THE IT WORKFORCE CRISIS: WHAT IS THE SOLUTION?

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Australia faces a major supply crisis with professional IT workers. Industry representatives argue that there should be an increase in the supply of both local IT graduates and immigration IT professionals. Under present government policies most of the growth in supply will come from immigrants trained in Australia as full-fee overseas students. Additions from this source are a good thing but there is an urgent need for additional earmarked funds for the training of local students.

AUSTRALIA'S GROWING IT WORKER SHORTAGE

By almost any standards, the Information Technology (IT) field is booming. Current demand for skilled IT workers is greatly exceeding earlier projections. For example, in 1995 the Commonwealth Government indicated that computing professionals would be by far the most rapidly growing professional occupation in the period 2004-2005 (aside from some smaller specialities, like speech pathologists, statisticians and actuaries).[1] Projections prepared at the time estimated that the number of persons employed as computing professionals would increase from 79,400 in 1993-94 to 146,000 in 2004-05. But by August 1998, according to Australian Bureau of Statistics (ABS) Labour Force survey results, there were already 134,700 employed in the field.[2]

One consequence is that the capacity of Australian training institutions to keep up with demand is being strained. This shows in well-documented evidence of increased numbers of job vacancies and recruitment problems in the computing field.[3] Alarm bells have been ringing in both industry and government circles. If Australia cannot produce the required number of computing professionals then its capacity to be a competitive global player in the knowledge industries is said to be under threat. Some industry leaders have said that Australia has already lost investment because of the skills issue. In August 1999, the President of the Australian Telecommunications Industry Association and Chief Executive of Alcatel (Ron Spithill) said:

> Alcatel's global investment decisions are already influenced by the availability of skills. Australia's supply of skills is now a limitation on the rate of growth of our business in Australia. I believe that the same is true for other multinational corporations in this industry.[4]

The IT industry has taken a leadership role on the matter. This led to a national summit of Government and industry representatives in December 1998 which addressed the situation. It resulted in the creation of an industry-led IT&T Skills Taskforce (its chairman is the Telstra Group Managing Director, Network and Technology, Mr Gerry Moriaty). The Taskforce commissioned a major industry survey of demand for IT&T skills and released key findings in August 1999. An outcome of the survey is the industry's projection that, over the five years to 2004, demand for skilled IT&T staff will continue to grow by at least nine per cent per year, thus adding fuel to industry concerns about skill shortages. The survey also found that employers said most positions needed one to three years experience; and that training or retraining of

existing staff 'is expected to decline significantly' as a method for meeting requirements.[5]

There have been various proposals from this Taskforce and other industry players. Some focus mainly on domestic training and others give more attention to migration. The Australian Computer Society for instance, has called for a massive increase in the number of undergraduate places in computing.[6] The Taskforce has also urged 'more action in directing education funding to provide more tertiary and post-tertiary places' in IT&T.[7] At a second summit in September 1999, it also proposed the establishment of an Australian Institute of IT&T skills which would both drive and coordinate training initiatives in Australia, especially retraining professionals from other fields.

Some industry leaders would like a complete deregulation of the rules covering migrant computing professionals. The Chairman of the Australian Information Industry Association, Mr Alan Baxter has recommended industry should have access to the foreign students who are trained here. 'We also train a lot of foreign students on student visas who are required to go home. Why can't they be given the option of staying?'[8]

The Australian Government response

For its part, the Coalition Government announced a series of IT initiatives in April 1999.

First, these included more research on skill needs and the initiation of a survey of the extent of unmet local student demand for university computing courses (numbers of qualified students who cannot find places in such courses).

Second, there were to be better information flows between industry and the education sector so as to promote a more appropriate and timely training response.

Third, a series of measures aimed to improve linkages between industry and education, including industry-funded internship schemes for graduates and other new entrants.

Finally, the Government listed its recent immigration initiatives. The most important of these are the provisions introduced in mid-1999 which allow overseas students trained in Australia in certain fields (including computing) to apply for permanent residence under the Skilled-Australian Linked (SAL) and Independent categories immediately on completion of their training. (This is the measure sought by the AIIA noted above, though in the case of computing the measure only applies to degree-level students). Previously, these overseas students trained in Australia generally needed to build up a three-year work record out of the country after finishing their study before they could apply for permanent residence.

