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Double Jeopardy: The Crises in Information Systems, an Australian Perspective

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Abstract

Students have been deserting IS and ICT courses in droves over the last three or four years, despite forecasts that job prospects in the IS/ICT industry are improving and that there is an impending skills shortage. This paper discusses implications of the current crisis, suggesting that there are in fact two related crises, before outlining a local national response and then proposing a framework for defining an IS career that recognizes the changes in the IS/ICT industry since the turn of the century. Broad career streams that emphasise the importance of IS students being given broad knowledge that includes people, business and technology skills are described. This framework needs to be further developed to provide a foundation to promote a business-focussed, vibrant and important IS industry overall that will appeal to prospective students in order to provide the graduates to address the predicted skills shortage.

Keywords

IS Skills Crisis, ICT Skills Crisis, IS Careers

Introduction

Following the boom of the 1990s, the early part of the 21st century has been more doom and gloom than boom for the information systems (IS) industry. These problems have been reflected in the attractiveness of IS, and Information and Communication Technology (ICT) more generally, as fields of study for prospective students – most OECD countries have experienced dramatic falls in applications for and enrolments in IS (and ICT) courses over the last three or four years (in the remainder of the paper the term IS will be used but many of the issues raised and points made could equally apply to ICT). This ‘first’ crisis in IS is discussed in Section 2 of this paper.

Recently there have been distinct signs of an improvement in the job prospects for IS professionals and in line with the roller-coaster nature of the industry this has quickly developed into forecasts of significant skills shortages in the immediate future. However, despite strong signs that the IS job market has ‘turned the corner’ (explored in Section 3), applications for and enrolments in IS courses continue to fall. IS careers are no longer perceived as fulfilling and rewarding avenues to follow and these perceptions by prospective students need to be addressed. This second crisis in IS is discussed in Section 4.

This paper then outlines a current local national response to the IS skills shortage and proposes a framework for defining an IS career that recognizes the changes in the IS industry since the turn of the century (Section 5). Broad career streams that emphasise the importance of IS students being given broad knowledge that includes people, business and technology skills are described. This framework needs to be further developed to provide a foundation to promote a business-focussed, vibrant and important IS industry overall that will appeal to prospective students in order to provide the graduates to address the predicted skills shortage.

Crisis in IS (1)

The debate surrounding Nicholas Carr's (2003) article, *IT Doesn't Matter*, has more or less run its course in the three years since its publication (for example, Schrage (2003); DeJarnette, Laskey & Trainor (2004)). Opinion is divided with as many commentators in the pro-Carr camp as there are in the anti-Carr camp, probably based on each individual's perspective and actual experience with IS (DeJarnette, Laskey & Trainor, 2004). Carr's main premise is that IS is a commodity, affordable and accessible to everyone, and therefore no longer provides a strategic/competitive advantage to anyone and, ergo, does not matter. Whether Carr is correct or not, his article has proved prophetic in that interest in and applications for IS courses have fallen dramatically in the last few years – students certainly appear to be of the opinion that IS does not matter!

Australia's largest state, New South Wales, has experienced falls in university applications of 17.3% and 12.4% (1,766 to 1,461 to 1,280) for first preference applications and of 20.4% and 14.5% (14,189 to 11,295 to 9,661) for all preference applications for 2005-2006 and 2006-2007 respectively in the field of education "IT" (including IS and ICT courses). Similarly, university application statistics show a fall of 39.2% in offers (2,983 to 1,814) for courses in NSW with field of education "IT" between 2001 and 2007. These trends in New South Wales have been replicated across Australia. Figure 1 shows the application and offer trends (domestic undergraduate students) as reported by the Australian Vice-Chancellors Committee (AVCC, 2006). Similarly, the Federal Department of Education, Science and Training (DEST, 2006) reports trends in numbers (Figure 2) and growth trends as a percentage of 2002 (Figure 3) of commencements, enrolments and completions (domestic undergraduate and postgraduate students) for the field of education "IT". Some academics have estimated that in 2005 there were more students enrolled in the 3rd year of IS/ICT degrees than in the 1st and 2nd years combined.

A survey by the Australian Council of Professors and Heads of Information Systems (ACPHIS) (2006) further illustrates these trends (16 respondents, approximately, half the information systems schools in Australia): Table 1 shows the responses in regard to trends in enrolment numbers and Table 2 shows the estimated percentage change.

