OPINION

Too few or perhaps too many STEM graduates

Bob Birrell

The Australian Population Research Institute

Industry bodies, research and educational organisations have lobbied intensely for increased funding for training in the STEM disciplines. It is time to reassess this advocacy. Undergraduate commencements in STEM fields have increased strongly since 2009, yet the current employment prospects for these graduates are poor. Advocates have not made a convincing case that this situation will change. The outlook in the information technology (IT) fields is particularly concerning. Domestic graduates in IT face a labour market in which their numbers are being dwarfed by the influx of immigrant IT professionals, many of whom are employed by Indian IT service companies with branches in Australia. This is occurring at the same time as Australian public and private organisations are sending offshore much of their computing work through these same IT service companies.

Keywords: STEM, IT, Australia

There has been a recent crescendo of advocacy for more tertiary education training, especially in the STEM fields (science, technology, engineering and mathematics). Such training, it is said, is crucial for Australia's future prosperity. For Australia's Chief Scientist, Ian Chubb (Chief Scientist of Australia, 2015), it is not just the nation's prosperity that is at stake but the jobs young people may miss out on if they do not take STEM courses.

Chubb's advocacy for more training in the STEM fields at the secondary school level is not at issue. More technological literacy, especially in information technology, will be an advantage in whatever field of work young people enter. The topic explored here is the medium term employment prospects of those encouraged to graduate in STEM fields. While all STEM fields are discussed, the main focus is on information technology (IT), where graduates are encountering job competition from large numbers of migrants. Chubb's advocacy builds on a raft of reports from academic and research centres. One of the more impressive is the Australian Council of Learned Academies (ACOLA, 2014) report on the role of science, research and technology in lifting Australian productivity. The Council argues that Australia's prospects for knowledge intensive industries 'will depend on adopting technological innovation to develop high-value products and services for a global market' (ACOLA, 2014, p. 13). If this is to occur, Australia will have to develop an innovative workforce, 'with STEM skills and knowledge crucial.' The Council asserts that action is urgently needed, because, 'time is not on our side. In the past ten years, other countries have moved ahead of us (ACOLA, 2014, p. 21).'

This campaign is having some success, at least at the level of political rhetoric. The Labor Opposition Leader in the Australian federal parliament declared during his 2015 budget reply speech that Labor would write off the HECS debt of 20,000 STEM students each year for five years (Hudson, 2015).

The Coalition Government is sensitive to this issue because of the collapse in commodity prices since 2011 and the resultant slow-down in resource investment.

Table 1: Domestic and Overseas Undergraduate Commencements by Broad Field of Study 2009–2013

dom = domestic OS = overseas	*2009*		*2010*		*2011*		*2012*		*2013*		*% diff 09–13*	
	dom.	*OS*	*dom.*	*OS*	*dom.*	*OS*	*dom.*	*OS*	*dom.*	*OS*	*dom.*	*OS*
01 Natural & Phys. Sci.	19,885	3,326	22,783	3,230	24,460	3,388	27,869	3,144	29,019	3,363	46%	1%
02 Info. Technology	6,227	6,169	6,671	6,028	7,253	5,992	7,917	5,382	8,046	5,338	29%	-13%
03 Eng. & rel. Tech.	13,215	6,037	14,182	6,515	14,710	6,482	15,489	6,082	17,107	6,626	29%	10%
04 Architecture & Bldg	5,329	1,523	5,750	1,397	6,128	1,481	6,286	1,264	6,199	1,197	16%	-21%
05 Agriculture Env & rel. Studies	3,813	470	3,959	546	3,901	585	3,848	526	4,068	496	7%	6%
06 Health – All	34,261	7,074	37,718	6,956	39,081	6,675	43,060	6,179	47,933	6,284	40%	-11%
07 Education	21,435	859	22,451	882	22,511	795	25,294	669	25,733	607	20%	-29%
08 Management & Commerce	38,201	48,623	38,201	48,615	39,624	47,488	43,609	44,762	45,424	45,216	19%	-7%
09 Society & Culture – Law	8,572	559	8,650	550	8,788	478	9,256	395	10,076	342	18%	-39%
09 Society & Culture – other fields	49,929	5,004	55,615	5,226	56,395	5,812	60,716	5,077	63,623	4,832	27%	-3%
10 Creative Arts	22,083	5,541	23,130	4,871	24,105	4,437	25,690	4,084	27,503	3,914	25%	-29%
11 FHPS, 12 Mixed F & NWA	67	698	58	579	64	445	48	158	30	108	-55%	-85%
Total	204,879	85,044	220,104	84,608	226,837	83,301	248,510	77,032	263,073	77,727	28%	-9%