The Government issued a caution about what can achieved by immigration measures:

> Immigration responses to the skills shortage situation have the potential to provide a short-term means of addressing some specific areas of skills shortage. However, it is not intended that they be used by industry as a means of subverting training efforts for existing or new workers. There are also difficulties in attracting overseas workers, given global demand for IT&T skills.[9]

Both warnings in this statement seem appropriate. As noted above, the IT industry's own survey found that employer training and retraining was projected to decline significantly. As well, Australia faces a situation in which there is a worldwide shortage of IT professionals and global competition for their services. This shortage means that

Australia is facing competition from countries such as the USA and Canada. In the USA alone, the latest official projection is that the numbers of core IT workers needed by the year 2006 will be 2.6 million, up from 1.5 million in 1996.[10] This increase will occur at a time when IT businesses like Microsoft have recently succeeded in getting the US Congress to almost double the American annual skilled temporary-entry program from 65,000 to 115,000 in the years 1999 and 2000. Almost half of the entrants are IT personnel.[11] Already this number has proved to be insufficient to meet demand and Congress is currently considering proposals for further increases.

Implications of the Government's initiatives

The survey of student demand is currently underway and the Government expects a preliminary report by the end of December 1999. Until then, it will not be possible to quantify the extent to which qualified Australian students are unable to access IT courses.

Nevertheless, earlier this year it was reported that more than 1,000 students had applied for the 75 places available in the Bachelor of Information Technology courses at the University of NSW and the University of Technology in Sydney in 1999.[12] Our independent inquiries suggest that in several States some capable students are missing out on places in the more highly-regarded IT courses (including those with a substantial component of practical industry experience). In other institutions there is some concern about the capability of student applicants for IT places. But there seems little doubt that at least in the case of the high-quality IT courses, there is unmet demand for places from capable local students.

Implicit in the Government's action is the notion that universities will respond to new information about industry needs and about unmet local student demand by increasing the number of places for IT students. This assumption is questionable. First, there is the problem that Federal Government funding for local students is declining, such that any increase in places for computing students can only occur at the expense of places in other courses. Second, universities are under enormous financial pressure to increase their offerings to full-fee paying overseas students. Because computing is one of the most attractive areas for full-fee students, the temptation is to put whatever teaching capacity is available to the servicing of such students who are largely coming from overseas. The availability of teaching staff is a crucial issue, for such is the demand for quality computing professionals that universities face major problems both in holding existing staff and in filling teaching vacancies.

The Government's IT strategists should be aware of this situation, but perhaps they have been misled by the student output statistics generated by their own officers. The Government's December 1998 Discussion Paper on *Skill Shortages in Australia's IT&T Industries* indicates that there was a healthy increase of 139 per cent (from 2,100 to 5,100) in completions of computing graduates over the 1989 to 1996 period.[13] Similarly, in September 1999 Dr Kemp, the Commonwealth Minister for Education, Training and Youth Affairs cited more recent rosy growth figures. He also claimed that:

> Australia is keeping abreast of the worldwide surge in demand for skilled IT&T workers. In 1999, commencements in IT&T higher education courses rose by 26.5 per cent, and were 148 per cent

> higher than in 1989. Between 1989 and 1998, completions in these courses rose by 182 per cent.[14]

However, the Minister and the earlier paper do not distinguish between graduates who are full-fee paying overseas students and those who are local students (that is Australian residents). This is an important distinction. In fact, most of the increase during the 1990s (up to 1997) has been in overseas student completions. There are also some issues of statistical definition (explored below) which raise questions about Dr Kemp's growth claims. In addition, the Government's statements imply that there will be a continuation of recent growth in IT completions, but do not indicate how this growth will be sustained at a time when Government funding of university places is declining.

It may be that immigration will turn out to be a more important component of the supply response than the Government has anticipated. This is because of the initiative implemented in mid-1999 (cited above) which allows full-fee paying overseas students trained in Australia to degree level in computing, and some other disciplines, to apply for permanent residence immediately on completion of their course. The numbers of former overseas students in computing who will take up this option is likely to be substantial. The issues raised by this possible outcome are explored below.

The current IT workforce

Two broad categories of IT professional workers can be distinguished. The first includes the creators or engineers of computer hardware and software products. This work is highly technical and requires specialists with a command of programming skills and a knowledge of the network systems and computing machines for which their product is designed. They would normally need degree-level training in computing. Such experts are in great demand because they are at the cutting edge of a very rapidly changing technical environment in which the successful innovators stand to earn great rewards.

