and Law student load increased by 16.2%. International student load in Computing and Mathematics increased by 193.1%, while at the same time domestic student load in those disciplines increased by 16.5% (Table A5).

Remarkably Australia now has the second highest proportion of internationals in the OECD (12.6% of all higher education students in 1998) behind only Switzerland (15.9%). Australia is the fifth-biggest exporter of international tertiary education in the world, and the third largest exporter of international higher education, still considerably smaller than the USA and UK but with more than twice as many students as Canada. International education in Australia has achieved the policy objectives defined at the outset of commercialisation in the mid to late 1980s – it has provided the government with fiscal relief, and universities with a growing source of discretionary income, while establishing a major export industry which helps relieve the balance of trade.

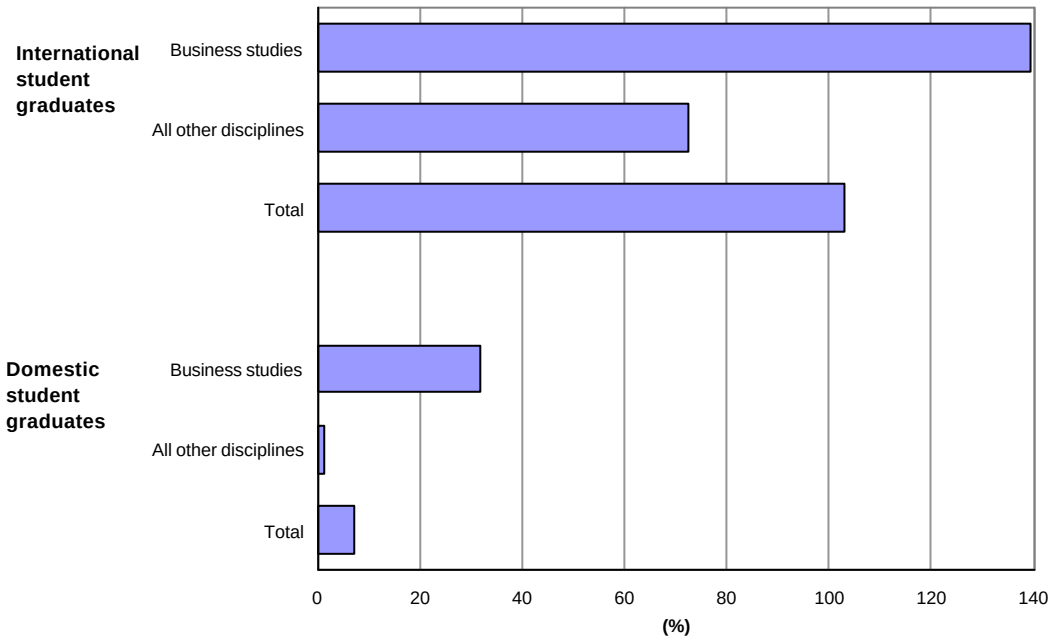
Yet at the same time international education has become very specific, even narrow in character, and rather more so than in the USA and the UK. It is concentrated in certain disciplines, largely confined to certain levels of course – Bachelor-level and coursework postgraduate – and draws largely on the Chinese diaspora from a small range of countries in South-East Asia. For families from these countries, Australia is not necessarily the most prestigious choice but Australian universities are closer and

perhaps safer than the USA and the UK, and fees are lower, partly thanks to the weak Australian dollar.

Perhaps the clearest illustration of this very specific form of internationalisation on the outputs from higher education is the pattern of graduates. Between 1990 and 1999, the annual number of graduates from higher education increased by 73.4%. Once the international graduates are separated out, the total increase in domestic graduates was considerably less – 51.7% – while international graduates increased by 460.3%. The disciplines with most rapid growth overall were Law, Business, Health Sciences and Science (including Computing). The number of Business studies graduates rose by 107.3% among domestic students but by 729.2% for internationals.

The divergent trends between 1995 and 1999 are even more striking (Figure 2). After 1995 the growth of domestic graduations in Business slows as the Business faculties focus their development efforts on fee-paying internationals. Domestic Business graduates rise by 31.7% but international business graduates rise by 139.5%, more than doubling in the three years to 1998. Domestic graduates in all other disciplines rise only 1.5%. Meanwhile, among the international graduations in 1998, 53.7% of all degrees are in one field – Business – 12.8% are in Science and Computing, and little more than a third are located in all of the other fields of study taken together.

Figure 2. Growth in number of graduates, higher education, international and domestic students, 1995 to 1999



Source: DETYA (2001).

The aggregation of these trends is a decidedly lop-sided pattern of development. It seems there are two separate 'economies' in higher education, one that is growing rapidly and one that is stagnant or growing quite slowly. The kinds of student places that have expanded rapidly, particularly since 1995, are those where direct fees are

charged and the resulting revenues go to the universities themselves. These places are filled by fee-paying internationals and by some domestic students in coursework postgraduate degrees; and they are overwhelmingly in Business and Computing. Law has also grown rapidly, mostly among domestic students. Other areas – the general degrees in Social Sciences, Humanities and Natural Sciences; the professional courses in Engineering and related fields, Agriculture, Building and Architecture and so on – have grown more slowly, while numbers in Education have dropped dramatically.

Areas of growth attract increasing revenues, and can afford to provide opportunities for younger staff and purchase learning materials and library resources. They are in a stronger position to attract and hold globally mobile academics. It is on the areas where numbers are not increasing that the problem of declining learning conditions falls most heavily. In the 1990s Australia has expanded its capacity for higher education in Business Studies, Computing and to a lesser extent in Law, much more so than in Engineering, the natural sciences and the social sciences. Whether this was the best use of scarce national resources or the best way for federal governments to manage fiscal policy is a matter which lies outside our current remit. However there are certainly questions which need to be asked about the contribution of this strategy to building capacity in the knowledge economy. Related to this is the question of whether this development of higher education constitutes the optimum form of the internationalisation of Australian universities.

While these matters deserve a more extensive study than is possible here, we would like to make some observations on the data discussed thus far.

Table 10. International student load in Business and Law, Computing and Mathematics, Engineering and Science, 1989 to 1999

	Business, Economics, Administration and Law %	Computing and Mathematics %	Engineering, Processing and Science %
1989	31.9	17.3	24.2
1990	35.8	18.5	20.1
1991	37.1	18.6	19.1
1992	37.9	17.6	18.6
1993	37.3	17.7	18.1
1994	39.2	16.4	17.4
1995	40.0	15.6	16.5
1996	43.1	15.7	14.3
1997	45.3	15.2	13.1
1998	46.3	15.2	12.8
1999	45.1	16.7	12.5
2000	43.6	19.3	12.0

Source: DETYA (2001).

The first such observation relates to the fields of study which have expanded as a result of internationalisation. While Business Studies may provide undergraduates with suitable skills for taking junior posts in the administration of firms, such programs have little to contribute either to particular high technology skills, or to research capacity in general. For example the proportion of international students going into Engineering and Science halved during the 1990s, from 24.2% to 12.0%.

And whereas in 1990 6.9% of all international graduates took out research degrees, by 1999 this had fallen to 3.3% (Table 10 above).

This hardly seemed to indicate that Australian higher education was making a strong contribution to the development of the knowledge economy in those (mostly Asian) countries sending their undergraduates for training. Looked at from the local perspective, the internationalisation program was not a strong contributor to Australia's capacity as a knowledge nation, either. Typically, undergraduates make no contribution to the knowledge economy until they have graduated and entered the workforce. By definition international students who are undergraduates, and nearly all coursework postgraduates also, are unable to make such a contribution to the Australian economy. The same is not the case for postgraduates who undertake research degrees. Their projects contribute directly to Australian research capacity. Other leading OECD countries concentrate much of their international education programs at this level. In the USA and the UK a high proportion of international students enrol in research degrees, which contribute directly to capacity-building in those countries.

Moreover such research degree programs tend to attract international students of high calibre, the kind of students who enrich the universities they attend, and make excellent international contacts (and migrants) after they graduate – rather than those internationals who enrol in the cheapest available English-language country, or in the course which gives them the quickest postgraduate credential in Business (even when the course content is indistiguishable from an undergraduate program, as is too often the case).

Table 11. Postgraduate research degrees compared to Masters by course work, international students, 1988 to 1998

	Proportion of all international graduates with:	
	Research degrees %	Masters coursework %
1988	8.1	7.6
1989	6.0	6.4
1990	6.9	13.6
1991	7.1	13.2
1992	6.6	14.6
1993	7.3	14.9
1994	7.4	15.0
1995	6.1	16.3
1996	4.9	20.6
1997	4.4	23.9
1998	3.5	25.1
1999	3.3	27.3

Source: DETYA (2001).

While international Business Studies, driven partly by credentialism, are at the heart of the growth economy in higher education, international research degrees are scarcely a blink on the radar screen. Despite the great expansion of Business Studies programs, in 1999 only 0.8% of international graduates in Business Studies had undertaken research degrees. The figure was higher in Engineering (7.0%) and Science and

Computing (6.2%), but in all disciplines the overwhelming majority of post-graduates were in coursework programs where the research contribution was minimal. Because research degrees take longer than coursework degrees, using graduate numbers as the measure of these trends might appear to understate the international research degree cohort. Even so, in terms of student load, the proportion of all international students who were enrolled in doctoral programs or in Masters by research fell from 11.9% in 1990 to 4.9% in 2000. This is an unmistakable sign that the international program is 'dumbing down'.

But as we have noted, the main explanation for these changes in the higher education sector were not policies related to innovation capacity-building. Rather the motives were fiscal, with universities being forced to fill the gap left by rapidly declining levels of government funding per student, especially after 1995. At its crudest this involved the exploitation of international demand with the cheapest available programs, defined as those requiring little in the way of technological investment or research expertise. Programs that could most easily be taught by casual staff, in make-shift accommodation and requiring the least specific pre-matriculation preparation, became the most popular.

Tertiary Funding

This lop-sided pattern of development draws attention to the close connections between what is produced in education, and the manner in which education is financed. As Table 12 shows, universities – now free under government guidelines to choose the balance between fields of study, and to enrol as many fee-paying students as they wish, regardless of the long-term consequences for the nation's capacity in higher education – have put their student places where the money is. Government/ HECS funded places are funded at a diminishing rate, and are limited in number, with enrolments above planned student load supported only at the level of the lowest band of the HECS, discounted by 25%. Fee-paying places are funded at whatever price the individual university sets and there is no policy limit on the number of such places. This incentive framework has led to quite predictable results. As we have described, the former category has grown quite slowly, while the latter category is where the action is.

Table 12. Growth in higher education student load compared to growth in income, international and domestic students, Australia, 1995 to 1999

	1995	1999	Change between 1995 and 1998
Fee income from international students	$400.9 M	$686.3 M	+ 71.2%
International student load	39,367	78,109	+ 98.4%
Income from governments and the HECS	$4828.6 M	$5155.4 M	+ 6.8%
Domestic student load	422,720	466,037	+ 10.2%

Income data in 1989-90 prices.
Source: DETYA.

The bifurcation between the commercial economy in higher education and the government/ HECS-funded economy in higher education has fed into the longer-term trend of university funding in Australia, whereby private funding (both deferred fees through the HECS, and direct fee-charging) have come to replace a proportion of the erstwhile public funding. The extent to which the *functions* funded by private income actually 'replace' the functions funded by government income is another matter, as we will see. First, though, let's look at the aggregate trends in income by source.