Source: Customised data, Higher Education Statistics, Department of Education and Training

The China boom between 2003 and 2011 had been expected to continue for years while China continued with its break-neck growth trajectory. There are now fears that China might have reached a plateau in its resource-intensive growth phase. This has prompted a frantic search for 'replacement' activities, or as it is sometimes put, the 'rebalancing' of the Australian economy for a post-mineral investment boom setting.

This situation has given the academic and research community more leverage in putting its case. Though the global economy is idling, a focus on STEM training appears plausible because one area of thriving activity is the digital revolution. As a result, the global economy appears to be on the threshold of another IT boom, like that of the late 1990s.

Australia, as a technologically advanced nation, so it is said, is well-placed to participate in this boom. However, as STEM advocates emphasise, if Australia is to play a significant role it must increase the level of training in STEM disciplines.

Before we advance too rapidly down this path, some of the assumptions behind this advocacy should be tested. First, enrolments in STEM fields have not stalled. It may surprise that higher education enrolments in STEM fields have already risen rapidly over the past few years (see Table 1). Second, the employment prospects for STEM graduates are currently poor. Nor have the advocates demonstrated that Australian-based firms have good prospects for breaking into global hi-tech markets. This article explores these two issues.

STEM enrolments are increasing

Through the years 2005 to 2008 domestic undergraduate commencements (in all fields) were flat. They began to increase in 2008, and as Table 1 shows, grew rapidly between 2009 and 2013. The overall increase in commencements between 2009 and 2013 was 28 per cent.

This increase was facilitated by the progressive removal of caps on government funding of undergraduate enrolments over the academic years 2010 to 2012 by the Rudd/Gillard Labor Governments. Prior to 2010, universities were bound by caps on the number of places the government was prepared to fund for each field of education. These were set by Canberra-based higher education bureaucrats. The complete removal of these caps (with the exception of law and medicine) by the 2013 academic year meant that universities could enrol as many domestic students as they wished, with per capita funding guaranteed by the government.

Universities were keen to recruit more students because they were desperate for additional funding on account of the relentless winding down by successive Commonwealth governments in real funding per student (see, for example, University of Melbourne, 2011). For their part, in the aftermath of the global financial crisis in 2009, young people about to leave school have faced a softer labour market. As has generally been the case when this happens, the effect is to heighten the appeal of post-school education, by comparison with leaving school and fighting for employment in a weak labour market.

STEM field commencements shared in this overall enrolment surge. As Table 1 shows, in the case of Natural and Physical Sciences, domestic undergraduate commencements increased from 19,865 in 2009 to 29,019 in 2013, or by 46 per cent – far greater than the overall 28 per cent increase in enrolments.

Though not shown in Table 1, the contrast with the years prior to 2009 is striking. Domestic commencements in Natural and Physical Sciences had increased slowly, from 17,708 in 2003 to 19,885 in 2009. There was a similar pattern for engineering. Commencements in Engineering and Related Technologies were 9,950 in 2003. They increased moderately to 13,215 in 2009, then increased by 29 per cent to 17,107 in 2013.

Even in IT, where there had been a serious decline in enrolments from 11,563 in 2003 to 6227 in 2009, they began to rise after 2009. They grew by 29 per cent between 2009 and 2013 (Table 1).

The surge in STEM commencements will translate into strong increases in completions over the next few years.