The second category of IT professional workers covers those workers who adapt and apply computing products. This is by far the dominant activity in Australia (as in the USA), but more so here because of Australian reliance on imported software products. The 'adapters' include analysts who design computing solutions for diverse business and government activities, programmers who adapt and service computing products at the operation level and increasingly, those who utilise computing products via increasingly powerful personal computers. There is a resultant fuzziness at the fringes of the IT profession these days because an increased share of the programming load has been passed down to the 'coal-face' users. As an important recent US Department of Commerce review of the Digital Work Force puts it:

> The transition from a mainframe to a primarily PC-based environment has blurred the once rigid distinction between the programmer and the user. Increasingly adept users are taking over many of the tasks previously performed by computer programmers. A growing number of sophisticated software packages allow users and systems analysts to write programs.[15]

The enormous growth in demand for computing professionals in Australia largely derives from the extent to which firms across a wide spectrum of industries have had to incorporate new software packages into their operations.

The explosion of interest in Internet-based e-commerce, for example, means there has been a jump in demand for staff who can install and service the relevant software products.

Table 1 provides an indication of the spread of involvement of computing professionals. It shows the distribution of persons classified by the Australian Bureau of Statistics as Computing Professionals (the definition includes both 'creators' and 'adaptors' as described above) and Information Technology Managers by industry. Of the 81,341 persons enumerated in the 1996 Census who were employed as Computing Professionals, 26,254, or 32.3 per cent were employed in the computer services industry (as in computing consulting firms or software manufacturing). The rest are dispersed widely across diverse public and private industries where they are likely to be utilising the kind of PC based software referred to above.

The level of training of Australian computing professionals appears to reflect the graduate supply problems described earlier. Table 2 indicates that, as of 1996, just on half (52 per cent or 42,426) of employed Computing Profes-

Table 1: Industry location of Information Technology Managers and Computing Professionals, 1996

Industry (ANZIC code and name)	Occupation (ASCO code and name)	
	1224 Information Technology Managers	2231 Computing Professionals
783 Computer Services	2,511	26,254
811 Government Administration	1,714	5,444
732 Deposit Taking Financiers	690	4,422
712 Telecommunications Services	1,984	4,381
461 Machinery & Equip Wholesaling	718	3,551
785 Marktng & Business Mngmnt Serv	675	2,947
843 Post School Education	357	2,642
782 Technical Services	235	1,572
284 Electronic Equipment Mfg	193	1,429
523 Frntre Hware Applnce Retailing	215	1,233
742 Other Insurance	152	1,210
820 Defence	254	1,172
751 Serv to Finance & Investment	277	1,166
784 Legal and Accounting Services	224	1,105
786 Other Business Services	186	1,095
741 Life Insur & Suprantn Funds	136	874
781 Scientific Research	109	855
640 Air and Space Transport	68	733
361 Electricity Supply	125	706
861 Hospitals and Nursing Homes	146	630
990 Non-classifiable economic units	108	602
740 Insurance undefined	57	550
242 Publishing	95	490
Other industries	3,537	16,278
Total	14,766	81,341

Source: ABS, 1996 Census unpublished customized matrix, Centre for Population and Urban Research Monash University

sionals held degree-level qualifications. By contrast, in the U.S. 68 per cent of the core IT-workforce holds degree-level credentials.[16] It is also probably no surprise to find that persons graduating from universities with a computing credential as their highest qualification fill less than half of all the ranks of those with degree-level credentials who work as Computing Professionals (20,364 out of 42,426). The others include 6,879 with degrees in science and 7,000 in engineering.

These statistics imply that there has been a great deal of skill upgrading occurring at the workplace through on-the-job training and specialist courses on various software applications. But this is hardly a fully satisfactory solution to the looming supply crisis for specialist IT professionals. If Australian industry is to compete in the creation and utilisation of information technology, it must have access to well-trained professionals. Where are they going to come from?