The survey also required respondents to identify the three most important challenges facing them and the three most important advantages they could leverage – the responses fell into the following categories (listed in order of importance):

Most Important Challenges	Most Important Opportunities
Falling applications/enrolments	Market (improving job market)
Culture environment (internal)	Industry focus / readiness of graduates
Research issues	Internal factors
Awareness of information systems	Innovation & brand
Staffing issues	Teaching and curriculum
Culture environment (external)	Research factors

Falling enrolments of this magnitude have dire consequences. Already, universities are re-structuring and retrenching in response to falling IS enrolments. In Australia, IS/ICT departments have been closed and merged at Bond University and the University of South Australia and IS/ICT academic staff have been retrenched at several universities, including Monash University, Queensland University of Technology, University of NSW, University of Queensland, and University of Technology, Sydney.

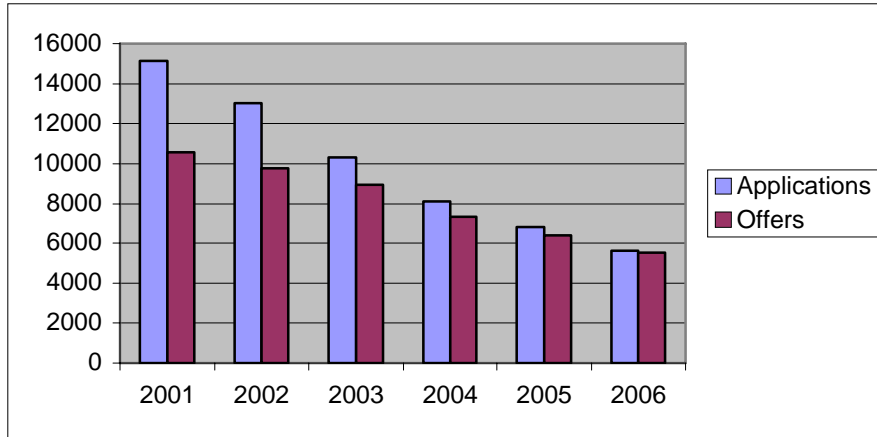


Figure 1: Australian Application and Offer Trends for Field of Education 'IT'

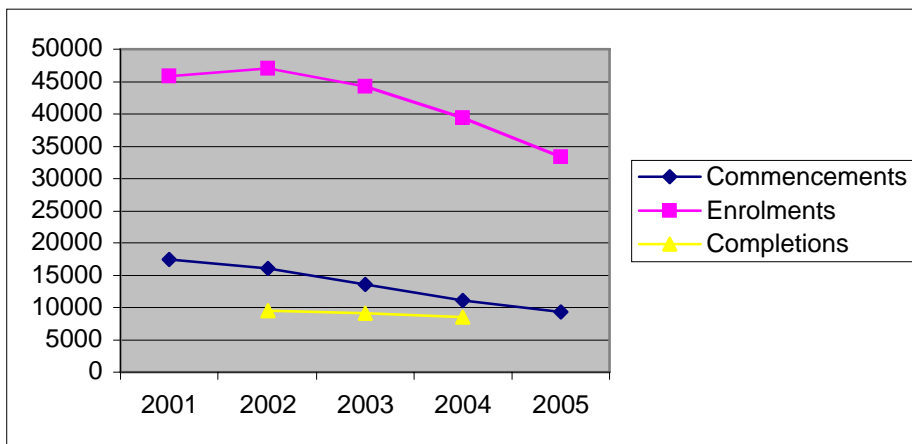


Figure 2: Australian Commencement, Enrolment and Completion Trends for Field of Education 'IT'