Job prospects for STEM graduates

Recent graduates in STEM fields, as with most other fields of education since 2009, have faced a slack job market. The best indication of their current prospects is the Graduate Careers Council annual survey. It reports on the job outcomes for graduates as of April each year following completion of their course. The latest information is for the survey conducted in April 2014. The key measure is the proportion of bachelor graduates seeking full-time work who have found such work as of April in the year after graduation. (This metric refers to any field of work, not necessarily in the graduate's field of training). The best year was 2008 when 85.2 per cent of all graduates (including STEM graduates) looking for full-time work reported finding it. This proportion has since fallen, to 76.2 per cent in 2010 and 71.3 per cent in 2013 (GCA, 2014). In 2014 it fell to 68.1 per cent (GCA, 2015).

The STEM fields mirror this decline. Some 90 per cent of engineering graduates had obtained full-time work in 2008 but only around 75 per cent in 2014. Graduates in the life sciences are amongst the worst affected with just 48 per cent of those looking for full-time work being able to find it by April 2014 (compared with 76.4 per cent in 2008). For those graduating in the physical sciences the corresponding proportion was 54.9 per cent, way down from the 84.6 level in 2008 (GCA, 2014; GCA, 2015).

In the case of computer science, 83 per cent had found fulltime work in 2008. By 2014 this share had fallen to 67.2 per cent. This reflects a recent slow-down in the demand for IT professionals (GCA, 2015). The Department of Employment concluded in its June 2014 review of the labour market for IT professionals that there was no shortage of IT professionals in Australia. Its survey of recruitment agencies indicated that there were 'an average of 41.1 qualified applicants per vacancy' (Department of Employment, 2014).

There are two broad reasons for believing the situation will not improve in the medium term. The first is that the preconditions for a flourishing innovative, high value-added, goods and services industry sector in Australia are not in place. The second reason is that whatever progress is made, Australian graduates, especially in the IT fields, will have to compete with the very large number of the overseas-born professionals who have access to Australia's labour market.

Australia's competitive position in hi-tech fields

As Noble Laureate Brian Schmidt has argued, in order to increase our prosperity we have to create high value-added companies. But, because 'we have so few businesses that are of the high-growth, high innovation flavour, I think the bulk of effort needs to be directed to creating and growing new business of a different character' (quoted in Hare, 2015, p. 35).

He is surely right. There is only a tiny corporate base in Australia that is capable of competing in global hi-tech markets. The third industrial revolution of the 1990s and early 21st Century passed Australia by. Australia-based firms played no role in the developments of the semiconductor industry and subsequent IT hardware and software industries utilising semi-conductors. As for the consumer and producer goods embodying these innovations, almost all the manufacturing of these products has occurred offshore.

Unfortunately, there is no sign that the Coalition Government is prepared to follow Schmidt's advice.

So far, despite all the rhetoric about selling advanced manufacturing and services into Asia, there has been little targeted support for these industries. Rather, the Government's focus has been on negotiating Free Trade Agreements with various Asian countries. The Free Trade Agreements completed with Japan and South Korea and now China, will give businesses in these countries greater access to Australian markets in return for opening up their markets for Australia's agricultural commodities (notably beef and dairy products) and services (Minister for Trade and Investment, 2015).

The Coalition Government has stuck with its mantra that the best thing it can do for Australian enterprises is to reduce government intervention (as with red tape and restrictive environmental and labour market rules). In this stance, it is supported by both public and private sector economic elites.

Consistent with this position, the Coalition has reduced funding for the CSIRO, Australia's national science agency, and in 2014, abolished the $300 million Innovation Investment Fund. As the Australian start-up industry lobby puts it, this decision was taken 'despite [this fund] having been the Government's primary means of stimulating the creation of venture capital funds in Australia' (StartupAUS, 2015, p. 7). Likewise, the Australian Council of Learned Academies notes that 'Australia has not kept pace, and has under-invested in catalysing and supporting its high-tech industries, as evidenced by the fact that we now have one of the lowest rates of startup formation in the world, and one of the lower rates of venture capital investment' (ACOLA, 2014, p. 7). The Council goes on to assert that the linkages between university science and industry are amongst the lowest in the OECD (ACOLA, 2014).