IT TRAINING IN THE HIGHER EDUCATION SECTOR

Interpreting the statistics

The statistics available on IT students in the university sector are sparse and easily misinterpreted. Some universities have been offering branded 'Bachelor of Computer Science' degrees for only a few years. In earlier years 'computer science' was one of many disciplines that students enrolled in a Bachelor of Science course in which they might specialise.[17] This means that some of the apparent growth in computing course enrolments may be the result of rebranding 'science' degrees into 'computing degrees'. It is also possible that there is some understatement in the figures. This is dependent on the number of universities where computer science is still taught as one of several options in a generalist Bachelor of Science degree. The Department of Education, Training and Youth Affairs (DETYA) publishes an annual volume of statistics entitled *Selected Higher Education Student Statistics*, but this gives no detail on students commencing or completing computing courses, nor any breakdown of whether they are local or full-fee paying students. To obtain data on the number of students involved in computing requires detailed interrogation of unpublished DETYA student files across many courses and subjects.

The statement by Dr Kemp, cited above, in which he claimed that there had been an increase of 26.6 per in computing commencements in 1999 may reflect the statistical problems discussed. Since DETYA have not released 1999 data, it is not possible to check this claim. However, the DETYA data for earlier years analysed below makes an increase on the scale suggested unlikely.

Table 2: Level of training by field of qualification of persons employed as computing professionals (ASCO 2231), 1996

Field of qualification	Level of qualification				
	Degree/ Postgraduate diploma	Undergraduate/ Associate diploma	Skilled vocational qualification	Other (basic vocational, N.S., N.A.,)	Total
Accounting	1,323	575	-	99	1,997
Other Business and Administration	2,539	779	103	962	4,383
Medicine	42	-	-	-	42
Nursing	39	81	-	28	148
Education	677	219	-	21	917
Economics	815	15	3	9	842
Law	103	3	-	6	112
Other Society and Culture	1,709	238	61	103	2,111
Computer Science	20,364	5,008	257	2,460	28,089
Other Natural and Physical Sciences	6,879	205	6	136	7,226
Mechanical Engineering	368	195	487	65	1,115
Other Engineering	6,704	1,709	2,119	956	11,488
Building Design	59	28	18	12	117
Other(incl. NS and NA)	805	245	318	21,532	22,900
Total	42,426	9,300	3,372	26,389	81,487

Source: ABS, 1996 Census unpublished customized matrix, Centre for Population and Urban Research Monash University

The Coalition Government Discussion Paper referred to earlier partially overcomes these problems by providing details of commencing and completing enrolments in Computer Science/ Information Systems and Engineering courses linked to computing. These statistics show growth in both. For the Computer Science/ Information Systems fields there were increases of 58 per cent for commencing students (over the 1992-1997 period) and 33 per cent for completions (over the 1992-1996 period) respectively.[18]

Analysis of local and full fee overseas student IT statistics

While the Discussion Paper and Dr Kemp's statistics indicate healthy increases, our study of unpublished DETYA data files suggests a different story. When the completion data are disaggregated into overseas full-fee paying students and local students they show that 54 per cent of the growth in completions (shown in Table 3) for the period 1992-1997 are attributable to overseas students (the 1998 completion data are still not available). During the years in question, the overseas students were generally required to leave Australia following graduation. Thus just over half of the increment in output over the five year period in question was not available to Australian employers.

The course completion data do not give the full picture because, as noted above, it may be that many students who are *not* labelled as computing/information science on the completion files nevertheless take computing subjects during their studies which might provide a basis for entry into the profession. To explore this possibility we calculated the student load which is expressed as the Equivalent Full Time Student Units (EFTSU) for students at all levels who took subjects defined as 'computing', regardless of the course or faculty they were enrolled in. The results for 1992 and 1997 show a similar picture to that noted for course completion data. Table 4 indicates that during this period the access to teaching in 'computing' on the part of full-fee overseas students increased by 72.8 per cent compared with 19 per cent for local students. The share of the total increase in the student load for local students is considerably greater than for overseas fee-paying students (because the latter start from a lower base).

A further analysis of computing-related teaching shows a sharply contrasting pattern. As might be expected, most of this teaching was provided to students in science/information science and business courses. However, the distribution of the load between overseas and local students differs dramatically. As Table 5 shows, all the expansion in

Table 3: University completions in computer science courses 1992 and 1997 by whether local or overseas full-fee students

	Overseas	Local	Total
1992	635	3,319	3,954
1997	1,848	4,360	6,208
Increase 1992 to 1997	1,213	1,041	2,254

Source: DETYA unpublished files

Table 4: Equivalent full-time student load for university computing subjects for overseas and local students in 1992 and 1997

	Overseas students	Local students
1992	3,263.5	21,272.2
1997	5,640.1	25,318.2
increase 1992 to 1997	2,376.6	4,046.0
% increase	72.8	19.0
% share of 92-97 increase	37.0	63.0

Source: DETYA unpublished files

teaching in business faculties was to fee-paying overseas students. In other words, there has been almost no increase in IT training to local business students.

