World Transactions on Engineering and Technology Education
Vol.1, No.1, 2002

Financial support for technology education

Robert K. Duggins

University College (UNSW), Australian Defence Force Academy
Canberra, Australia

ABSTRACT: Information has been gathered from a number of sources to enable comparisons to be made between the funding levels in OECD countries in research and development and tertiary education. The distillation of the data has revealed that there are surprisingly large differences. In funding per tertiary student, for example, leading Japanese universities receive more than four times as much as corresponding ones in Australia. Furthermore, the disparity is increasing with no evidence of the trend changing. Public investment in tertiary education in Australia, expressed as a percentage of GDP, was about the OECD average in 1996-1997, but has fallen in each year since then and is predicted to fall further in each of the next three years. Engineering and technology education will continue to suffer much like other disciplines, but a small benefit might flow from a recent Government undertaking to give financial encouragement to industry/university research interaction.

GOVERNMENT FUNDING OF RESEARCH AND DEVELOPMENT IN THE OECD COUNTRIES.

Analysis of annual expenditure of government funding towards research and development has yielded some interesting results. Table 1 gives the average data for the Organization for Economic Development (OECD) as a whole and for Australia in particular. This information was provided in October 2001 by Australia's so-called *Group of Eight* research-oriented universities.

Table 1: Annual expenditure (in $ billion). Actual amounts for the period 1996-2001 and projected for 2001-2005.

Period	OECD	Australia
January 1997	10.73	9.25
January 1999	12.15	9.05
January 2001	14.00	9.04
January 2003	15.50	10.25
January 2005	17.07	10.70

The figures in Table 1 show that, in the OECD countries, expenditure has risen approximately uniformly (by about one billion dollars per year) during the past five years, from about $10.7 billion dollars at the end of 1996 to the present amount of $14 billion. The gradient is expected to remain unchanged during the next four years with expenditure reaching almost $18 billion by the end of 2005. If this expectation proves to be accurate, there will have been a 67% increase over the nine-year period.

Such a creditable rise, sustained over a long period, provides convincing evidence that the OECD countries attach considerable and increasing importance to research and development in relation to their future well-being. Engineering and technology can be expected to play a major role in view of the OECD's stated objectives; strong emphasis is to be given to the application of knowledge, innovation and applied research based on interaction with industry.

The right-hand column shows the corresponding data for Australia in particular. Clearly they are much lower than the OECD ones and have not risen; expenditure has been fairly constant for the past five years at $9.2 billion. It is predicted that there will be a modest rise to only $11.3 billion by the end of 2005 so that, in percentage terms, Australian expenditure was low at 85% of OECD at the start of the nine-year period but will be lower still at 63% at the end.

Clearly this low level of government funding in Australia for research and development is a cause for concern. The accumulated shortfall has been quantified by the Australian Vice-Chancellors' Committee (AVCC); it has calculated that an injection of $14 billion will be required if the nation is to regain its former position in the OECD rankings [1].

FUNDING OF TERTIARY EDUCATION IN THE OECD COUNTRIES

The focus will now turn from research and development expenditure to student funding data, recognising that there is not necessarily a correlation between the two but noting also that both have an impact on engineering and technology education.

In contrast to the previous information given in Table 1, where comparisons were limited to Australia and the OECD average, comparisons can be made between selected universities in individual OECD countries in Table 2 (adjustments have been made using a purchasing price parity model to facilitate such international comparisons).

Table 2: Funding per student at leading international universities.

Leading International University Group	Funding
Australia (top 8 universities)	$US 12,341
Canada (UBC, Toronto)	$US 15,376
Korea (Chongnam, Seoul)	$US 17,521
UK (13 leading universities)	$US 21,886
UK (Imperial, Oxford, Cambridge, UCL)	$US 32,720
USA (8 state universities)	$US 35,162
Hong Kong (4 universities)	$US 37.965
Japan (6 leading universities)	$US 56,190

It can be seen from Table 2 that the levels of student funding are very different from each other for the various countries. For example, at one end of the spectrum are the eight top Australian universities for which the average funding per student is $US 12,341; at the other end are the six leading Japanese universities for which the average figure is more than four times greater at $US 56,190.

For the sake of conciseness, data for other OECD countries have been omitted from the table. Suffice to say that in 2000, Australia ranked 20th out of 28 OECD nations in the educational attainment levels of 25 to 34 year olds – a disappointing outcome which is no doubt related to funding provision and its decline over time. Between 1991 and 1997, the nation experienced the second (to Canada) largest decrease in the funding of tertiary education relative to Gross Domestic Product (GDP) among the OECD countries.