Australian industries and consumers are avid adopters and users of ICT products that employ the latest digital hardware and software. Perhaps user expertise could be the basis for selling such services into Asia. However, the opposite could be the case. Asian countries are devoting enormous resources to STEM training, particularly in the engineering and IT fields. The number of Asian graduates is soaring, a high proportion of whom are in STEM fields. They make up 50 per cent of graduates in Singapore, 41 per cent in China and around 34 per cent in South Korea (AiGroup, 2015). As the Australian Government's White Paper on Australia in the Asian Century acknowledges, one consequence is that Asia has emerged as a global innovation hub (Australian Government, 2012).

Recent descriptions of the Chinese effort to promote its innovative, high-value added industries reveal just how systematically the central, regional and city governments in China are doing exactly what Schmidt has prescribed for Australia. The major regional governments have promoted thousands of science and technology parks in which they encourage western companies to set up branches. These companies are cajoled into linking up with Chinese universities and enterprises. They are required to transfer their technology, in return for broader access to the Chinese marketplace. In this way university research activities are directly linked to corporate research and productive activities (Breznitz & Murphee, 2011).

It follows that Asian countries are becoming quite capable of providing their own services and, more ominously, of providing such services to Australian enterprises and consumers. As detailed below, this is obvious with the Indian IT service companies, whose leading firms are now multinational giants. This is not a possibility canvassed by STEM advocates in Australia.

Popular books like Clyde Prestowitz's (2005) *Three Billion New Capitalists* and Thomas Friedman's (2007) *The World is Flat* have provided breathless accounts of how this surge of graduates has been translated into the provision of IT services to the US. This process, as we will see, is well underway in Australia.

Another consequence of the increased output of higher education graduates in Asia is a spill-over of interest in finding employment in developed countries, including Australia.

Competition for STEM jobs in Australia

Part of the difficulty that Australian STEM graduates experience when entering the job market is that they must compete with various streams of professional migrants. These include migrants recruited under the permanent entry skilled program, those sponsored by employers for temporary work (457 visa holders) and those granted other temporary visas with work rights, including overseas students who will benefit from the new Temporary Graduate visa (analysed below).

This is not so much of an issue for the sciences and engineering. However it is of huge significance for IT. As is detailed in Table 2, the number of primary applicants granted visas in the permanent and temporary skilled visa programs for IT professionals is far higher than the number of domestic undergraduate completions in IT.

Migrants will keep coming

The scale of the migrant influx reflects the rules successive Australian governments have put in place to regulate it.

Table 2: Domestic and Overseas Undergraduate Completions by Broad Field of Study 2009–2013

dom. = domestic OS = overseas	*2009*		*2010*		*2011*		*2012*		*2013*		*% diff 09–13*	
	dom.	*OS*	*dom.*	*OS*	*dom.*	*OS*	*dom.*	*OS*	*dom.*	*OS*	*dom.*	*OS*
01 Natural & Phys. Sci.	11,331	2,134	11,975	2,374	12,693	2,384	13,318	2,461	14,842	2,622	31%	23%
02 Info. Technology	3,137	3,859	3,036	4,112	3,212	3,976	3,191	3,766	3,416	3,656	9%	-5%
03 Eng. & re. Tech.	6,401	2,934	6,666	3,301	7,117	3,782	7,454	3,971	7,675	4,511	20%	54%
04 Architecture & Bldg	2,823	984	3,093	1,147	3,183	975	3,351	991	3,544	1,105	26%	12%
05 Agriculture Env & rel. Studies	2,037	128	1,958	237	2,142	325	2,011	384	2,107	396	3%	209%
06 Health – All	19,600	4,802	20,535	5,129	22,329	5,415	22,974	5,101	24,772	5,141	26%	7%
07 Education	12,335	1,057	11,921	667	11,302	639	11,093	532	11,913	659	-3%	-38%
08 Management & Commerce	24,232	31,134	24,368	34,608	24,868	36,525	23,660	37,159	23,922	36,893	-1%	18%
09 Society & Culture – Law	5,678	273	5,638	287	5,991	286	5,706	295	6,185	384	9%	41%
09 Society & Culture – other fields	24,481	2,478	25,170	3,040	27,694	3,438	28,507	3,586	30,205	4,372	23%	76%
10 Creative Arts	11,653	3,549	12,338	3,699	12,924	3,939	13,365	3,712	13,715	3,305	18%	-7%
11 FHPS, 12 Mixed F & NWA	37	445	18	363	27	315	14	48	15	56	-59%	-87%
Total	115,346	53,443	117,362	58,447	123,858	61,504	125,145	61,565	131,952	62,528	14%	17%