Universities were almost 90% funded by governments from the early 1970s till the late 1980s. However the actual level of government investment as a proportion of GDP declined from a highpoint of 1.50% in 1974-75 to 0.79% in 1989-90 at the time the Dawkins reforms were being introduced. This decline in the national priority given to public investment in higher education occurred at the same time as a 59.6% growth in student load: this led to a collapse in public investment per student in real terms, to only 54.5% of the 1975-76 level (Tables A6 and A7). Government investment picked up slightly as a proportion of GDP in the early 1990s, amid a marked growth in student load following expansion under the Dawkins Ministry, and was at 1.04% in 1994-95. Per student funding rose again, though to less than two thirds of the 1975-76 level. However, from the mid 1990s public investment again fell as a proportion of GDP, and per student funding again dropped sharply.

Significantly, government final consumption expenditure in higher education has fallen more sharply than government funding as a whole (Tables A6 and A7: Government funding as a whole includes capital works and student assistance payments, as well as consumption expenditure). Government final consumption expenditure in higher education, together with revenues from the HECS, is the key to the long-term capacity of the higher education system to generate public goods such as undergraduate education and basic research. Government final consumption expenditure is defined by the ABS as net outlays by general government for current purposes such as salaries, intermediate services, power, library and educational materials; that is, government-source outlays which do not result in the creation of capital assets or land (ABS 2000c). While expenditures on these academic resources are recorded as current expenditures, in one sense they are also akin to fixed capital investment, in that the benefits are partly drawn on in years subsequent to the current year. Academic resources (especially the combined knowledge-capacity of the individuals working in universities) constitute an on-going social infrastructure which tends to accumulate – or erode – over time, depending on the degree to which that capacity is being augmented by current outlays. It is in this respect that the aggregate government expenditure on higher education, capital and current expenditures taken together, is described in broad terms as 'public investment' in higher education.

Remarkably, government final consumption expenditure peaked as early as 1977-78 at $3.012 billion (1989-90 prices) at a time when student load was 245,400, less than half its present level. At that time Commonwealth policy began to place a higher priority on containing the fiscal costs of higher education, than on the long-term benefits of national investment in higher education. Since 1977-78 a long series of successive budgets have resolutely held government final consumption expenditure at below the $3 billion mark (Table A6). The accumulated investment of the 1960s and 1970s was steadily eroded and has never been adequately replenished. Briefly the situation began to reverse in the early 1990s, but the mini-recovery was cut-off in the middle of the

1990s. This long-term trend is the key to current problems of capacity and quality in higher education.

As Table A9 shows in detail, in 1983, fees and charges were less than 3% of the income of higher education institutions. In 1990, after mixed public/private university funding had been introduced by Dawkins, 68.4% was government money, 11.8% was from the HECS and 8.4% was from fees and charges. During the first half of the 1990s, the government share fell and income from fees and charges increased slightly, with little change in the role of HECS. After 1995, total government grants fell, the rate of the HECS was increased and there was the aforementioned explosion of growth in fee-paying courses. By 1999, the government share was down to 49.1%, the HECS was 19.0% and fees and charges brought in 17.7%. In other words, in 15 years income from fees and charges of one sort or another jumped from less than 3 % to more thane 36% of toal income.

All else being equal, a sharp increase in private investment in higher education is beneficial to both universities and the nation. The key here is to ensure that the quality of university teaching and research is maintained, and the new private income contributes to an expansion in the overall capacity and relevance of higher education. Unfortunately in the 1990s all else was not equal and the growth of private funding was associated with a pattern of deterioration. The total income of higher education institutions rose throughout the 1990s; in fact until 1996 total government funding rose, and there were marked increases in all sources of private funding throughout the decade (Table A8). However the increase in total funds did not translate into a consistent increase in funds per student, and by no means all of the additional money was applied to teaching and research functions.

To work out what happened to university resourcing in the 1990s we need to look at two distinct periods (Table 13).

- In the first half of the 1990s total funding per student rose significantly but there was little improvement in the per student level of government funding plus the HECS, that part of income which contributed directly to public final consumption expenditure. The overall student-staff ratio deteriorated from 12.8 to 14.5;

- In the four years after 1995 total funding per student fell by 6.1% per cent. This occurred despite a 75.8% per cent jump in HECS revenue, the 71.2% growth in fee income from international students, and a 152.9% growth in domestic student fees including the small number of fee-paying undergraduates who commenced in 1998, and was due to the fall in government funding instigated by the 1996 budget. The staffing ratio continued to deteriorate, now at a more rapid rate.

How is it that in the 1990s the ratio of academic staffing to students (i.e. the obverse of the student-staff ratio) deteriorated by 28.9%, while total income per student rose by 9.6%? We suspect that what has happened is that some teaching and research functions previously supported out of government funding (and later government funding plus the HECS) are no longer being supported from the newer sources of income, fees and charges. The total income figures might suggest that universities are better off than in 1990 and little worse off than in 1995. But in terms of teaching and

Table 13. Income of higher education institutions per unit of student load, compared to staff-student ratio, Australia, 1989 to 1998

	Student Load	Income per unit of student load, from:			Student-staff ratio *
		Governments	Governments plus HECS	All sources	
		$ million 1989-90 prices	*$ million 1989-90 prices*	*$ million 1989-90 prices*	
1989	354,235	8724	10,140	12,412	12.81
1990	376,522	8691	10,185	12,698	12.81
1991	422,563	8306	9758	12,423	13.49
1992	433,005	8362	10,087	13,034	14.69
1993	441,085	8268	10,052	13,708	14.50
1994	444,406	8888	10,713	14,315	14.53
1995	462,087	8676	10,449	14,819	n.a.
1996	487,977	8548	10,250	14,712	15.31
1997	514,727	7717	9786	14,054	16.75
1998	528,838	7250	9650	13,983	17.38
1999	544,146	6826	9474	13,914	17.81

* Units of student load per effective full-time teaching-related staff member (including casual staff). Teaching related staff includes teaching only and teaching/ research staff; excludes research-only staff.
n.a. means data not available.
Source: DETYA (2001).

research functions, the increased private income per student *has not necessarily substituted for* the public income per student that has been lost.

One reason is that the income from fees and charges does not spread across all areas of teaching and research, but to the extent it is used to augment academic capacity, it goes disproportionately to those teaching areas where that income is generated, and student numbers have grown, i.e. Business Studies and Computing. A second and more significant reason is that the income from fees and charges is used to underpin the growth of the non-academic functions of universities, including functions associated with the costs of earning that same private income, and other functions associated with enhancing the individual position of each 'Enterprise University' (Marginson and Considine 2000) in the now competitive national system. In other words, most of the increased private income is ploughed back not into teaching and research but into the corporate functions of universities, including off-shore operations, marketing, public relations, IT and communications, asset management, quality assurance, alumni fundraising and so on.

While many OECD countries have seen increases in the private funding of university education, few have experienced this kind of zero-sum shift from public to private sources. Comparing the public funding of Australian universities since 1995 with the OECD region as a whole, Australia was one of only five OECD countries where funding fell in real terms. Funding in Australia dropped by 5 per cent; only Canada saw a worse outcome. Seven OECD countries increased public funding by 10 per cent or more, including 40% in Ireland (Table 14).

Further, cumulative expenditure per student over the average duration of tertiary studies – a measure of the resource-intensity of tertiary places – is now below the

OECD average of USD $35,087. The level of expenditure in Australia is $29,194, less than half the level applying in Switzerland, Austria and Sweden; and two third the level in Finland and Germany (Table 15).

Table 14. Change in public expenditure on tertiary education institutions 1995-1998, OECD countries

	Change in public expenditure (1995-1998)
Greece	+ 78%
Poland	+ 56%
Turkey	+ 41%
Ireland	+ 40%
Portugal	+ 19%
Spain	+ 16%
Mexico	+ 13%
Czech Republic	+ 13%
France	+ 7%
Hungary	+ 7%
Finland	+ 5%
Netherlands	+ 5%
Austria	+ 4%
Italy	+ 4%
Belgium	+ 3%
New Zealand	+ 2%
Norway	+ 1%
UK	- 1%
Denmark	- 1%
Germany	- 1%
AUSTRALIA	**- 5%**
Canada	- 9%

Source: OECD (2001).

Table 15. Cumulative expenditure per student over the average duration of tertiary studies, OECD countries, 1998

	Cumulative expenditure per tertiary student in US$
Austria	72,184
Sweden	60,928
Switzerland	60,030
Germany	46,078
Finland	45,413
Netherlands	41,951
Denmark	40,065
Italy	34,559
UK	34,348
France	33,830
AUSTRALIA	**29,194**
Ireland	27,610
Canada	27,419
Spain	22,922
Korea	21,800
Greece	21,657
Hungary	20,545
Poland	15,685
Mexico	13,005
OECD country average	35,087

Average duration of tertiary studies and expenditure over the duration of studies in US dollars, converted using OECD Purchasing Power Parity data.
Source: OECD (2001).

Funding Trends in Vocational Education

These funding trends in higher education – thinned out core funding and a forced focus on anything and everything that generates short-term revenues – have been more obvious in the VET sector, and with worse results. Between 1990 and 1999 the number of students in publicly funded VET institutions grew from 966,800 to 1,647,200. As with higher education institutions, a mix of cuts in government funding and new corporate freedoms have been used to encourage VET institutions to service their growing clientele by broadening their income base. However, VET institutions have not been able to develop fees and charges on the same scale as have higher education institutions: the vocational credentials produced in VET have a lesser labour market value. Further, the cutbacks in Commonwealth funds have been even more severe than in higher education, especially since 1995, though the total State government funding of VET has been sustained.

According to the ABS data, between 1990-91 and 1997-98 government expenditure per course hour – the most accurate available measure of student use – fell from $9.34 to $7.73, a decline of 17.3% in real terms (1989-90 prices, ABS 2000c). The National Council of Vocational Education Research (NCVER) provides a more detailed picture of recent trends in VET income, taking into account both private and public income sources. These data show that in the two years between 1997 and 1999, public-source incomes fell by 2.2%, while the total income from student fees and charges and other fee-for-service activities fell by 2.6%. Meanwhile teaching effort continued to increase, out of this diminishing resource base, whether measured by the trend in student numbers (11.9%) or teaching hours (9.6%). The outcome was a major decline in total income per course hour, from $11.03 to $9.82 – a fall of 11.0% in only two years. Table 16 sets down the trend.

Table 16. Income of publicly-funded Vocational Education and Training institutions per course hour, Australia, 1996 to 1999, (1989-1990 prices)

	CW govt	State govt	Student fees and charges	Fee for service	Ancillary trading and other	Total VET income	Total VET course hours	VET income per course hour
	$ million	*$ million*	*$ million*	*$ million*	*$ million*	*$ million*	*millions*	*$*
1996	760.1	1846.2	132.8	309.0	156.0	3204.1	285.047	11.24
1997	833.8	1871.8	137.1	309.1	181.9	3333.7	302.200	11.03
1998	757.0	1916.7	135.1	282.0	168.5	3259.4	312.777	10.42
1999	718.0	1929.3	138.5	296.1	170.2	3252.0	331.071	9.82

Source: NCVER (2000).

Trends like this are unsustainable in the medium term. Not only are VET institutions thereby rendered unable to play their appropriate roles in a knowledge economy – such as the diffusion of new technologies, techniques and modes of work organisation and industry retraining – if there is much more of this, some institutions will simply close their doors. There is less scope for expanding private income in VET than in higher education. As noted, VET qualifications do not command the kind of private benefits

able to sustain a fee-based regime; while industry is manifestly unwilling to fund a large part of VET because the skills it fashions are portable within, and often between, industries. VET creates predominantly public goods in the form of transferable vocational skills. Unless governments fund the production of these public goods, many will not be produced.