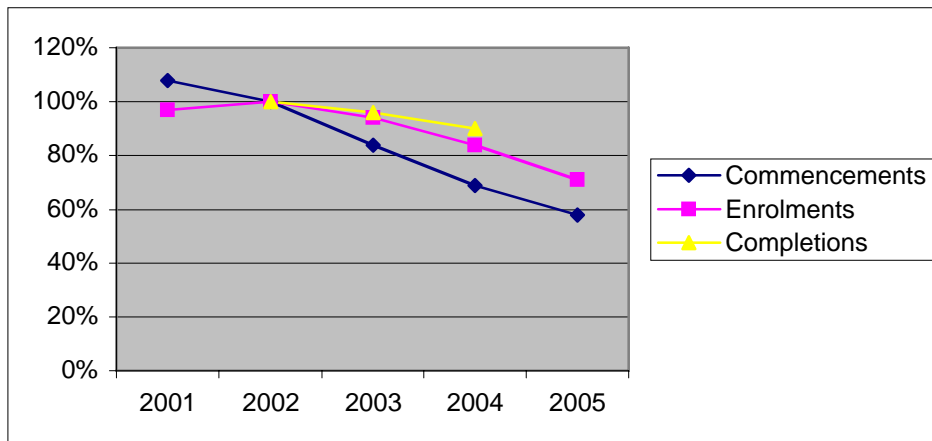


Figure 3: Australian Commencement, Enrolment and Completion Growth Trends for Field of Education 'IT', taking 2002 as the reference year

Table 1: Are enrolment numbers increasing or falling?

Trend	Code	% of Respondents
Falling Significantly	1	7
Falling	2	49
Constant	3	28
Increasing	4	14
Increasing Significantly	5	0
Mean= 2.5, Standard Deviation= 0.85		

Table 2: If not constant, what is approximate % increase/fall?

Trend	Code	% of Respondents (Last Year)	% of Respondents (Last 3 Years)
below 5%	0	0	12
5%	1	25	0
10%	2	25	12
15%	3	12	0
20%	4	12	12
25%	5	0	0
30%	6	25	12
35%	7	0	25
40%	8	0	0
above 40%	9	0	25
		Mean = 3.1 Std Dev = 2.03	Mean = 5.5 Std Dev = 3.25

IS Value and Prospects

The anti-Carr camp has argued that whilst the basic technology may be ubiquitous, competitive and strategic use of the technology is leveraged by how the technology is managed and the IS environment is developed to allow resources such as capital, people and technology to contribute effectively (Schrage, 2003). IS value is derived from business practice innovation (for example, customer relationship management, business process improvement, knowledge management etc.) and are realised by people not the technology *per se* (DeJarnette, Laskey & Trainor, 2004). Even Carr (2003, p1) acknowledges “The way you approach IT investment and management will need to change dramatically”.

A more recent study (Zwieg *et al*, 2006) finds that:

- Most IT departments will add staff by 2008;
- The IT skill mix is shifting from technical to project management and business skills;
- External sourcing, especially of offshore staff employed by domestic third party providers, will increase by 2008;
- Organisations use third party providers to obtain technical skills—mainly back office operations skills and application-related skills;
- A technical foundation is still important for entry-level IT workers.

Significantly, most ‘large’ and Fortune 500 respondent organisations indicated that they expected to moderately increase staffing levels by 2008, whilst most SME respondents anticipated dramatic increases in hiring (Zwieg *et al*, 2006). Similarly, Luftman, Kempaiah & Nash (2005) identify the top five CIO concerns as:

- IT and business alignment;
- Attracting, developing, and retaining IS professionals;
- Security and privacy;
- IT strategic planning;
- Business process reengineering.

This survey shows that 51% of respondents anticipate the IS budget continuing to rise 2006, with 40% of spend attributed to staff and 77.5% of the respondents reporting the same or increased IT headcount in 2005 over 2004 (Luftman, Kempaiah & Nash, 2005). 'Attracting, developing, and retaining IT professionals' ranked second, "consistent with the continued low ranking of staff reduction, now last on management's concerns" (Luftman, Kempaiah & Nash, 2005, p91).

These reports appear to confirm that the IS job market has 'turned the corner' and is improving. Forecasts of IS budget increases and long-term commitment to hiring and developing IS staff are encouraging. The number of IS jobs is likely to remain stable through 2008 and, with the imminent retirement of the baby boom generation, is likely to grow significantly to 2011 and beyond.

Crisis in IS (2)

This situation raises the question, if there is a looming IS skills shortage, why are applications for and enrolments in IS courses still falling? There appears to be no one simple answer, but possible reasons that have been advanced include:

- fears that the improvement is a 'spike' and will not be sustained;
- a natural lag in students responding to the changed jobs situation – things might improve in 2007 or 2008;
- despite the improvement IS/ICT has lost its 'golden glow' – it is no longer a discipline of choice;
- the stereotype of IS being dominated by male 'nerds' is strong and puts off potential applicants;
- current school students being computer literate and not appreciating the career opportunities in the industry;
- IS does not appeal to the aspirations of 'GenY' or the 'millenium generation'.