Likely future teaching patterns in the IT field

It is predicted that the rate of increase of 19 per cent over the 1992 to 1997 period in the overall level of IT training for local students shown in Table 4 will abate. The increase in this period was mainly a consequence of the overall increase in higher education enrolments of Government funded local students during the first half of the 1990s. This increase has now come to an end.

Table 6 provides supporting evidence for this prediction. It shows that the rate of growth in commencements of local students (of whom very few are full-fee students) was just 2.5 per cent between 1997 and 1998. Most of the overall growth in commencements of seven per cent between 1997 and 1998 is attributable to overseas full fee students (in fact, over 70 per cent or 620 of 864 new commencements). The vast majority of these overseas full-fee students are on-shore students studying at Australian campuses.

Without further funding initiatives from the Government it is unlikely that more places will be allocated within IT fields for local students because the number of fully funded undergraduate places up to 2001 in Australia will remain slightly below the level reached in 1997.[19] Universities could of course allocate a higher proportion of these places to IT training. They are unlikely to do so partly because of the difficulty in reallocating resources and the loss of academic staff positions this involves, partly because the Australian Government has not required the universities to increase their training in IT fields, and partly because there is no financial advantage to a university by doing so. The fact is that universities gain no additional funding by taking on the pain of restructuring their course offerings

Table 5: Equivalent full-time student load for university computing subjects in Science/Information Science courses and Business courses, for overseas and local students, 1992 and 1997

	Science/Information Science		Business	
	Overseas	Local	Overseas	Local
1992	1,677.4	11,448.4	1,292.0	5,911.3
1997	2,792.9	14,068.0	2,396.8	5,933.4
increase 1992 to 1997	1,115.5	2,619.6	1,104.8	22.1
% increase	66.5	22.8	85.5	0.4
% share of 92-97 increase	29.9	70.1	98.0	2.0

Table 6: Commencing student enrolments in Computer Science, Information Systems courses*, 1989, 1997 and 1998 by local and full fee paying overseas students**

	1989	1997	1998	1989-97	1997-98
Local Students	6,125	9,670	9,914	57.9	2.5
Full-fee Overseas Students	545	2,570	3,190	371.6	24.1
All students	6,670	12,240	13,104	83.5	7.0

Source: DETYA Student files, unpublished
* Undergraduate plus postgraduate courses
** Local students include full fee students

because they can fill their funded domestic-student places within their existing course offerings.

On the other hand there is a major financial advantage for Australian universities that provide extra places to overseas full-fee paying students. Universities are under enormous financial pressure to increase their non-Government revenues. As indicated, the number of Government-funded places has been capped and, in addition, the real return per student has been reduced. By contrast, there are no restrictions on the numbers of appropriately qualified overseas students which universities may enrol and so far those enrolled have been prepared to pay a higher fee than the universities receive for Government-funded local students. Since the IT field is one of the two main sources of growth in overseas student numbers (the other is business/accounting) there is a powerful incentive to put any potential new IT-training capacity to the servicing of overseas fee-paying students. Indeed, some universities may be tempted to divert existing capacity to overseas students.

The Government is likely to respond with the claim that local students too can now access IT-training at the undergraduate level through the new full-fee options opened in 1998. So far, however, there has been little response to this offer in the IT field.[20] Only in law schools has there been a significant enrolment of local full-fee students. The story is similar at the post-graduate level. Most of the growth in IT courses at the postgraduate level has been among overseas full fee paying students.

THE MIGRANT SOLUTION

The conclusion is that, within the context of the present Government policy, universities will not be able to provide the boost to computing professional supply that Australian employers are hoping for. Instead employers will have to depend on IT-staff trained on the job or in the plethora of TAFE, private college and industry training courses which have flourished in recent years, or from migrants. As far as the latter is concerned these could come from two sources. The first is from the ranks of the overseas students trained in Australia and the second already trained professionals willing to migrate here.

Overseas students trained in Australia

We are confident that there will be a continuing increase in the numbers of overseas students willing to pay full-fees for IT courses in Australia. The global scarcity of such professionals means there is a strong incentive even for families of moderate wealth throughout Asia to invest in their children's education in a country like Australia where the qualifications gained have a reputable international currency. This incentive has recently been sharply increased by the changes the Australian Government introduced in mid-1999 to its Independent and SAL categories' selection system.