Comparative International Funding of Tertiary Education

The trend in investment in VET, and the trend in investment in higher education, foreshadow a decline in Australia's investment in tertiary education when compared with other countries in the OECD. Nevertheless, Table 17 suggests that Australia's relative position in tertiary funding is not as bad as its relative position in the funding of education and training as a whole, especially public funding (see Table 18 below). Australia has the fourth highest level of private expenditure in the OECD after Korea, the USA and Japan. In terms of public funding, Australian expenditure is the 11th highest of 28 countries. This sounds relatively favourable but it needs to be remembered that tertiary participation in Australia is also relatively high.

Australian investment in tertiary education fell from 1.67% in 1995 to 1.59% in 1998. Public investment at 1.09% was just above the OECD country average. Private investment (0.51%) was significantly higher than the OECD country average (0.29%) but had fallen since 1997 when the level was 0.7% (OECD 2001; 2000b). American public investment (1.07%) was just below the Australian level; but private investment was higher (1.22%), and total funding of tertiary education was at 2.29% of GDP which was the second highest level in the OECD as Table 17 shows.

To develop a fuller picture it is necessary to align the trend in comparative tertiary funding with the trend in comparative tertiary participation. In sum:

- Tertiary participation is remains above the OECD average though it appears to be coming back to the average in the longer term, as other nations pick up their performance;
- Tertiary expenditure is above the OECD average, but by a lesser proportion than is participation, and expenditure is falling as a proportion of GDP: it is moving down to the OECD average;
- Accordingly, funding per student is falling, and it is now well below the OECD average as at 1998;
- Further, the trends in Australian university and VET funding since 1996 that were mentioned in the previous section suggest that there has been a more pronounced decline in the comparative position since 1998.

Table 17. National investment in tertiary education as a proportion of GDP, public and private sources, Australia and selected OECD and other countries, 1995 and 1998 (%)

	Expenditure on tertiary education as a proportion of GDP, from:			
	All sources 1995	Public sources 1998	Private sources 1998	All sources 1998
Korea	---	0.44	2.07	2.51
USA	---	1.07	1.22	2.29
Canada	2.17	1.53	0.32	1.85
Iceland	---	1.74	0.04	1.78
Finland	1.90	1.68	---	1.67
Sweden	---	1.49	0.17	1.67
AUSTRALIA	**1.67**	**1.09**	**0.51**	**1.59**
Denmark	1.60	1.49	0.04	1.53
Norway	1.69	1.42	0.09	1.51
Austria	1.52	1.44	0.02	1.46
Ireland	1.33	1.08	0.30	1.38
Greece	0.70	1.04	0.17	1.21
Netherlands	1.24	1.15	0.03	1.18
France	1.14	1.01	0.12	1.13
UK	1.19	0.83	0.28	1.11
Spain	1.03	0.84	0.27	1.11
Germany	1.09	0.97	0.08	1.04
Portugal	0.93	0.96	0.08	1.04
Japan	---	0.43	0.60	1.02
Hungary	---	0.80	0.21	1.01
Belgium	---	0.91	---	0.91
Mexico	1.06	0.78	0.11	0.89
Czech Republic	0.96	0.76	0.12	0.88
Italy	0.76	0.68	0.16	0.84
Turkey	0.69	0.81	0.03	0.84
Poland	---	1.16	---	---
Switzerland	---	1.11	---	---
New Zealand	1.09	1.06	---	---
OECD total		**0.93**	**0.67**	**1.59**
OECD country average	---	1.06	0.29	1.33
Thailand	---	0.84	1.74	2.58
Chile	---	0.57	1.27	1.85
Malaysia	---	1.26	---	---
Brazil	---	1.07	---	---

Source: OECD (2001).

Overall National Investment in Education

In 1998 Australia's spending on education was below the OECD mean, with 5.46% of GDP devoted to all forms of education, compared to the overall OECD total of 5.75% – boosted by the weight of the USA within the total – and the OECD country average of 5.66%. Australia's relative position declined during the 1990s. We started just ahead of the OECD country mean, but in the mid 1990s fell behind and stayed there.

If we single out public expenditure on education the trend is sharper. Australia (4.34%) has a significantly lower level of public investment than the USA (4.82%) and is not much greater than the level of public spending in the even more privatised

Korea (4.07%). Australia's public investment is significantly worse than the OECD country average (5.00%). Australia ranks 21st out of 29 OECD countries. Canada (5.48%) and the UK (4.65%) were higher; and five OECD countries exceeded 6%. Below Australia were Turkey, Greece, Korea, Japan, Ireland, the Czech Republic and Mexico. Australian public spending has fallen since 1995 when it was 4.46% of GDP.

The level of private spending in Australia (1.13% of GDP) was the 6th highest in the OECD although it had fallen since 1997 (1.3%). Table 18 provides details.

Table 18. National investment in education, all sectors, as a proportion of GDP, public and private sources, Australia and OECD and other countries, 1995 and 1998 (%)

	Expenditure on education as a proportion of GDP, from:			
	All sources 1995	Public sources 1998	Private sources 1998	All sources 1998
Denmark	6.71	6.81	0.36	7.17
Korea	---	4.07	2.96	7.03
Norway	7.20	6.77	0.13	6.90
Iceland	---	6.55	0.32	6.87
Sweden	6.42	6.59	0.18	6.77
USA	6.37	4.82	1.61	6.43
Austria	6.61	5.98	0.38	6.36
France	6.32	5.88	0.36	6.24
Canada	6.95	5.48	0.68	6.16
Switzerland	---	5.38	0.47	5.86
Finland	6.30	5.75	---	5.72
Portugal	5.30	5.57	0.08	5.65
Germany	5.76	4.35	1.20	5.55
AUSTRALIA	**5.46**	**4.34**	**1.13**	**5.46**
Spain	5.53	4.44	0.85	5.30
Hungary	5.49	4.46	0.59	5.04
Italy	4.59	4.82	0.19	5.01
Belgium	---	4.97	---	4.97
UK	5.06	4.65	0.28	4.92
Greece	---	3.44	1.32	4.76
Mexico	5.57	4.10	0.65	4.75
Japan	4.76	3.55	1.17	4.72
Ireland	5.27	4.31	0.40	4.71
Czech Republic	5.38	4.07	0.60	4.67
Netherlands	4.69	4.49	0.12	4.61
Turkey	2.47	2.94	0.54	3.48
New Zealand	---	6.05	---	---
Poland	---	5.35	---	---
OECD total	---	4.64	1.11	5.75
OECD country average	---	5.00	0.66	5.66
Thailand	---	4.27	3.35	7.62
Chile	---	3.54	2.62	6.16
Brazil	---	4.63	___	___
Malaysia	---	4.49	___	___

Source: OECD (2001).

Investment in Schooling

The largest single item within total education investment is the schools budget. Part of the problem in the Australian case is that within the federal system, the national government uses its superior fiscal position to support public education at the tertiary level (albeit to a diminishing extent) but does not do so with any vigour at secondary, primary and pre-primary level. The Commonwealth allocates two-thirds of its schools budget to the private sector. When the States are added to the picture, the total public spending on schools in Australia (3.80% in 1998) was above the OECD average though it had been below the OECD average in 1997. Australia was behind Canada, Korea, France and the Scandinavian countries, among others. The States lack the fiscal capacity to substantially expand knowledge nation investment in public schooling. The permanently depressed 'floor' of investment in public schooling holds down the material standards of schooling as a whole, an effect that is reinforced by federal funding formulas that tie private school funding to a proportion of the cost of education in government-provided schools.

Only a small handful of elite independent schools have the private resources to escape the effects of the limits placed on investment in schooling by the current policy regime. These schools have substantial private means and have received increased assistance from the Commonwealth. However these are high fee schools dedicated to the creation of private educational goods and there are only limited spillovers to the overall knowledge economy.

One result of the state of schools funding is that we find a pattern of career incentives in schools that has something in common with that found in universities. Teaching workloads increased throughout the 1990s and at the same time salaries either declined relative to other countries and sectors, or failed to keep pace with competitor careers.

Typically Australian teacher salaries are higher at the start of careers than salaries in most other countries, including the USA, but the comparative position declines at the later stages of schooling (see the 1998 data in Table A14). Teachers in Australia reach the ceiling level of salary – unless promoted to one of the relatively small number of positions as school leaders –earlier in their careers, after 8-9 years, than most of their counterparts elsewhere. This means that in Australia, incentives to build a long career in teaching are relatively weak. As if to rationalise the negative effects of this incentive structure, the notion has developed that teaching is a 'young person's profession', and that it is a bad thing if teachers stay 'too long' in the teaching service – it shows a lack of ambition, or no awareness of the 'real world outside the school'.

However this is not the way our international competitors see it. They provide incentives that encourage a lifelong commitment to teaching, with continuity of service linked to professional development and a progressively improved performance.

Private Investment in Education

In the mid 1970s Australia was a country with relatively low private investment in education. In OECD terms it is now a high private investor. All else being equal this would be a desirable trend, subject to the caveat that there would be a need for

compensatory policies to modify the economic inefficiencies and distributional inequities normally associated with rising levels of private investment and a partial shift from private to public goods. Unfortunately the growth of private investment has been associated with a larger reduction in public investment as a proportion of GDP. The overall national funding of education (that is, public and private investment taken together) has declined as a proportion of GDP from 6.1% in 1977-78 to 5.2% in 1997-98.

Unlike countries such as the US that also have high private expenditure, in the Australian case private funding has become a substitute for public funding, not a supplement to it, especially in recent years. Far from being positive sum, education funding has been worse than zero-sum. It seems that governments, particularly the Commonwealth, have encouraged private investment not so much because it increases total national investment in education, or creates a closer relationship between education and the economy, as because the swing to private spending provides favourable conditions for fiscal savings.

In this policy context, Australia's higher than average reliance upon private funding for education has two key elements. The first, already mentioned, is the fact that in primary and secondary education, both governments and private citizens invest heavily in private education. In some situations increased private funding has been associated with direct reductions in the level of public investment in public schools: for example through formulas such as the enrolment benchmark adjustment (which was recently abandoned by the Commonwealth). More generally, there can be little doubt that the focus on private schooling has contributed to the weakening of the status of the public school, and the will of all governments to lift the resource standards of those schools. In turn, this weakens the capacity of those schools to create public goods. This not only results in adverse effects on the equitable distribution of educational opportunities, it also leads to lower overall investment in capacity building in the knowledge economy. In most OECD countries, a high priority is given to maintaining a strong public school system that is able to sustain the flow of public educational goods such as improving levels of literacy and numeracy.

The second element of the higher level of private investment is focused upon payments by students for participation in tertiary education, especially at universities. The point we want to emphasise here is that this kind of increased level of private investment might provide taxation relief and constitute an effective set of mechanisms for levying charges, but it does not constitute a move towards the knowledge economy.

Essentially, Australia's high level of private funding of universities has been achieved by a transfer of part of the cost of those universities from taxpayer to student. It is almost entirely explained by the HECS collections which the Commonwealth Government makes on behalf of universities and which are paid by individual consumers of undergraduate programs, plus international student fees and those of domestic postgraduates in vocational courses. This rarely equates to private funding through business partnerships, corporate scholarships or bequests. It is not grounded upon investments in public-private partnerships between universities and industry groups.

Indeed the contribution made by business and other corporate sources to the research effort of universities remains low. In 1998-99 approximately $2.6 billion was spent on research and development in the higher education sector, but only $0.136 billion came from industry, 5.2% of the total. Despite some very promising commercial outcomes from CRCs and other recent cooperative research initiatives involving industry, and in spite of the fact that universities themselves are undertaking a new 'enterprise' strategy with regard to income generation and internal incentives, the higher education system has not been used as the kind of innovation node or hub for the development and dissemination of innovation which has occurred in other countries, and which some policy-makers hoped for here.