Whatever the reason, and in reality all these reasons may contribute to the issue, it is clear that IS has lost credibility with potential students (MMV, 2007). The Y2K 'fizzer', the dot.com bust, the trend towards off-shoring, and a poor understanding of the IS industry among the general public have all contributed to decreased interest in IS-related careers amongst young people.

The crisis of low enrolments in IS courses needs to be understood and considered in the context of increased demand from industry for IS professionals, exacerbated by the impending retirement of baby boomers (currently the mainstay of the IS industry). Given the time required to attract, enrol, educate and graduate students from tertiary courses, then educational institutions, professional bodies and the IS industry need to join forces to address this issue by determining how, when, and where future IS professionals will acquire the range of skills and experiences they require to contribute to organisational needs at all levels (Zwieg *et al*, 2006). The recent stagnation in demand for IS graduates (2001 to 2006) is about to be replaced by a significant increase in demand at a time when the number of IS graduates around the world is not only at the lowest in over a decade but is continuing to fall. Third party providers also require IS professionals and, as the IS services market continues to grow, client and customer will compete for entry-level employees from a common pool of graduates. IS professionals are increasingly likely to move between third party providers and client organisations in order to develop strong business and project management skills (Zweig *et al*, 2006). This in turn will fuel the demand for IS professionals.

The immediate issue is to promote IS as an interesting and rewarding career option for young people and to return the discipline to being one of choice.

The Way Forward

Australian Initiatives

In Australia the response has commenced with the impending IS skills shortage issue being addressed by the ICT Skills Foresighting Working Group (established by Senator Helen Coonan and published its final report in June 2006 (DCITA, 2006)) and the National ICT Skills Summit (organized by the Queensland Government and held in Brisbane in June 2006). As a result of these initiatives, the peak information and communication technology (ICT) associations, the Australian Information Industry Association (AIIA) and the Australian Computer Society (ACS), have established the Industry Leadership Group (ILG) to develop and facilitate participation in ICT study