OECD data also quantify the *private* funding of universities and this will be considered later. Here it suffices to state that, after South Korea, the USA and Japan, Australia has become the country in which the largest *private* funding, including student/graduate contributions, is made. A consequence is that Australian students and graduates now meet a high fraction of their course costs measured in both historical and international terms.

The inevitable conclusion regarding *public* funding, however, is that it is no better for tertiary education than it is for research and development considered earlier. As Rupert Murdoch recently stated, there is no country in the developed world where there is a more urgent need for improvement.

FUNDING OF TERTIARY EDUCATION IN AUSTRALIA

Reference was made in the previous paragraphs of funding relative to GDP for a number of OECD countries and here it is useful to quantify this relativity for Australia in particular. Table 3 has been compiled from information released in November 2000 by the relevant Government Department (DETYA) [2]. Table 3 reveals how the percentage of GDP has changed with the passing of time.

Table 3: Tertiary funding in Australia as a percentage of GDP.

Period	% GDP	Period	% GDP
1996-1997	0.720	2000-2001	0.585
1997-1998	0.698	2001-2002	0.567
1998-1999	0.643	2002-2003	0.547
1999-2000	0.617	2003-2004	0.529

In 1996-1997, Australia's direct public investment in tertiary education as a percentage of GDP was about average for OECD countries, namely 0.72%. Table 3 shows that in each year since that time, the percentage has fallen progressively by about one fifth to 0.57%. Sadly, DETYA sees no sign of this descent being halted and expects the percentage to fall to about 0.53% in 2003-2004. Accordingly, Australia's unenviable near-record (only one OECD country suffered a greater decrease in funding than Australia in the period 1991 to 1997) looks set to continue into the future.

Making the situation even harder to accept is that, during the same period, Australia's financial well-being has improved. The predicted continuing growth in GDP should provide the basis for additional investment that would not just reverse the decline but allow the reversal to occur without adversely affecting other budget areas. A modest increase in expenditure on higher education against GDP of about 0.1% would provide an additional $700 million a year over the next decade.

It is interesting to compare this hypothetical amount with the figure recently presented by the Australian Vice-Chancellors' Committee (AVCC) for the reduction in public investment in Australia's universities for the period 1996-2000. The Committee calculated it to be $546 million with decreases occurring each year – a cause for *grave concern* [1].

The year-by-year reduction and the changing pattern of resources are shown in Figure 1 [2]. Inflation having been taken appropriately into account, the histogram shows that the current total revenue stands at about $9 billion.

Particularly conspicuous is the substantial decrease in the contribution from Commonwealth grants, now less than half the total. Also revealed are the contrasting major increases in most of the other components of income – fees, charges and students/graduates' contributions via the Higher Education Contribution Scheme (HECS). Incidentally, as an illustration of HECS payments, engineering and technology students are required to pay $5,015 per annum in 2001, which amounts to about a third of the true cost of their education.

As the figure shows, the contribution from HECS is now large and rapidly getting larger. However, as the AVCC points out, this does not lead to more income overall.

> *The Government determines the total amount that universities should receive and balances its contribution against the students' to ensure universities receive what it considers to be the appropriate amount*.

The following additional data provide further evidence of this compensating effect.

- In 1996, Commonwealth base operating grants were $4,259m, the HECS revenue was $492m, and the two components together were $4,751m.
- Four years later the corresponding amounts were $3,762m, $1,035m and $4,797m.
- Although the separate components exhibit considerable changes in magnitude, their sum totals differ by less than 1%.

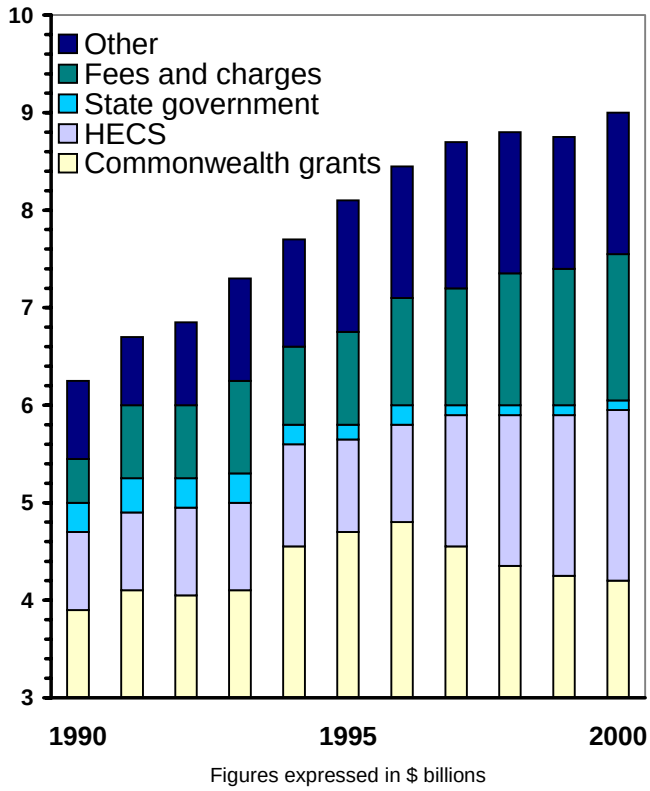

Figure 1: Total higher education revenue for 1990-2000.