Part of the reason for this lies in a slow Australian industry take-up of the opportunities in university R&D, a slowness reinforced by the lack of venture capital and the reduction in taxation subsidies. However, it needs to be emphasised that the other part of the reason derives directly from education policy itself. It lies in the policy settings and goals embedded in the higher education and further education sectors, where fiscal priorities have overtaken the consideration of other policy objectives. In the outcome, the erosion of university capacity and energies that has been brought about by the coupling of rapid entrepreneurial development to declining levels of public investment per student – giving rise to the difficult conjunction of intense cost pressures, a major investment in new income-generating activities, and a declining capacity for basic research – has probably reduced the attractiveness of universities as sites for industry investment.

The policy lesson is that if industry is to effectively utilise higher education infrastructure as a source of private knowledge goods, that infrastructure must be in a tip-top state. In other words, higher education provides the public goods that underpin the production of private goods by other agents. This policy logic is followed in Finland, where national investment dovetails nicely with Nokia's R&D. It is in this sense that universities do not have to be a business to serve business, though they *do* need to be highly business-aware. But once a university system ceases to produce first class public goods, it has missed the main contribution it can make to the nation's short and long-term capacity in innovation.

4. R&D, New Technology and Trade in the Global Knowledge Economy

As noted in Section 2 above, there are increasing signs that Australia is falling off the pace in terms of adjustment to the knowledge economy. In addition to investment in education, three other areas where there is real cause for concern are research and development, the information industries, and trade in knowledge-intensive goods and services. Each of these areas is now reviewed in more detail.

Research and Development

Other than trends in education (Section 3 above), the major weakness in Australia's investment in knowledge lies in R&D and innovation. While the broader concept of

innovation – the application of knowledge new to the organisation in many diverse areas – is the one that is most relevant to our present discussion, internationally comparative data on innovation remains limited. Our review here will be focused on R&D.

Complete data on the components of expenditure on R&D are normally assembled only every two years in Australia, although annual data are available on business expenditure and on some other components. The full data are summarised in Table 19, for 1992-93 to 1998-89, on a biennial basis. This table shows expenditure on R&D, and its components, in terms of both current prices and chain volume measures and as a share of GDP.

Table 19. Trends in gross spending on R&D, Australia, 1992-93 to 1998-99

	1992-93	1994-95	1996-97	1998-99
Current prices				
Business	2861.9	3508.3	4246.9	3991.7
Government				
Commonwealth	1155.4	1193.3	1264.2	1192.6
State	668.5	782.8	812.7	879.0
Higher education	1695.2	1829.6	2307.6	2602.7
Private non-profit	101.9	152.7	173.4	183.9
Total	**6482.9**	**7466.7**	**8804.8**	**8850.0**
Share of GDP (%)				
Business	0.67	0.74	0.80	0.67
Government				
Commonwealth	0.27	0.25	0.24	0.20
State	0.16	0.17	0.15	0.15
Higher education	0.40	0.39	0.43	0.44
Private non-profit	0.02	0.03	0.03	0.03
Total	**1.52**	**1.58**	**1.65**	**1.49**
Chain volume measures				
Business	3247.1	3844.8	4437.6	3991.7
Government				
Commonwealth	1298.9	1297.7	1312.6	1192.6
State	752.2	850.3	842.2	879.0
Higher education	1957.9	2042.7	2435.0	2602.7
Private non-profit	117.9	170.9	182.6	183.9
Total	**7374.0**	**8206.4**	**9210.0**	**8850.0**

Source: ABS (2000d).

The main messages of Table 19 are familiar in the Australian public debate, and need not be dwelt on at length here. In current values, total expenditure on R&D was only

marginally higher (by 0.5%) in 1998-99 than in 1996-97. This corresponded to a fall in real terms of 3.9% and a decline as a share of GDP from 1.65% to 1.49%. Thus the share of the nation's GDP devoted to R&D fell by 10% over this two-year period. The fall was concentrated in two sectors – business expenditure, which fell 10% in real terms and from 0.80% to 0.67% of GDP – and Commonwealth Government spending on R&D, which fell 9.1% in real terms and from 0.24% to 0.20% of GDP. R&D spending by the higher education sector rose as a share of GDP, while spending by the private non-profit sector became somewhat more important.

Table 20. Investment in R&D, Australia and selected OECD countries, 1992-98, (share of GDP)

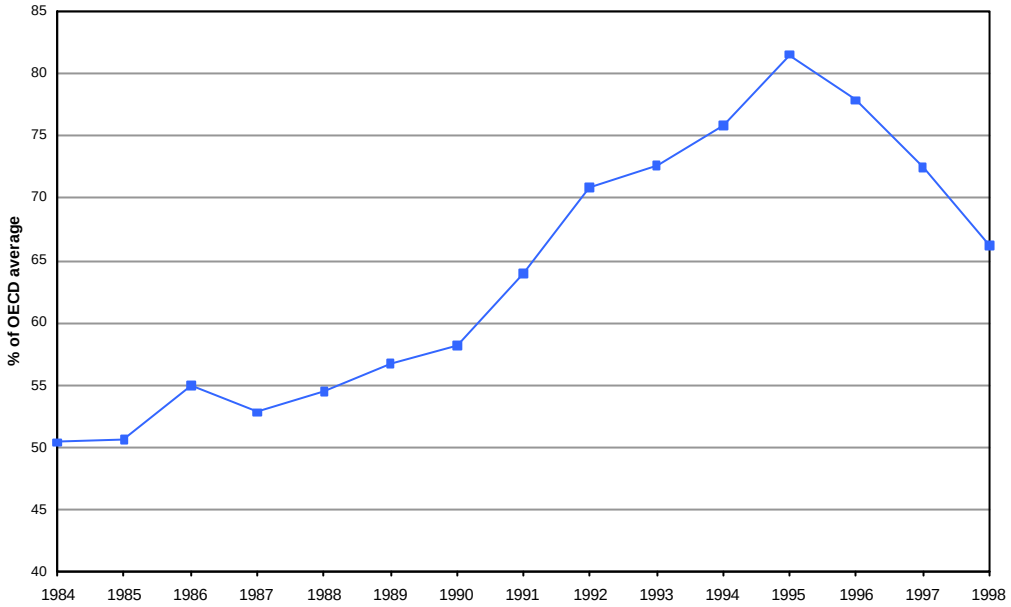
	1984	1991	1992	1993	1994	1995	1996	1997	1998	1984-95 *change (%)*	1995-98 *change (%)*
OECD	2.20	2.28	2.24	2.19	2.14	2.16	2.18	2.21	2.25	-1.8	4.2
Australia	1.11	1.46	1.59	1.59	1.62	1.76	1.70	1.60	1.49	59.0	-15.4
USA	2.73	2.81	2.74	2.62	2.52	2.61	2.66	2.71	2.74	-4.4	5.0

Source: OECD Main Science and Technology Indicators (2000d) and estimates by the authors. For the years in which components of Australian R&D expenditure other than business spending are not available, aggregate figures have been created by interpolating a value for these components. Australian data are for the financial year starting on 1 July in the year shown.

In an international context, there are two quite striking aspects of Australian R&D performance over the past two decades (see Table 20 and Figure 3). One is the rapid growth in Australian R&D spending between about 1984 and 1995, both as a share of GDP and in relationship to OECD spending levels. Australian R&D spending increased from 1.11% of GDP in 1983-84 to 1.76% of GDP, an increase in this ratio of 59%. With the overall OECD spending ratio declining significantly between 1990 and 1995, the rise in Australian spending was very pronounced in relative terms. From being just over 50% of the OECD figure in 1984, the Australian figure rose to 81.6% in 1995. This represented a very important shift in the relative allocation of resources for R&D in Australia. (For further analysis of these developments, see Sheehan et al. 1995.)

The second notable fact has been the decline in relative spending in Australia since 1995-96. At a time in which R&D spending is increasing in many major countries, expenditure on R&D in Australia has fallen significantly in real terms. As a share of GDP it has fallen by 15%, from 1.76% in 1995-96 to 1.49% in 1998-99. The share of GDP devoted to R&D in Australia has fallen from 81.6% of the OECD share in 1995 to 66.6% in 1998 – about half of the gain achieved over 1984-1995 was lost in these three years. Nor is there any reason to believe that this decline in Australia's relative R&D position ceased in 1998-99.

Figure 3. Australian R&D spending (as a share of GDP), as a proportion of total OECD spending levels



Source: Derived from the data in Table 20.

The Information Industries

It is widely argued that the information industries are both key drivers of the global knowledge economy and central sources of growth in modern economies. For the USA, for example, a range of studies have shown that information technologies and the information industries have been driving forces behind the rapid economic growth of the US economy in the second half of the 1990s (Department of Commerce 1999). This impact occurs through two main channels – rapid growth in output and employment in the information industries themselves, and the rapid adoption of information technology goods and services across all industries.

In Australia, it has been widely held that, in spite of having failed to develop a major role in the creation and manufacture of IT products, the nation is relatively well advanced in other information industries and in the application of IT goods and services in businesses generally. Thus the information industries should provide a strong impetus to growth in Australia also. But recent research (Houghton 2001) has shown that, over the past few years, this seems not to have been the case. The information industries as considered by Houghton include four industry sectors: communication services, information-based services, communication and information equipment and information products (content or software). Some of the main conclusions reached by Houghton include:

- Australia's position in the communication and information equipment area, which had been relatively small but growing, has declined significantly in recent years.

- In spite of the importance of the information industries, and their strong growth globally, employment in Australia in these industries has barely increased at all since 1995-96, and employment in ICT specialist businesses has fallen.

- While the number of firms engaged in these industries has continued to grow, that growth has been slower since 1995-96 than was the case for the previous three years, and has been largely composed of an increase in the number of very small firms.

- In terms of spending on the ICT industries, Australia rates relatively highly among OECD countries, although in part this is due to the impact of distance on spending on telecommunications infrastructure.

- The overall market for the products and services of the information industries continued to grow strongly in Australia, with the total market estimated at about $75 billion in 2000. But the share of domestic production in total income from those sales declined sharply between 1995-96 and 1998-99.

- More generally, in terms of the contribution of the information industries to the national economy, Australia ranks last of the 18 OECD countries for which information is available.

While space considerations prevent a full discussion, evidence for some of these important conclusions will now be provided.

Table 21. Employment in the information industries, 1992-93 to 1998-99

	1992-93	1995-96	1998-99	Share 1998-99	Growth 1992-3 to 1998-9
	no.	*no.*	*no.*	*(%)*	*(%)*
Communication services	68,000	91,701	74,467	30.3	9.5
Information services	30,071	55,028	74,395	30.3	147.4
Manufacturing & wholesale	60,613	83,208	79,931	32.5	31.9
Information content	13,308	15,155	16,982	6.9	27.6
Total	**171,992**	**245,092**	**245,775**	**100.0**	**42.9**

Source: Houghton (2001), based on ABS sources.

One of the most striking of these findings is in terms of employment in the information industries, data on which are provided in Table 21. After growing by 42.5% between 1992-93 and 1995-96, employment in these industries increased by only 0.3% in the three years to 1998-99. This cessation of growth reflects two main factors: a big decline (18.8%) in employment in the communications services industries, as service providers cut back sharply on staff levels, and a smaller decline in the manufacturing and wholesale area (3.9%). While the information services and content areas continued to grow, by 35.2% and 12.1% respectively, this growth barely

offset the declines in the other two areas. Specialist ICT businesses make up about 80% of total employment in the information industries, and in these businesses employment actually fell by about 2,500 persons between 1995-96 and 1998-99.