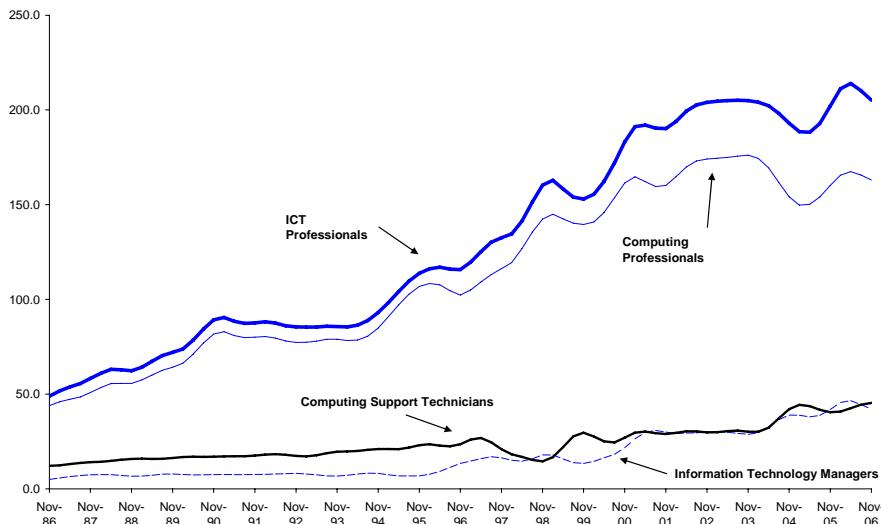


Figure 4: Australian Employment Trends for ICT Occupations

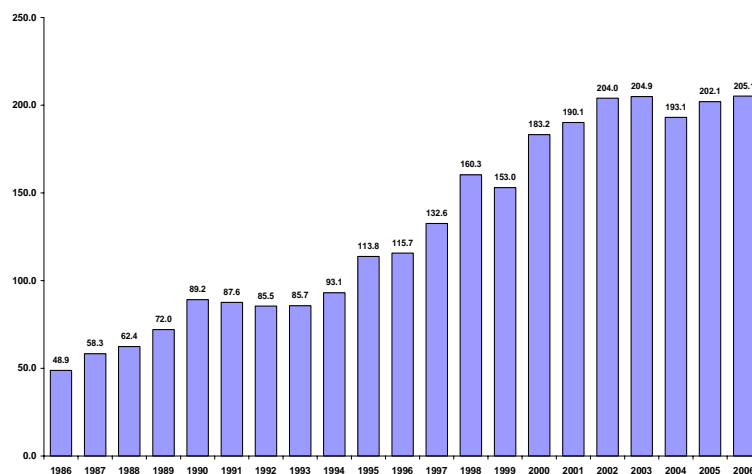


Figure 5: Australian Employment for ICT Professionals

and careers as recommended in the 2006 *Building Australian ICT Skills Report* (DCITA, 2006). The ICT industry is currently worth 4.6% of the nation's GDP and the ILG is committed to collaborative action to address the continued development of a skilled ICT workforce that will play a critical role in either limiting or facilitating industry growth in the coming decade (AIIA, 2006).

The ILG has commenced work in implementing the ICT Skills Foresighting Working Group report's (DCITA, 2006) key recommendations to develop and facilitate improved ICT information and participation in ICT occupations and careers – four projects have been initiated and are expected to report in late 2007:

- Project 1 – ICT Workforce and Labour Market Research and Intelligence

The ILG agreed that the desired outcome of this project is to develop a methodology, which is repeatable, to identify the drivers of industry demand for ICT occupations. Governments, education providers, employers, employees, students and potential students will have consolidated and useful data and information on the supply and demand for workers for the Australian, State and regional ICT labour markets. Convenor: Ron Webber (Monash University).

- Project 2 – ICT Skills Development in the Workplace

The ILG agreed that the desired outcome of this project is to examine issues associated in encouraging workforce retraining, re-skilling and retention initiatives to retain and maintain the Australian ICT workforce size and its capabilities. DEWR advised that it could help with developing questions for surveys to be conducted by the working group. Convenor: Geraldine Kennedy (AIG).

- Project 3 – Teaching of ICT in Schools

The ILG agreed that the desired outcome of this project is to encourage post-school ICT studies as a result of ICT being better presented by school teachers and by being given a good foundation in ICT through their secondary school curriculum. It was noted that the outcomes from project 3 would inform project 4. Convenor: Andrew Blair (AIG).

- Project 4 – ICT Study and Careers Promotion

The ILG agreed that the desired outcome of this project is to deliver a higher profile and appreciation for ICT careers through a harmonised presentation of ICT study and careers to young people and a sharing of campaign information and research within governments, education providers, industry and professional bodies. Convenor: Penny Coulter (Women in ICT).

IS Career Framework

The IS industry is changing and exhibits a shift from a techno-centric focus with technology priorities to a business-centric focus with business priorities where client-facing capabilities allied with business and project management skills are critical (Abraham *et al*, 2006; Zweg *et al*, 2006). IS professionals are now typically required to possess business domain knowledge and project management skills and to have the ability work well with clients and colleagues to solve business problems - the emphasis is on the client-facing skills of analysis and design enhanced by good communication skills, functional area process knowledge, and industry knowledge (Abraham *et al*, 2006). This view is supported by CIOs who identify ineffective communication with IS as the top inhibitor of alignment between the business and IS (Luftman, Kempaiah & Nash, 2005). Zweg *et al* (2006) identify that, in the past, technically skilled early-career IS professionals transformed themselves into mid-career professionals with strong business and project management skills through experience gained over many years. In the 21st century this change needs to be effected more rapidly and this will require changes in university curricula, career paths and the continued development and training of IS professionals. Zweg *et al* (2006) conclude that, although the balance of technical, business, and project management skills is unlikely to be found in a fresh undergraduate, CIOs want to hire graduates with foundation technical skills complemented by business knowledge and project skills and the ability to work closely with non-technical departments and users.

This defines a need for new IS career paths, better development and training programs, and new IS degree and certification programs to better meet the needs of the changing IS industry. Grant (2006) has proposed a framework for defining an IS career, largely because he feels that there is a lack of understanding about the IS industry among the general public. The authors have extended his framework to recognize the changes in the IS industry (with many information jobs migrating from a central IT department to be integrated in business units) as shown in Table 3. The proposed IS careers map reasonably well with the Skills Framework for the Information Age (SFIA, 2005) which provides a common reference model for the identification of the skills needed to develop effective IS (SFIA was developed by a group of industry trade associations, government, professional bodies, practitioners and academics in the UK).