The above compensation and the changing pattern of resources do not mean, of course, that the universities have escaped financial damage. As the Minister for Education himself has stated, it is manifest in many ways, notably in smaller numbers of teaching staff and less frequent lecture and tutorial contact.

Table 4 shows that the student/staff ratio has grown about 40% during the past decade, mostly in the latter part. Interestingly, student numbers had ceased rising by about 1996 and had levelled off so that the later growth in the student/staff ratio can be attributed wholly to reduced staffing levels.

Table 4: Student/teaching staff ratios, 1989-2000.

Year	Ratio	Year	Ratio
1989	13.50	1995	14.82
1990	13.17	1996	15.68
1991	13.95	1997	17.18
1992	14.56	1998	17.55
1993	14.56	1999	18.30
1994	14.52	2000	18.84

Obviously, it is the students who have suffered most from these recent developments. Not only has their education been impaired by the damaged well-being of their institutions, they are having to make larger HECS payments than their predecessors did (92% more in the case of engineering and technology students).

IMPLICATIONS FOR ENGINEERING AND TECHNOLOGY EDUCATION

Continuing to focus on the international scene, peculiar to the discipline of engineering and technology is the Washington Accord. It is an Agreement between signatory countries (at present eight in number) recognising the comparability of accreditation systems and standards for professional engineering and technology degrees. It is maintained through an ongoing programme of mutual inspection and validation.

The Accord also provides a motivation to institutions in member countries to ensure that their offerings are comparable to the best in the world. Universities need to operate at the cutting edge of the latest technologies and to use them effectively in their teaching and research.

Turning to the situation in Australia, the current shortfall in resources needs to be considered in these contexts. The discipline of engineering and technology has suffered at least as much as others and there is considerable evidence of decline. The quality of course offerings has inevitably been impaired, a few engineering and technology schools have had to close and many others forced into downsizing, etc.

Engineering and technology programmes are considered by the Government to be in the high-cost category and in recent years, students in Australia have been financially punished because of this, ie they now have to pay much more for their education than their counterparts studying in such fields as the humanities. As stated earlier, they are paying more but receiving less, their education being inferior to that received by their predecessors.

Bearing in mind the way in which engineering and technology drive a country's wealth-creation, one would have hoped that the Government would have made these fields of study more attractive to school leavers.

The only favourable development that comes to mind in relation to the well-being of engineering and technology, concerns the funding of future research. From 2002, the Government will reward universities that generate commercial revenue by increasing their share of public funds in line with the amount they receive from industry. Since faculties in engineering and technology have perhaps the greatest inter-action with industry, one might expect them to benefit more than others from the Government's supplementary funding.

CONCLUDING REMARKS

The prospects in Australia for Government funding of tertiary education in the coming triennium are that the present unsatisfactory situation will continue. The Government has stated that there will be no significant increase in public funding and DETYA has announced that it expects the number of student places to remain steady, i.e. 390,530, 390,850 and 390,715 in 2001, 2002 and 2003 respectively. Overall, the total revenue for the higher education sector is projected to be $9.8 billion by 2003 and, as a proportion of GDP, there is no sign of any slowing down in the rate of fall.

The Government defends its stance, stating that:

> *Income from sources other than government grants has risen and dependency on Commonwealth payments has reduced. Increasing self-reliance enables universities to pursue diverse missions and meet varying community needs.*

Gratuitously, it adds that *if there are critical pressures on universities, they reflect the inadequacy of the management of the universities to deal with the problem.* One must hope that

the Government does not take this argument further, ie a further reduction in Commonwealth payments with the objective of obtaining even greater self-reliance for institutions. Some further deregulation of the system is indeed a possibility in spite of fears that participation could be weakened, course choices distorted and the burden on students increased.

Turning to research and development in Australia in general, and in engineering and technology in particular, the financial situation is not much better than that for tertiary education. By way of consolation, a small benefit might flow from the increased weighting that is being assigned to industry research funding.

From an international perspective, it is pleasing to see that the profession is faring well. In most OECD Countries, increased capital is being directed to both tertiary education and research and development.

REFERENCES

1. Australian Vice-Chancellors Committee (AVCC), Discussion Paper, Our Universities: Our Future. Canberra: AGPS (2000).
2. DETYA, Higher Eduction Triennium Report for 2001-2003. Canberra: AGPS (2001).