This weakness in employment in the information industries after 1995-96 is in turn related to trends in the number of businesses active in these industries. As Table 22 shows, the overall number of businesses operating in the information industries continued to rise after 1995-96, increasing by 30.4% between 1995-96 and 1998-99. But the overwhelming share of the additional jobs was in the information services sector, and jobs in the manufacturing and wholesale sector fell by 20.7%.

More important, perhaps, is the change in the number of firms in the information industries by size (Table 23). Between 1995-96 and 1998-99, the number of medium sized firms (20-99 employees) actually fell, and there was only a small increase in large firms. Apart from this, all of the increase in firm numbers was in firms with less than 20 employees, which increased by 4530 firms or 35.4%. Small firms operating in information services now account for a dominant share of the Australian information industries.

Table 22. Number of businesses in the information industries, 1992-93 to 1998-99

	1992-93	1995-96	1998-99	Share 1998-99	Growth 1992-3 to 1998-9
	no.	*no.*	*no.*	*(%)*	*(%)*
Communications services	191	410	869	4.3	355.0
Information services	4,886	9,673	14,731	72.4	201.5
Manufacturing & wholesale	4,383	5,207	4,131	20.3	-5.7
Information content	37	308	611	3.0	-
Total	**9,497**	**15,598**	**20,342**	**100.0**	**114.2**

Source: Houghton (2001), based on ABS sources.

It is likely that an industry which consists primarily of small firms operating in the information services area will not be able to compete effectively with the large international companies which play such a decisive role globally. In fact, one of the most disturbing trends of the period since 1995-96 has been the falling share of the large Australian market which has been met by Australian providers. As shown in Figure 4, the share of domestic production in total income from Australian sales has fallen sharply for the packaged software and communications and ICT hardware markets.

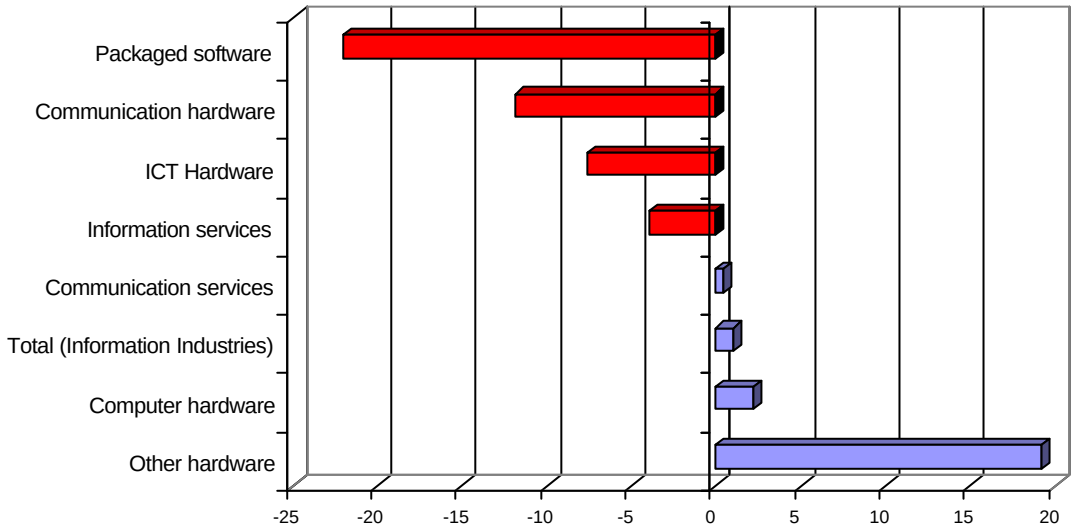
Table 23. Size of ICT specialist businesses by employment, June 1999 (number of businesses)

	Small 0-19	Medium 20-99	Large 100+	Total
1992-93	6,827	299	79	7,205
1995-96	12,798	591	145	13,535
1998-99	17,328	589	155	18,071

Sources: Houghton (2001), based on ABS (various years) *Information Technology Australia*, 8126.0, Canberra.

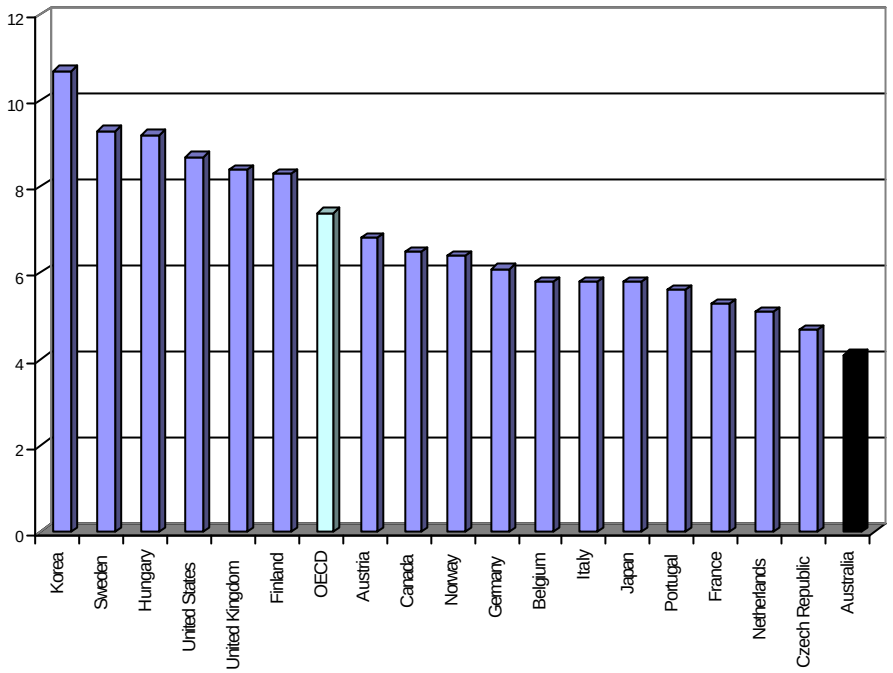
As Houghton concludes, 'it appears that Australia's information industries are failing to hold their own against competition from overseas products' (Houghton 2001, p. 21). The communications and information services are still much less exposed to global competition than the product industries, although that competition is intensifying rapidly.

Figure 4. Change in the share of domestic production in total income from sales by sector, 1995-96 to 1998-99 (%)



Note: ICT Hardware is the sum of communication hardware, computer hardware and other hardware.
Source: CSES analysis.

Figure 5. Share of ICT industries value added in total business sector value added in OECD countries, circa 1998 (%)



Source: OECD (2000) *Measuring the ICT Sector*, OECD, Paris.

This weakening trend in Australia's information industries belies the widely held belief that this is an area where this country is coping reasonably well with the emergence of the global knowledge economy. Indeed, comparative data on the share of value added of the ICT industries in total business sector value added (Figure 5) show starkly the limitations of these industries in Australia. Of the 18 OECD countries for which data are available, Australia has the smallest share ICT value added of any country. The information industries may be growing rapidly around the world, but Australia's position within them is small and seems to be declining in relative terms.

Trends in Merchandise Trade

Currently there is much discussion about the falling value of the Australian dollar and the level of Australia's overseas debt. It may thus be appropriate to conclude this report by discussing those issues in relation to Australia's long-term pattern of failure to adequately invest in knowledge and in knowledge based industries. The link is clearly apparent. One direct consequence of that failure is a very heavy deficit in trade in knowledge intensive goods and services, which is the dominant feature of our current account deficit. This current action deficit is in turn the main factor behind high foreign debt levels.

In view of the technical difficulties of deriving up-to-date trade data on a knowledge intensity classification such as that used by the OECD, we will proceed here in terms of the Australian concept of 'elaborately transformed manufactures' (ETMs). Within ETMs we will concentrate in particular on a group of commodities identified as a focus of special attention in the 1980s, and where exports increased very rapidly

between about 1985 and 1995. The 'Policy Group' (for more detail see Table 25) includes the main knowledge intensive product areas, but also clothing, a continuing focus of policy in Australia.

Table 24. Components of the net position on merchandise trade, Australia, 1985-86 to 1999-2000 (surplus +ve)

	1985-86	1999-2000	1985/6 to1999/2000
	($ million)		(%)
Policy ETMs	-8062	-29756	269.1
Other ETMs	-14160	-31797	124.6
All Other Commodities	19528	52599	169.4
Total Trade Position	-2694	-8954	232.3

Source: Estimates of the authors based on unpublished trade statistics (at the two-digit commodity level) provided by the Australian Bureau of Statistics.

Table 24 demonstrates the relevance of the policy group to the issue of Australia's merchandise trade position, and hence to the level of foreign debt and the value of the $A. By 1999-2000, the overall annual deficit on trade in ETMs was $61.6 billion: the policy group deficit was nearly half, at $29.8 billion. What is more, the policy group deficit had increased almost fourfold since 1985-86, growing at about twice the rate of the deficit on other ETMs.

The six commodities groups which constitute the policy group, and their trade outcomes over the period 1985-86 to 1999-2000, are summarised in Table 25. Data on other ETMs and on merchandise trade as a whole are provided in Table 26.

In addition to the growth in R&D noted above, one of the other notable features of the Australian economy after about 1985 was the rapid growth in ETM exports, and particularly in policy group exports. As shown in Table 25, exports of all policy ETM items grew rapidly between 1985-86 and 1995-96, with group exports increasing by 21.3% per annum. This very rapid rate far outshone the growth in imports (10.2%), so that over this period the deficit on policy group commodities grew less rapidly than imports.

Since 1995-96, the growth in policy and other ETMs exports has slowed sharply (Table 26), while the rate of growth of policy group imports has accelerated. More specifically, the key point is the sharp slowing of the growth of policy ETM exports after 1995-96 (from 21.3% per annum in the earlier period to 9.3% in the latter) at a time at which import growth was accelerating. This in turn led to much more rapid growth in the deficit on policy ETMs – 14.2% per annum in the later period as opposed to 8% per annum in the earlier), and to a deficit in 1999-2000 that was close to $30 billion.

Table 25. Exports, imports and the trade deficit, policy ETMs

	1985-86	1995-96	1999-2000	Per cent change per annum	
				85/6 - 95/6	95/6 - 99/00
				(%)	
Exports					
Pharmaceuticals	147.8	893.2	1713.8	19.7	17.7
Computing equipment	220.7	1901.6	1312.4	24.0	-8.9
Telecommunications	67.3	715.7	1179.4	26.7	13.3
Road vehicles	263.7	1198.1	2810.8	16.3	23.8
Other transport equipment	193.7	1296.4	1670.8	20.9	6.5
Clothing	22.7	318.6	340.3	30.2	1.7
Total	**915.9**	**6323.7**	**9027.5**	**21.3**	**9.3**
Imports					
Pharmaceuticals	394.0	1829.5	3517.5	16.6	17.8
Computing equipment	2174.1	6031.2	7554.5	10.7	5.8
Telecommunications	1466.0	3739.3	6734.8	9.8	15.8
Road vehicles	3771.0	7966.2	12756.8	7.8	12.5
Other transport equipment	605.0	2476.0	5429.1	15.1	21.7
Clothing	568.0	1763.9	2791.1	12.0	12.2
Total	**8978.1**	**23806.1**	**38783.8**	**10.2**	**13.0**
Trade deficit					
Pharmaceuticals	246.2	936.3	1803.7	14.3	17.8
Computing equipment	1953.4	4129.6	6242.2	7.8	10.9
Telecommunications	1398.7	3023.6	5555.5	8.0	16.4
Road vehicles	3507.3	6768.1	9946.0	6.8	10.1
Other transport equipment	411.3	1179.5	3758.3	11.1	33.6
Clothing	545.3	1445.3	2450.8	10.2	14.1
Total	**8062.1**	**17482.4**	**29756.3**	**8.0**	**14.2**

Source: As for Table 24.