Source: Customised data, Higher Education Statistics, Department of Education and Training

Since the Australian job market began to soften in 2012 there has been little government action to reduce the numbers visaed under the permanent and temporary entry skilled visa programs. The number of places allocated in the permanent entry skilled program has actually increased, from 107,868 in 2009-10 to 125,755 in 2011-12 and 128,973 in 2012-13. It has since stayed at this level, and at the time of the May 2015 Federal Budget the Coalition announced that this will continue to be the case for 2015-16.

Labor's tightening of the 457 visa rules through its 2013 legislation (including a limited form of labour market testing) had some impact. However, aside from engineering, there is no labour market testing in the other STEM fields, including all the sub-fields of IT.

Readers may be aware that for the permanent entry points tested visa subclasses there is a Skills Occupation List (SOL). This is supposed to be confined to occupations where there is a national shortage. In reality, the Australian government has been reluctant to enforce this provision, as indicated by the fact that accountants and IT professionals remain on the SOL, despite the judgement of the Department of Employment that both occupations are in oversupply (Birrell & Healy, 2014). As noted above, the Department of Employment continues to express this view for IT professionals.

The reason for this reluctance to take these occupations off the SOL is probably that if this happened it would undermine Australia's overseas student industry (Birrell & Healy, 2014). As Table 1 showed, commencements in business and commerce at the undergraduate level are by far the largest stream, following (distantly) by commencements in IT. The same is true for postgraduate by course work courses.

Nor has there been any move to cap the number of 457 visas issued. Employers can recruit as many professional or trade workers as they please. Once here, 457 visa holders have shown a high propensity to seek permanent residence in Australia through the various pathways open to them, especially via employer sponsorship permanent entry visa subclass. As far as IT is concerned, Table 2 shows that there were slightly more overseas student completions in this field than for domestic students. Many of these overseas students too, are making use of opportunities to stay on, including by taking up the Temporary Graduate 485 visa and/or by finding an employer to sponsor them on a 457 visa (Birrell & Healy, 2012).

It is unlikely that a softening of the Australian labour market will diminish the interest of STEM graduates in India or China from seeking entry to the Australian labour market. This reflects Australia's attraction as a destination.

Table 3: Number of 457 visas issued for selected IT fields, by total number, total and proportion who were Indian citizens, 2008-09 to 2013-14

ANZSCO	*Country of Origin*	*Year*					
		2008-09	*2009-10*	*2010-11*	*2011-12*	*2012-13*	*2013-14*
Software and Applications Programmers (2613)	India	3730	3353	4102	4354	3632	3301
	All	5602	4715	5246	5388	4602	4161
	% Indian	67%	71%	78%	81%	79%	79%
ICT Business and Systems Analysts (2611)	India	73	251	845	1176	1498	1238
	All	167	447	1457	2013	2111	1795
	% Indian	44%	56%	58%	58%	71%	69%

Source: Department of Immigration and Border Protection Subclass 457 – Temporary Work (Skilled) visa statistics, Quarterly Pivot Tables

Salaries are at least five times higher (in the case of India and China) and the quality of life infinitely better. In this respect Australia's attractions for STEM graduates parallel those of the USA where overseas graduates now play a major role in the American STEM workforce (National Science Board, 2014).

Beginning in 2010 the Australian government tightened the rules governing the financial resources required of overseas students. It also tightened their subsequent access to permanent entry skilled visas (as by tougher English standards) (Birrell & Healy, 2012). There was a subsequent downturn in overseas student undergraduate commencements in the higher education system (from 85,044 in 2009 to 77,727 in 2013 – see Table 1). There was a similar pattern for overseas student postgraduate by course work commencements.