The new selection criteria favour applicants trained in Australia. As the critical comments from industry leaders quoted above indicate, prior to mid-1999 overseas students trained in Australia normally had to return home because of a requirement that they possess several years experience within their occupation.[21] This requirement has now been abolished if the student has completed a degree level course in Australia. In addition the selection system has been changed to favour applicants in a narrow range of occupations, including computing professionals, where the training is specific to the applicant's occupation.

The computing field is also one of the few occupations where additional points are allocated because the occupation is deemed to be 'in demand' in Australia. Overseas students who complete a computing degree in an Australian university will have no difficulty achieving the pass mark for the skill selection system and thus are virtually guaranteed permanent residence if they apply within six months of completing their course.

At this stage, the new selection system has not been in operation long enough to assess how many recent IT graduates will take up the permanent-residence option. Preliminary inquiries from IT graduates concerning the first phase of the process (which involves an assessment of their qualifications by the Australian Computer Society) indicate that a high proportion will respond to the new opportunity. Between August and November 1999, nearly 300 per month have applied for this assessment. At this stage, the applicants are mainly postgraduate diploma and masters graduates. When the overseas full-fee paying undergraduate students receive their results it is expected that the application rate will increase rapidly. On the face of it the new immigration rules look likely to help deliver a major increment to Australia's IT workforce and to do it in a way that increases the financial returns to Australian universities.

The new immigration arrangements will add to the existing attractions of study in Australia. When universities and prospective students overseas become fully aware of the new selection criteria this will give a further impetus to the industry. The new arrangements provide a great marketing opportunity for universities in the IT and other fields. The prospect is therefore that the trend towards the allocation of teaching resources into the few fields attractive to full-fee paying overseas students will be accentuated.

Migration of trained IT professionals

It is important to distinguish between permanent settlers and temporary migration. The prospects for increased recruitment of IT professionals with overseas training and experience as settlers are not positive. The best indicator of the extent to which persons living overseas who hold computing credentials recognised in Australia are interested in coming here as settlers are the numbers recruited as principal applicants under the Independent skill category. Since 1992, one of the required criteria for selection in this category is that the applicant's credentials must be assessed as adequate for professional level work in Australia. Almost all the successful applicants also need a reasonable knowledge of English. The numbers of persons identified as in the computing professional occupation who entering Australia this way were 558 in 1995-96, 608 in 1996-97, 573 in 1997-98 and 574 in 1998-99.[22]

The implication of these figures is that there is no great reserve of such people who of their own volition have decided that they would like to come to Australia. There are other streams of migrants entering Australia, including accompanying family members, spouses, sponsored siblings and New Zealanders, most of whom do not have their credentials evaluated but who declare themselves to be computing professionals when they enter Australia. Their numbers are about the same each year as the Independent entrants. In 1998-99 the number of arrivals was higher, at 1,430 (of whom as noted above, 574 were principal applicants entering under the Independent category. Another 201 were principal applicants under the Skilled Australian

Linked category. But in 1998-99 there were also 218 from New Zealand who claimed they were computing professionals — up from 74 in 1995-96.

For several years now, temporary rather than permanent migration has been the more significant source of IT professionals from overseas. These are principally overseas nationals sponsored by Australian-based employers or recruitment agencies under the visa class 457 specialist temporary-entry program (like the H1-B visas in America). The 457 visa allows a stay of up to four years. In 1998-99, there were 3,556 nominations from Australian sponsors for Computing Professionals and another 395 for Information Technology Managers (many more than the number of IT-qualified professionals arriving as settlers). The main source countries for temporary entrants in 1998-99 were the UK, the USA, India and South Africa. The stay in Australia is sometimes short, because their role is often to help local users adapt to imported hardware and software products. Their high numbers are indicative of Australia's dependence on imported IT products.