Table 26. Exports, imports and the trade deficit, merchandise trade (per cent change)

	1985-86	1995-96	1999-2000	85/86 - 95/96	95/96 – 99/00
Policy ETMs					
Exports	915.9	6323.7	9027.5	21.3	9.3
Imports	8978.1	23806.1	38783.8	10.2	13.0
Trade deficit	8062.1	17482.4	29756.3	8.0	14.2
Other ETMs					
Exports	2726.3	11808.7	12772.5	15.8	2.0
Imports	16886.0	36611.0	44569.1	8.0	5.0
Trade deficit	14159.7	24802.3	31796.6	5.8	6.4
All other commodities					
Exports	28216.5	57757.7	75178.5	7.4	6.8
Imports	8688.9	16899.4	22579.4	6.9	7.5
Trade surplus	19527.6	40858.4	52599.1	7.7	6.5
All merchandise trade					
Exports	31858.7	75890.1	96978.5	9.1	6.3
Imports	34553.0	77316.4	105932.2	8.4	8.2
Trade deficit	2694.3	1426.3	8953.8	-6.2	58.3

Source: As for Table 24.

Australia's failure to invest in knowledge and in knowledge based industries is directly related to the country's problems in terms of external balance, foreign debt and the value of the Australian dollar. Indeed, escalating growth in the deficit on trade in policy ETMs is likely to constrain the nation's options to a significant degree in the years ahead. This constraint will worsen over time, unless there is a change in operating conditions. Such a development is only likely to be brought about by a sea-change in public policy.

Bibliography

Anderson Report (2000) *Australia's Information and Communications Technology (ICT) Research Base: Driving the New Economy*, Report of the Working Party of the Prime Minister's Science, Engineering and Innovation Council, Canberra, December.

Australian Bureau of Statistics (ABS) (2000a) *Schools Australia*, Cat. No. 4202.0, Canberra.

_____ (2000b) *The Labour Force*, Cat. No. 6203.0, Canberra, ABS.

_____ (2000c) *Expenditure on Education*, Cat. No. 5510.0, Canberra, ABS.

_____ (2000d) *Research and Experimental Development: All Sector Summary 1998-99*, Cat. No. 8112.0, Canberra, ABS.

Croes, M. (1999) 'Intangible investments in 15 OECD countries', OECD Working Paper, Paris.

Dawkins, J. (1987) *Higher Education: A Policy Discussion Paper*, Canberra, AGPS.

Department of Commerce (US) (2000) *The Digital Economy 2000*, Washington DC.

Department of Employment, Education and Training (DETYA) (2001) Higher Education statistical collections, accessible via www.detya.gov.au/highered/statinfo.htm

Department of Trade and Industry (DTI) (1998) *Building the Knowledge Driven Economy: Competitive Advantage in the Digital Economy*, London. See http://www.dti.gov.uk/comp/

Dunning, J. (ed.) (2000) *Regions, Globalisation and the Knowledge Based Economy*, Oxford University Press, New York.

Economic Planning Advisory Commission (EPAC) (1996) *Interim Report on Future Child Care Provision in Australia*, Canberra.

Foray, D and Freeman, C (1993) *Technology and the Wealth of Nations*, Frances Pinter, London.

Hill, P. and Russell, J. (1994) *Resource Levels for Government Primary Schools*, University of Melbourne Faculty of Education, Melbourne.

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

Lamb, S. (1998) 'Completing school in Australia: Trends in the 1990s', *Australian Journal of Education*, 42(1): pp. 5-31.

Lundvall, S. (1992) *National Systems of Innovation*, Frances Pinter, London.

Marginson, S. and Considine M. (2000), *The Enterprise University: Power, Governance and Reinvention in Australia*, Cambridge University Press, Cambridge, Mass.

McInnis, C. (2000) *The Work Roles of Academics in Australian Universities*, Evaluations and Investigations Programme 00/5, DETYA, Canberra.

National Council for Vocational Education Research (NCVER) (2000) Statistical collections.

Organization for Economic Cooperation and Development (OECD) (1996) *Technology, Productivity and Job Creation*, Paris.

_____ (1999a) *OECD Science, Technology and Industry Scoreboard 1999: Benchmarking Knowledge-Based Economies*, Paris.

_____ (1999b), *The Knowledge-Based Economy: A Set of Facts and Figures*, Paris.

_____ (2000a) *Education at a Glance*, Paris, OECD.

_____ (2000b) *ANBERD Database*, Paris, OECD.

_____ (2000c) *STAN Database*, Paris, OECD.

_____ (2000d) *Main Science and Technology Indicators*, Paris, OECD.

_____ (2001) *Education at a Glance*, Paris: OECD.

Sheehan, P. and Tegart, G. (eds) (1998), *Working for the Future: Technology and Employment in the Global Knowledge Economy*, Victoria University Press, Melbourne.

Sheehan, P., Pappas, N., Tikhomirova, G. and Sinclair, P. (1995), *Australia and the Knowledge Economy: An Assessment of Enhanced Economic Growth Through Science and Technology*, Centre for Strategic Economic Studies, Victoria University, Melbourne.

Data Appendix

Table A1: Participation of students aged 4 years and under (1999), and spending on pre-primary education (1998), selected OECD countries

Table A2: Expected years of tertiary education (university and non-university combined) for the average 17 year old, selected OECD countries: 1996 and 1999

Table A3: Foreign students as a proportion of all students in tertiary education, selected OECD countries: 1998

Table A4: Student load in higher education, by level of study, domestic and international students, Australia: 1990 to 1999

Table A5: Student load in higher education, by discipline group, domestic and international students, Australia: 1990 to 1999

Table A6: Government outlays on higher education, constant 1989-90 prices and as a proportion of Gross Domestic Product, Australia: 1961-62 to 1997-98

Table A7: Government outlays on higher education per unit of student load, Australia: 1975-76 to 1997-98, five year intervals

Table A8: Total income of higher education institutions by source, Australia: 1990 to 1998

Table A9: Total income of higher education institutions by source, proportional distribution by source, Australia: 1983, 1986 and 1989 to 1998

Table A10: Average academic salaries and compensation in universities in the United States of America, doctoral universities category I, compared to universities in Australia: 1979-1980, 1980-81, 1989-90, 1990-91, 1999-2000 (1)

Table A11: Average academic salaries and compensation in universities in the United States of America, doctoral universities category I, compared to universities in Australia: 1979-1980, 1980-81, 1989-90, 1990-91, 1999-2000 (2)

Table A12: Average academic salaries and compensation in universities in the United States of America, doctoral universities category I, compared to universities in Australia: 1979-1980, 1980-81, 1989-90, 1990-91, 1999-2000 (3)

Table A13: Average academic salaries and compensation in universities in the United States of America, doctoral universities category I, compared to universities in Australia: 1979-1980, 1980-81, 1989-90, 1990-91, 1999-2000 (4)

Table A14: Salaries and career salary structures, public school teachers at the lower secondary level of education, selected OECD countries: 1998

Table A15: International comparison of 8th grade scores in Mathematics and Science, 1995 and 1999, selected OECD countries

Table A16: Expenditure on education and training (all sectors),* including personal benefit payments, by source of expenditure and as proportion of GDP, constant 1989-90 prices, Australia: 1971-62 to 1997-98

Table A1. Participation of students aged 4 years and under (1999), and spending on pre-primary education (1998), selected OECD countries (%)

	Students aged 4 years and under as a proportion of population aged 3-4 years	Spending on pre-primary education, all sources, as a proportion of GDP
	1999	1998
France	118.2	0.7
Belgium	118.2	0.5
Italy	98.0	0.4
Spain	97.0	0.4
New Zealand	85.4	---
Denmark	78.9	1.1
UK	77.4	---
Japan	76.3	0.2
Norway	73.6	0.6
Sweden	66.9	0.6
Germany	65.8	---
Netherlands	49.7	0.4
USA	47.2	0.4
Finland	36.3	0.4
AUSTRALIA	**33.8**	**0.1**
Ireland	27.8	---
Canada	19.7	0.2
Switzerland	19.3	0.2
Korea	16.2	0.1
OECD country average	**60.0**	**0.4**

Source: OECD (2001).

Table A2. Expected years of tertiary education (university and non-university combined) in education institutions, selected OECD countries, 1996 and 1999

	Years of education expected by the average 17 year old in 1996		Years of education expected by the average 17 year old in 1999	
	Full-time only	Full-time and part-time	Full-time only	Full-time and part-time
Finland	3.2	3.2	3.9	3.9
Korea	2.5	2.5	3.5	3.5
Spain	2.5	2.5	2.6	2.8
France	2.6	2.6	2.6	2.6
Norway	2.2	2.8	2.5	3.1
Denmark	2.3	2.3	2.5	2.5
Belgium	---	---	2.4	2.7
Italy	---	---	2.2	2.2
USA	2.2	3.7	2.0	3.6
New Zealand	1.8	3.0	2.0	3.0
Canada	2.7	4.0	2.0	2.7
Netherlands	1.9	2.2	2.0	2.3
Germany	1.8	1.9	2.0	2.0
Ireland	1.7	2.2	1.8	2.4
AUSTRALIA	**1.7**	**3.6**	**1.7**	**3.0**
Sweden	1.6	2.2	1.7	2.9
UK	1.6	2.3	1.7	2.6
Switzerland	---	---	1.4	1.7
OECD country average	**1.8**	**2.3**	**2.0**	**2.5**

Source: OECD (2001).

Table A3. Foreign students as a proportion of all students in tertiary education, selected OECD countries, 1998 (%)

	Proportion of tertiary students * who were foreign students
Switzerland	15.9
AUSTRALIA	12.6
Austria	11.5
UK	10.8
Germany	8.2
France	7.3
Denmark	6.0
Ireland	4.8
Sweden	4.5
New Zealand	3.7
USA	3.2
Norway	3.2
Spain	1.7
Finland	1.7
Italy	1.2
Japan	0.9
Korea	0.1
OECD country average	4.8

* For Australia, universities only.
Source: OECD (2000a).