The Australian government has sought to boost the inflow again by easing up on the financial rules and by opening up access to the Australian job market when students complete their courses. Following the Knight review into the overseas student industry (Australian Government, 2011)) the Labor Government introduced (in March 2013) a new post-study work stream under its Temporary Graduate (485 visa). This allows all overseas students who graduate from an Australian university to stay on for at least two years with full work rights, regardless of their field of study. Under previous arrangements graduates seeking the 485 visa had to have qualifications in fields applicable to occupations that were listed on the SOL. As a result, overseas student enrolments at the undergraduate and postgraduate by course work levels have picked up since 2010.

At present, the numbers receiving the Temporary Graduate 485 visa are small, because to be eligible graduates must have been granted their student visa after 5 November 2011. The numbers will escalate over the coming years because the Department of Immigration and Border Protection expects that around 70 per cent of all graduates will apply. The Department's modelling implies that the number of 485 visa holders could exceed 200,000 by the 2017-18 program year (Senate Hansard, 2015).

As this summary indicates, the Australian Government has created multiple pathways for overseas-trained and Australian-trained foreign-born students to stay and work in Australia. As a result, migrants with STEM qualifications will continue to compete with domestic graduates for available professional work, especially in IT fields.

The outlook for domestic IT graduates

As STEM advocates are at pains to emphasise, IT skills will be a key determinant if Australian industry is to flourish in the current digital revolution. Not surprisingly this discipline is at the centre of STEM advocacy. But this may not be doing potential IT students any favours since they face intense competition for work from immigrants in a context where much of the professional work is being transferred offshore.

IT migrants are the largest source of professionals gaining permanent entry skilled visas and temporary entry work visas. In 2013-14 there were 9,220 permanent entry skilled visas granted to principal applicants with IT occupations under the various skilled visa subclasses. Just on half of these were for Indian nationals (Department of Immigration and Border Protection, 2014). The high demand for places in the skilled visa program reflects the interest in moving to Australia from the huge output of such graduates in South and East Asia.

The temporary entry stream is just as large. In 2013-14 8,482 visas were issued to primary applicants under the 457 program to primary applicants who were IT professionals and managers, most of whom were Indian nationals (Table 3). These IT professionals were mainly sponsored by companies providing IT services in Australia.

This situation reflects the transformation of the IT services industry in Australia over recent years. The emphasis has swung from internal corporate provision of these services to outsourcing the work to IT specialist service providers. Competition for this contracting work

is intense. It comes not just from domestic enterprises but increasingly from overseas-based companies, most of whom have service centres in Asia, particularly in India.

The companies with offshore service centres are advantaged in competing for IT service work in Australia. They can draw on their (usually) India-based and in-house trained staff when bidding for contract work. They can also hold out the carrot of potential offshoring of the service at a reduced price. This is crucial at a time when Australian clients like the banks, telecommunications companies and government agencies are under intense shareholder pressure to reduce their costs. With the Australian economy in idling mode, cost reduction strategies offer the best short-term potential for increased profits.

The overseas-based IT services providers have been granted a dream run by the Australian Government to exploit their cost advantages. Once they have established branches here they are permitted to sponsor an unlimited number of their overseas personnel on 457 visas. All the major IT offshoring companies that dominate the issuance of temporary work visas in the US (Teitelbaum, 2014) have established branches in Australia, including the global giants, Cognizant, Tata and Infosys.

These Indian companies make no bones about the fact that their business model depends on unrestricted access to their Indian staff. This is their area of comparative advantage, that is, their access to a huge IT graduate workforce willing to accept wages much lower than those paid in Australia. The consulting work these companies do for Australian clients 'requires a talented and highly skilled workforce which can be geared up quickly when a project is won' (NASSCOM, 2014, p. 2). This quotation is taken from the submission by NASSCOM to the recent Australian government 457 Integrity Review. NASSCOM is the lobby group representing these companies. The submission goes on to say that:

> India continues to produce high numbers of very skilled ICT professionals and has greater capacity to provide pools of workers with well-developed proprietary expertise. It is for this reason that most large ICT projects undertaken by our members in Australia will involve skilled professionals assigned to Australia from overseas, and principally from India (NASSCOM, 2014, p. 2).