Temporary entrants are unlikely to solve the looming IT supply crisis, though they are likely to make a larger future contribution given employers' demands for experienced IT professionals. It is expensive to bring overseas specialists to Australia and given the likely global competition for their services, there is no guarantee of their availability. On the other hand, some recruitment agencies claim that lifestyle attractions in Australia are still powerful inducements for North American and European professionals; and even more so for English-speaking IT professionals from Asia, especially India and the Philippines. However, changes to immigration regulations will not help. Businesses can already sponsor as many IT specialists as they please, without any need to 'labour market test' or prove that locals are not available for the work. As Mr Neville Roach the chief executive of Fujitsu Australia and head of DIMA's Business Advisory Panel has recently acknowledged in relation to temporary entrants: 'Despite what most businesses think, we have one of the most liberal and straightforward immigration regimes in the world'.[23]

CONCLUSION

The labour market for IT professionals in Australia is complex. It is important to distinguish between the booming current demand for experienced IT professionals and the longer-term need for IT skills. But there seems little doubt that the IT professional supply situation is in crisis. It is also clear that an increase in the output of university-trained IT specialists should be part of the solution.

While all the major players, Government, industry and universities, seem to agree, so far there is no convincing strategy in place to ensure that universities can play their part. All the Commonwealth Government has done is to signal that the universities should increase their IT training. But the Government has not given any direction to this effect or provided any additional funds tied to additional IT specific places for local students.

Universities are reluctant to embrace any alternative policy of reducing the number of places in non-IT fields, because of the intellectual arguments against culling more traditional disciplines and the institutional turmoil such measures usually generate. In any case, the limited availability of computing teaching staff and facilities and the enormous financial pressures universities are

under to supplement Government funding means that in practice they are focussing this capacity on full fee paying students.

The new immigration regulations implemented in mid-1999 will mean that many of the overseas students in computing will take out permanent residence visas. They will make a significant contribution to the supply of new IT graduates in Australia and ultimately to the stock of experienced IT professionals.

But this is hardly a satisfactory outcome. It means that overseas students who can afford to pay the fees will be the main beneficiary of expansion in a key industry offering high financial rewards. By contrast there will be little increase in opportunities for IT training at the university level for local students under existing policy settings.

It is no solution to suggest that local students should, like overseas students, be prepared to pay full fees for this training. Aspiring Australian students do not expect to have to pay full fees and in many cases could not afford to do so. The appropriate Government response should be the allocation of additional earmarked funds to universities for IT training for local undergraduate students.

References

1 *Australia's Workforce 2005: Jobs for the Future*, Australian Government Publishing Service, 1995, p. 140

2 Department of Communication, Information Technology and the Arts, *Skill Shortages in Australia's IT&T Industries*, December 1998, p.10

3 ibid, pp. 11-12

4 Media Release, IT &T Taskforce, 6 August 1999

5 'Future demand for IT&T skill in Australia, 1999-2004', Media Release, IT &T Task force, http://www.aiia.com.au/SkillsTaksForce.html

6 Australian Computing Society, *The Australian*, 17 August 1999

7 IT&T Taskforce, Media Release, 30 April 1999

8 B. Power, 'Skills drought strikes IT future', *Sydney Morning Herald*, 10 December 1998

9 IT&T skills shortage package, pp 7-9, Attachment to 29 April 1999, Media Release 58/99 Alston

10 U.S. Department of Commerce, Office of Technology Policy, *The Digital Work Force: Building Infotech Skills at the Speed of Innovation*, June 1999, p. 4

11 L. Lowell, 'Skilled temporary speciality workers in the United States', *People and Place,* vol. 7, no. 1, 1999, pp. 24-32

12 AIIA Media Release 25 March 1999

13 ibid. p. 20

14 Joint Media Release, 2 September 1999 from the Minister from Dr Kemp and from Senator Richard Alston, Minister for Communications, Information Technology and the Arts, and John Fahey, Minister for Finance and Administration

15 U.S. Department of Commerce, Office of Technology Policy, op.cit., p. 4

16 ibid., p. 33

17 I. R. Dobson and A. J. Calderon, *Trends in Science Education: Learning, Teaching and Outcomes 1989-1997*, Australian Council of Science Deans, 1999, pp 23-25

18 NOIE, op cit, p. 20

19 D. Kemp, *Higher Education Report for the 1999 to 2001 Triennium*, Department of Education, Training and Youth Affairs, 1999, p. 90

20 Table 79, Selected Higher Education Statistics, DETYA, 1998

21 For more details, see B. Birrell, 'The 1999-2000 immigration program', *People and Place*, vol. 7, no. 2, 1999, pp. 52-53

22 Department of Immigration and Multicultural Affairs, unpublished arrival statistics

23 *The Australian,* 30 November 1999