Table A4. Student load in higher education, by level of study, domestic and international students, Australia, 1990 to 1999

	Domestic student load							
	Doctoral degree	Masters research	Masters coursework	Other postgrad	Bachelor degree	Other undergrad	Other *	Total
1990	6425	4436	9614	22,083	260,062	48,229	3637	354,485
1991	7323	5028	11,987	25,657	297,285	45,395	3370	396,046
1992	9595	6234	14,495	25,851	316,457	26,022	4779	403,433
1993	11,423	7138	15,957	26,542	327,890	16,423	5483	410,857
1994	13,130	7124	16,939	24,186	331,645	11,038	5919	409,980
1995	14,794	6841	18,649	25,070	340,505	9911	6948	422,720
1996	15,729	6338	18,825	25,829	352,902	9841	6695	436,160
1997	16,852	6455	19,756	25,641	369,639	8635	6780	453,758
1998	17,534	6212	19,694	23,671	378,137	8116	7111	460,474
1999	18,716	6059	19,641	21,993	383,703	8353	7571	466,037
2000	19,471	5703	19,160	21,033	383,181	8337	7551	464,435
	International student load							
	Doctoral degree	Masters research	Masters coursework	Other postgrad	Bachelor degree	Other undergrad	Other *	Total
1990	1797	835	1346	1092	16,212	396	359	22,037
1991	2027	961	1671	1291	19,717	445	406	26,517
1992	2166	1044	1857	1289	22,393	315	509	29,572
1993	2425	1034	2354	1180	22,453	194	588	30,228
1994	2744	905	3247	1394	24,914	151	1069	34,426
1995	2800	865	4049	1840	28,337	104	1374	39,367
1996	2941	978	6532	2569	36,623	264	1912	51,817
1997	3049	953	8773	2881	42,711	421	2180	60,969
1998	3119	894	10,938	2648	47,985	458	2321	68,364
1999	3297	900	14,243	2889	53,485	496	2800	78,109
2000	3679	910	19,480	4076	60,833	618	3733	93,328
	All student load							
	Doctoral degree	Masters research	Masters coursework	Other postgrad	Bachelor degree	Other undergrad	Other *	Total
1990	8222	5271	10,960	23,175	276,274	48,625	3996	376,522
1991	9350	5989	13,658	26,948	317,002	45,840	3776	422,563
1992	11,761	7278	16,352	27,140	338,850	26,337	5288	433,005
1993	13,848	8172	18,311	27,722	350,343	16,617	6071	441,085
1994	15,874	8029	20,186	25,580	356,559	11,189	6988	444,406
1995	17,594	7706	22,698	26,910	368,842	10,015	8322	462,087
1996	18,670	7316	25,357	28,398	389,525	10,105	8607	487,977
1997	19,901	7408	28,529	28,522	412,350	9056	8960	514,727
1998	20,653	7106	30,632	26,319	426,122	8574	9432	528,838
1999	22,013	6959	33,884	24,882	437,188	8849	10,371	544,146
2000	23,151	6613	38,640	25,108	444,013	8955	11,284	557,763

* Includes enabling courses, non-award courses and cross-institutional programs.
1990-1993 data for international student load do not tally perfectly with other parts of the DETYA data collection due to data weaknesses.
Source: DETYA (2001).

Table A5. Student load in higher education, by discipline group, domestic and international students, Australia, 1990 to 1999

	Domestic students											
	Business, Admn., Econ. & Law	Computing & Maths	Social Studies	Humanities	Engineering, Processing	Science	Health Science	Education	Visual & Performing Arts	Built Environment	Agriculture, Renewable Resources	Total
1990	73,813	38,058	42,938	40,943	17,420	39,324	30,094	38,643	19,282	8691	5280	354,485
1991	81,282	42,632	48,484	44,984	20,086	44,191	35,308	42,242	21,089	9791	6047	396,046
1992	83,935	41,632	49,473	44,920	22,078	47,037	37,130	39,481	21,401	9610	6735	403,433
1993	85,095	41,506	51,088	44,443	23,397	48,190	39,660	39,154	21,557	9607	7160	410,857
1994	86,078	40,239	50,766	46,108	24,067	48,521	38,729	36,895	21,134	9945	7499	409,980
1995	90,309	41,480	52,820	47,280	24,357	50,010	39,189	37,423	21,792	10,297	7764	422,720
1996	94,563	42,707	55,600	49,207	24,519	50,771	40,014	37,557	22,828	10,819	7575	436,160
1997	100,990	44,419	59,164	51,333	24,605	50,990	39,920	39,763	24,162	10,897	7514	453,757
1998	104,186	45,120	57,867	51,589	25,277	51,970	40,710	40,855	24,427	11,019	7454	460,474
1999	106,276	47,185	57,454	51,604	25,980	51,628	42,099	41,254	24,432	10,877	7248	466,037
2000	104,911	48,318	55,951	50,781	25,983	50,147	43,532	42,795	24,298	10,791	6929	464,435
	International students											
	Business, Admn., Econ. & Law	Computing & Maths	Social Studies	Humanities	Engineering, Processing	Science	Health Science	Education	Visual & Performing Arts	Built Environment	Agriculture, Renewable Resources	Total
1990	7898	4070	1097	1364	2120	2300	1207	455	264	716	546	22,037
1991	9836	4920	1300	1642	2492	2568	1458	611	419	705	566	26,517
1992	11,195	5208	1541	1936	2731	2757	1742	543	513	788	620	29,572
1993	11,280	5363	1688	2144	2761	2709	1714	632	576	765	596	30,228
1994	13,483	5650	1846	2562	3138	2849	1861	695	745	979	617	34,426
1995	15,747	6156	2038	2984	3479	3000	2234	1062	871	1196	600	39,367
1996	22,356	8144	2550	3863	4070	3324	2703	1310	1288	1535	674	51,817
1997	27,602	9284	3074	4576	4519	3494	3123	1330	1581	1768	618	60,970
1998	31,615	10,364	3176	4889	5067	3671	3530	1377	1835	2062	778	68,364
1999	35,238	13,031	3869	5621	5881	3904	4062	1559	2183	2197	563	78,109
2000	40,732	18,043	4496	6540	6726	4446	4620	2035	2754	2350	586	93,328

	All students											
	Business, Admn., Econ. & Law	Computing & Maths	Social Studies	Humanities	Engineering, Processing	Science	Health Science	Education	Visual & Performing Arts	Built Environment	Agriculture, Renewable Resources	Total
1990	81,711	41,128	44,035	42,307	19,540	41,624	31,301	39,098	19,546	9407	5826	376,522
1991	91,118	47,552	49,784	46,536	22,578	46,759	36,766	42,853	21,508	10,496	6613	422,563
1992	95,130	46,840	51,014	46,856	24,809	49,794	38,872	40,024	21,914	10,398	7355	433,005
1993	96,375	46,869	52,776	46,587	26,158	50,899	41,374	39,786	22,133	10,372	7756	441,085
1994	99,561	45,889	52,616	48,670	27,205	51,370	40,590	37,590	21,879	10,924	8116	444,406
1995	106,056	47,636	54,858	50,264	27,836	53,010	41,423	38,485	22,663	11,493	8364	462,087
1996	116,919	50,851	58,150	53,070	28,589	54,095	42,717	38,867	24,116	12,354	8249	487,977
1997	128.592	53,703	62,238	55,909	29,124	54,484	43,043	41,093	25,743	12,665	8132	514,727
1998	135,801	55,484	61,043	56,478	30,344	55,641	44,240	42,232	26,262	13,081	8232	528,838
1999	141,514	60,216	61,323	57,225	31,861	55,532	46,161	42,813	26,615	13,074	7811	544,146
2000	145,643	66,362	60,447	57,321	32,709	54,593	48,152	44,829	27,052	13,141	7515	557,763

Source: DETYA (2001).

Table A6. Government outlays on higher education, constant 1989-90 prices and as a proportion of Gross Domestic Product, Australia, 1961-62 to 1997-98

	Final consumption spending	Spending on new fixed assets	Personal benefits	Total government outlays*	Total outlays minus personal benefits	Total government outlays	Total outlays minus personal benefits
	$ million 1989-90 prices	$ million 1989-90 prices	$ million 1989-90 prices	$ million 1989-90 prices	$ million 1989-90 prices	% of GDP	% of GDP
1961-62	397	221	137	748	611	0.61	0.49
1962-63	402	205	159	765	606	0.57	0.45
1963-64	460	212	168	854	686	0.60	0.48
1964-65	567	241	184	1000	816	0.66	0.54
1965-66	614	262	221	1097	876	0.71	0.56
1966-67	673	293	253	1227	973	0.74	0.59
1967-68	826	310	258	1407	1148	0.82	0.67
1968-69	906	331	300	1550	1250	0.82	0.66
1969-70	982	381	333	1702	1369	0.85	0.69
1970-71	1158	322	390	1870	1480	0.89	0.71
1971-72	1265	397	455	2122	1667	0.98	0.77
1972-73	1361	370	534	2274	1740	1.02	0.78
1973-74	2080	401	426	2916	2490	1.24	1.06
1974-75	2609	587	367	3584	3217	1.50	1.35
1975-76	2675	440	378	3505	3127	1.43	1.27
1976-77	3008	368	357	3735	3379	1.47	1.33
1977-78	3018	305	302	3631	3328	1.41	1.30
1978-79	2919	326	257	3506	3249	1.30	1.20
1979-80	2847	276	216	3343	3127	1.21	1.13
1980-81	2879	221	203	3309	3106	1.16	1.09
1981-82	2922	200	170	3296	3126	1.12	1.06
1982-83	2915	218	162	3301	3139	1.15	1.09
1983-84	2921	231	181	3349	3168	1.10	1.04
1984-85	2773	207	192	3184	2993	1.00	0.94
1985-86	2960	198	197	3352	3155	1.02	0.96
1986-87	2978	262	238	3520	3282	1.05	0.98
1987-88	2887	325	257	3448	3191	0.97	0.89
1988-89	2449	305	447	3181	2734	0.86	0.74
1989-90	2271	318	452	3048	2596	0.79	0.68
1990-91	2619	479	557	3636	3080	0.95	0.80
1991-92	2830	471	660	3943	3283	1.02	0.85
1992-93	2791	700	728	4220	3492	1.05	0.87
1993-94	2694	803	738	4248	3510	1.02	0.84
1994-95	2933	798	778	4528	3750	1.04	0.86
1995-96	2718	799	833	4334	3501	0.95	0.77
1996-97	2820	829	818	4451	3632	0.94	0.77
1997-98	2880	782	796	4420	3624	0.89	0.73

* Includes net expenditure on second-hand fixed assets, a minor category. Public spending excludes the HECS.
Source: Revised and unpublished data from the Australian Bureau of Statistics.

Table A7. Government outlays on higher education per unit of student load, Australia, 1975-76 to 1997-98, five-year intervals

	Student load	Government outlays per unit of student load		Government outlays per unit of student load	
		Final consumption expenditure	Total government outlays	Final consumption expenditure	Total government outlays
	(average of two calendar years)	$ 1989-90 prices	$ 1989-90 prices	1975-76 = 100.0	1975-76 = 100.0
1975-76	228,950	11,683	15,307	100.0	100.0
1976-77	239,150	12,580	15,619	107.7	102.0
1977-78	245,400	12,299	14,794	105.3	96.6
1978-79	248,900	11,726	14,086	100.4	92.0
1979-80	249,850	11,395	13,379	97.5	87.4
1980-81	251,450	11,449	13,158	98.0	86.0
1981-82	254,550	11,479	12,947	98.3	84.6
1982-83	256,756	11,354	12,858	97.2	84.0
1983-84	261,081	11,187	12,827	95.8	83.8
1984-85	269,761	10,279	11,805	88.0	77.1
1985-86	282,359	10,484	11,871	89.7	77.6
1986-87	296,888	10,030	11,856	85.9	77.5
1987-88	316,401	9125	10,898	78.1	71.2
1988-89	341,603	7170	9312	61.4	60.8
1989-90	365,379	6215	8324	53.2	54.4
1990-91	399,543	6554	9101	56.1	59.5
1991-92	427,799	6614	9217	56.6	60.2
1992-93	437,045	6385	9655	54.7	63.1
1993-94	442,746	6084	9594	52.1	62.7
1994-95	453,247	6471	9990	55.4	65.3
1995-96	475,032	5722	9123	49.0	59.6
1996-97	501,352	5625	8878	48.1	58.0
1997-98	521,783	5518	8471	47.2	55.3

Total outlays includes student assistance.
Source: Revised and unpublished data from the Australian Bureau of Statistics.