The scale of this movement is staggering. The two main IT skills being recruited on 457 visas are Software and Applications Programmers and ICT Business and Systems Analysts. As Table 3 shows, 5,956 visas were issued to principal applicants in these two IT fields in 2013-14. Of these, 4,539 (76 per cent) were issued to Indian citizens. That is not the end of the matter. The NASSCOM submission claims that its members are transferring skills to Australia. It does not admit that the process is often the other way. That is, while its staff are completing contract work in Australia they are gaining information that will facilitate the offshoring of the work to India. To this end, Australian IT workers often find themselves training the 457 visa holders in preparation for this offshoring.

The scale of this transfer is already registering in the statistics on the official trade in services statistics. These show that for 2013, imports of computer and information services and other business services from India were $552 million, up from $146 million in 2011. On the other hand, the exports of such services from Australia to India were minimal (Department of Foreign Affairs and Trade, 2014).

Conclusion

I share Schmidt's hope that the Australia government will promote Australian companies capable of competing in the international market for IT services and innovations. However, there is little prospect of this happening given government hostility to an activist industry policy.

In this context, advocates need to think again about their enrolment proposals. At the very least they should acknowledge the poor prospects for the required industry policy and take note of the situation STEM graduates now face in the Australian labour market. On the latter point none of the advocates pay any attention to the migration influx, especially in the IT fields.

Local IT graduates who take up the advocates' challenge face an overcrowded job market flush with migrants taking advantage of the permanent entry skilled program and those brought in by the computing service companies on temporary work visas.

If IT graduate numbers do increase as the advocates propose, the response is likely to be similar to that in the aftermath of dot.com collapse in the early 2000s. As work opportunities in IT shrank, so did Australian enrolments in IT. The Australian Workplace Productivity Authority (AWPA) has pointed out in its study of the ICT Workforce that entry into the IT profession is difficult, thus exacerbating local students' reluctance to enrol in IT. This is because: 'many students who pursue an ICT education experience difficulty in finding employment in the sector on graduation'. This is because 'there are a limited number of entry-level positions' (AWPA, 2013, p. 14).

This situation can only get worse as the outsourcing and offshoring process continues. Neither the companies outsourcing their IT work, nor the contracting service companies have any interest in creating more entry level

jobs, let alone a career structure for Australian graduates. If this scenario comes to pass it will have serious consequences for any prospects of Australia becoming an innovation hub. How, in these circumstances can there be a build-up of a front line IT community capable of competing with the Chinese technological hubs, let alone Silicon Valley? As Stephen Burns (2014), an Australian computer services contractor puts it in his submission to the 457 Integrity Review, local computing staff will be handicapped in competing with overseas suppliers:

> Deep knowledge of the business systems is obtained primarily by the personnel working on the development, deployment and maintenance of these systems. Where development and maintenance is sent offshore or is undertaken onshore by 457 based personnel there is a much higher probability that this Intellectual Property is lost to the business when these personnel are allocated to another project in another country as the project or contracts complete (Burns, 2014, p. 2).

Many measures could be taken to reduce the migrant flow. In particular, the Australian Computer Society (ACS) which is a vocal advocate for more local IT training could act unilaterally to raise the English language standards required of applicants for points tested visas before they are eligible to pursue a visa application. Most professional associations (including all the health fields and accounting) require professional level English (7 on the IELTS scale) before they will accredit applicants for points tested visas. The ACS only requires 6 which is considered to be well short of the English skills needed by professionals.

For its part, the Australian government policy could act to restrict the 485 post-study visa for overseas students to shortage occupations only (as was the case before 2013). In the case of the 457 visa, it could require those sponsoring IT workers to demonstrate that no 'suitably qualified and experienced' Australian IT worker is available.

Bob Birrell is the President of the Australian Population Research Institute (www.tapri.org.au).

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