Table A8. Total income of higher education institutions by source, Australia, 1990 to 1999 ($ million, 1989-90 prices)

	Funding of higher education institutions from:								
	Governments	Higher Education Contribution Scheme	International student fees	Domestic student fees (award courses)	Other fees and charges *	Donations & endowments	University investments	Other	Total
1990	3272.274	562.518	136.714	11.962	251.423	110.260	252.357	183.560	4781.068
1991	3509.671	613.520	207.671	18.602	289.723	108.632	226.309	275.186	5249.316
1992	3620.920	746.701	269.239	26.027	289.896	102.001	201.120	395.041	5650.946
1993	3646.860	786.950	317.217	36.780	350.548	94.396	206.223	607.260	6046.234
1994	3949.751	811.146	355.376	50.671	279.607	60.508	119.741	734.917	6361.718
1995	4008.887	819.669	400.938	67.032	332.033	77.514	277.185	864.285	6847.543
1996	4170.021	831.725	473.571	80.186	407.397	75.120	265.904	875.373	7179.297
1997	3972.290	1064.754	552.238	99.865	427.846	90.256	287.302	739.295	7233.846
1998	3834.152	1268.901	613.027	141.784	430.876	100.180	261.139	744.512	7394.571
1999	3714.201	1441.201	686.349	169.519	484.911	115.950	239.034	720.355	7571.519

* Includes fees for non-award continuing education courses, and part of fee-for-service research and consulting income (the remainder of research and consulting activities are included under 'other').
Source: DETYA (2001).

Table A9. Total income of higher education institutions by source, proportional distribution by source, Australia, 1983, 1986 and 1989 to 1999, (%)

	Proportion of total funding of higher education institutions from:						
	Governments	Higher Education Contribution Scheme	Commercial fees and charges *	Donations & endowments	University investments	Other *	Total
1983	89.9	0	(included in 'other')	2.9	3.8	3.4	100.0
1986	87.3	0	(included in 'other')	3.4	4.3	5.0	100.0
1989	70.29	11.41	5.89	3.20	5.26	3.96	100.00
1990	68.44	11.77	8.37	2.31	5.28	3.84	100.00
1991	66.86	11.69	9.83	2.07	4.31	5.24	100.00
1992	64.08	13.21	10.36	1.81	3.56	6.99	100.00
1993	60.32	13.02	11.65	1.56	3.41	10.04	100.00
1994	62.09	12.75	10.78	0.95	1.88	11.55	100.00
1995	58.54	11.97	11.68	1.13	4.05	12.62	100.00
1996	58.08	11.59	13.39	1.05	3.70	12.19	100.00
1997	54.91	14.72	14.93	1.25	3.97	10.22	100.00
1998	51.85	17.16	16.03	1.35	3.53	10.07	100.00
1999	49.05	19.03	17.71	1.53	3.16	9.51	100.00

* In data for 1983 and 1986, 'other' includes income from continuing education, the provision of consulting and research services, and other commercial operations (see Dawkins 1987, p. 76).
Source: DETYA (2001).

Table A10. Average academic salaries and compensation in universities in the US, doctoral universities category I, compared to universities in Australia: 1979-1980, 1980-81, 1989-90, 1990-91, 1999-2000 (1)

	Australia: Salary only for 12 months		
	Professor	Level C	Level B
	AUS$	AUS$	AUS$
1979-80	34,119	24,029	19,212
1980-81	40,067	28,219	22,562
1989-90	65,837	46,800	37,710
1990-91	67,812	48,204	38,841
1999-00	91,556	64,631	53,806

Australian salaries award rates for universities only, as at 1 January 1980 for 1979-80, 1 January 1991 for 1990-91, and average salaries in October 1999 for 1999-00. Level C (formerly Senior Lecturer) salary at the third top of 6 steps; Level B (formerly Lecturer) salary at the third top of 6 steps/ fourth top of 8 steps. The 1991 rates fall prior to award salary increases 23 July 1991 and 23 July 1992, a cumulative 12.1 per cent for Professors. The Australian salary covers 12 months, and includes some elements (such as part of superannuation) outside the base salary in the USA, while excluding other elements of remuneration (part of superannuation, salary loadings, etc.).

Table A11. Average academic salaries and compensation in universities in the US, doctoral universities category I, compared to universities in Australia: 1979-1980, 1980-81, 1989-90, 1990-91, 1999-2000 (2)

	Australia: Salary only for 12 months		
	Professor	Level C	Level B
	US$	US$	US$
1979-80	32,650	22,994	18,385
1980-81	38,342	27,004	21,590
1989-90	47,536	33,791	27,227
1990-91	49,139	34,930	28,146
1999-00	69,624	49,149	40,917

Conversion from AUD to USD using OECD purchasing power parity data, *not* exchange rates. Purchasing power parity takes the respective national costs of living into account. PPP indices expressed as the AUD value of $USD $1.00, are 1979-80, 1.045; 1980-81, 1.045; 1989-90, 1.385; 1990-91, 1.380; 1999-00, 1.315.

Table A12. Average academic salaries and compensation in universities in the US, doctoral universities category I, compared to universities in Australia: 1979-1980, 1980-81, 1989-90, 1990-91, 1999-2000 (3)

	United States: Average salary + compensation for 10 months		
	Professor	Associate Professor	Assistant Professor
	US$	US$	US$
1979-80	35,920	26,380	21,370
1980-81	39,390	29,020	23,430
1989-90	72,970	53,060	44,680
1990-91	76,800	55,820	47,000
1999-00	107,039	75,469	63,607

US salaries and compensation average for all fields of study, for all Doctoral Level I universities for the financial year. US salaries exclude summer term earnings, stipends, extra loadings etc. Typically they cover 81.8 per cent of the calendar year. Salaries plus compensation are approximately equal to an average 12 months of salary only.

Table A13. Average academic salaries and compensation in universities in the US, doctoral universities category I, compared to universities in Australia: 1979-1980, 1980-81, 1989-90, 1990-91, 1999-2000 (4)

	Australian salary as proportion of US salary + compensation (both expressed in US$)		
	Professor	Level C	Level B
	%	%	%
1979-80	90.90	87.16	86.03
1980-81	97.34	93.05	92.15
1989-90	65.14	63.68	60.94
1990-91	63.98	62.58	59.89
1999-00	65.05	65.12	64.33

Each of the national data used in the comparison exclude some elements of total remuneration. USA salary plus compensation excludes summer term earnings plus minor further remuneration, while Australian salary excludes part of remuneration. The exclusions from the American data are probably larger, suggesting that if anything, the data over-estimate Australian remuneration relative to American, i.e. the disparity between academic earnings in the two nations might be slightly greater than suggested here. OECD purchasing power parity ratios.

Sources: Annual survey of Faculty remuneration in *Academe*, American Association of University Professors ; National Tertiary Education Union.

Table A14. Salaries and career salary structures, public school teachers at the lower secondary level of education, selected OECD countries, 1998

	Starting salary, teacher with minimum training	Salary at top of scale, teacher with minimum training	Years from starting salary to top salary
	US$ p.a.	US$ p.a.	years
Spain	27,506	40,806	42
Korea	24,150	66,269	41
Italy	21,108	31,546	35
France	22,579	42,697	34
Japan	21,899	52,867	31
USA	23,581	43,458	30
Germany	32,769	43,156	28
Norway	19,565	25,702	28
Netherlands	25,515	38,988	24
Ireland	23,303	40,708	22
Finland	20,660	29,127	20
Scotland	19,658	32,679	11
Denmark	25,375	31,000	10
AUSTRALIA	25,775	36,175	8
New Zealand	19,863	32,260	8
England	22,661	52,023	n.a.
Chile *	12,711	21,237	30
Malaysia *	12,535	27,417	29
Thailand *	6412	42,867	37

* 1997 data.
Source: OECD (2000a).

Table A15. International comparison of 8th grade achievement scores in Mathematics and Science, 1995 and 1999, selected OECD countries

	8th grade student achievement scores in Mathematics				8th grade student achievement scores in Science			
	mean score		standard deviation		mean score		standard deviation	
	1995	1999	1995	1999	1995	1999	1995	1999
Korea	581	587	85	79	546	549	83	85
Japan	581	579	79	80	554	550	77	76
Belgium (Flemish)	550	558	75	77	533	535	76	69
Netherlands	529	540	76	73	541	545	76	77
Hungary	527	532	79	85	537	552	79	84
Canada	521	531	72	73	514	533	82	78
AUSTRALIA	**519**	**525**	**85**	**80**	**527**	**540**	**94**	**87**
Czech Republic	546	520	75	79	555	539	77	80
USA	492	502	84	88	513	515	96	97
England	498	496	85	83	533	538	92	91
New Zealand	501	491	82	89	511	510	90	93
Italy	491	485	91	86	497	498	86	88
OECD country mean	**528**	**529**	**---**	**---**	**530**	**534**	**---**	**---**

* England only.
Source: OECD (2000a).

TableA16. Expenditure on education and training (all sectors),* including personal benefit payments, by source of expenditure and as proportion of GDP, Australia, 1971-62 to 1997-98

	GDP	Public sources	Private sources	Total education spending	Public sources	Private sources	Total education spending	GDP	Public source education spending
	$ million 1989-90 prices	$ million 1989-90 prices	$ million 1989-90 prices	$ million 1989-90 prices	% of GDP	% of GDP	% of GDP	1975-76 = 100.0	1975-76 = 100.0
1971-72	217063	8503	1085	9587	3.9	0.5	4.4	88.5	61.6
1972-73	222832	9135	1087	10221	4.1	0.5	4.6	90.8	66.2
1973-74	235844	10553	899	11451	4.5	0.4	4.9	96.1	76.5
1974-75	238790	13036	701	13737	5.5	0.3	5.8	97.3	94.4
1975-76	245396	13802	755	14557	5.6	0.3	5.9	100.0	100.0
1976-77	254095	14281	752	15033	5.6	0.3	5.9	103.5	103.5
1977-78	256674	14873	765	15638	5.8	0.3	6.1	104.6	107.8
1978-79	270391	14837	777	15614	5.5	0.3	5.8	110.2	107.5
1979-80	276289	14478	681	15159	5.2	0.2	5.5	112.6	104.9
1980-81	284273	14875	807	15682	5.2	0.3	5.5	115.8	107.8
1981-82	294404	15246	860	16106	5.2	0.3	5.5	120.0	110.5
1982-83	287646	15599	897	16497	5.4	0.3	5.7	117.2	113.0
1983-84	303286	16159	1024	17183	5.3	0.3	5.7	123.6	117.1
1984-85	318955	16492	1157	17650	5.2	0.4	5.5	130.0	119.5
1985-86	328927	17096	1194	18290	5.2	0.4	5.6	134.0	123.9
1986-87	336231	17200	1478	18678	5.1	0.4	5.6	137.0	124.6
1987-88	357077	16612	1576	18188	4.7	0.4	5.1	145.5	120.4
1988-89	371564	16472	1901	18374	4.4	0.5	4.9	151.4	119.3
1989-90	383497	16657	2316	18973	4.3	0.6	4.9	156.3	120.7
1990-91	384323	17885	2646	20531	4.7	0.7	5.3	156.6	129.6
1991-92	386604	18950	2679	21630	4.9	0.7	5.6	157.5	137.3
1992-93	402816	19682	2859	22542	4.9	0.7	5.6	164.1	142.6
1993-94	417318	19665	2991	22656	4.7	0.7	5.4	170.1	142.5
1994-95	436657	20251	3060	23311	4.6	0.7	5.3	177.9	146.7
1995-96	456739	20434	3354	23787	4.5	0.7	5.2	186.1	148.0
1996-97	471394	21438	3664	25102	4.5	0.8	5.3	192.1	155.3
1997-98	494375	21944	4004	25948	4.4	0.8	5.2	201.5	159.0

* Excludes on-the job industry financed training. Private spending includes only private spending financed from private sources. The HECS is defined as private not public.
Source: Revised and unpublished data from the Australian Bureau of Statistics.