Table 3: IS Career Framework

IS Careers	SFIA Category	Description
Technology Building	Development	Specialised programming and engineering roles involved in building systems from the ground up. This stream accounted for a majority of ICT jobs in the 1980s and 1990s
Technology Implementation	Business Change	Business technology roles that are critical in managing and implementing change across organisations. ICT roles integrated into business units attempting to leverage competitive advantage from packaged software implementations
Technology Infrastructure	Service Provision	Within organisations, roles that provide and support the network infrastructure that underpins technology building and implementation
Technology Services	–	An entire industry spanning ICT services to both the government and private sector
Technology Governance	Strategy and Planning	Strategic roles implementing organisation strategy by aligning business and ICT strategic planning

These broad career streams emphasise the importance of IS students being given broad knowledge that includes people, business and technology skills – a pure technology focus was probably insufficient for a traditional technology building role but is certainly inadequate for the newer career streams that are emerging for IS professionals. Abraham *et al* (2006) recommend that IS courses must provide education within a business-context, enabling students to develop the business, management, and client-facing technical skills that industry demands.

Educational institutions, professional bodies and the IS industry must unite in agreeing these new IS career paths and new IS degree and certification programs to better meet the needs of the changing IS industry and commence promoting a business-focussed, vibrant and important industry to motivate and excite young people toward IT-related careers.

Soft Skills and Business Skills

The Career Space consortium of leading European universities and international ICT companies supported by the European Commission and CEN/ISS (the European standardisation body for the information society) has established a project to develop a framework to describe the roles, skills and competencies required of IS professionals (Petersen & Wehmeyer, 2004, 2005; SFIA, 2005). The framework defines six IS business areas each with a unique set of different skill and competency needs, but also defines core generic skills that include behavioural and personal skills, soft and method skills, and general business understanding. The consortium stresses that IS system solutions are “increasing at the heart of the way companies do business” (Career Space, 2001, p14) and that an understanding of the fundamentals of business (economics, markets and business issues) is required of IS professionals. Also, IS professionals need “to be able to work with others from different cultures and backgrounds and arrive at a mutual understanding, in order to meet deadlines while working in this parallel way” (Career Space, 2001, p15), requiring specific education and training in team work (including real experience of team projects), personal skills (including problem solving and communication and persuasion skills), and behavioural skills (awareness of the need for life-long learning and awareness of cultural differences). Finally, the consortium recommends stronger collaboration between academia and industry.

Australian universities have traditionally responded well to these requirements and many IS courses already incorporate coverage of behavioural and personal skills, soft and method skills, and general business understanding, and in many cases have done so for many years. A majority of, if not all, IS undergraduate courses in Australia are accredited at the professional level by the Australian Computer Society (ACS). ACS accreditation (ACS, 2003) requires mandatory coverage of three areas, one of which is ‘interpersonal communications’. The interpersonal communications area

“deals with individual behaviour and group dynamics and the application of these principles to the system development process. There has been a consistent comment from employers that a high level of interpersonal communication ability is an essential attribute of IT staff at all levels. It is important that those seeking employment in this profession appreciate that it is largely people-centred rather than technology-centred“ (ACS, 2003,p41).

The ACS also requires that IS professionals not only acquire these generic skills but also understand and appreciate the working environment in which they are exercised – “the presentation of complex technical matters to a non-technical audience, the management of peer technical reviews or walkthroughs, the specification of procedures and structures by textual and diagrammatic means,, the selection and management of multi-skilled development teams with disparate interests and backgrounds, the preparation of documents of a technical nature such as tenders and requests for proposals, presentations of technical products and systems proposals“ (ACS, 2003, p41). IS courses in particular cover the fundamentals of business: 44% of Australian IS schools or departments are housed within a Faculty of Business or Business School (ACPHIS, 2006) and the topic ‘Fundamental Business Areas’ is identified as receiving in-depth coverage by over 60% of the responding schools or departments (ACPHIS, 2006).

Australian universities are also at the forefront in developing ‘work ready’ projects aimed at preparing graduates with the knowledge and skills needed for employment – inculcating behavioural and personal skills, soft and method skills, and general business understanding. Various different schemes are already operating at ANU, Flinders University, Monash University, Swinburne University of Technology, University of Canberra, University of New England, University of Sydney, University of Wollongong, and UTS. Also, many universities, particularly the ATN universities, have industry advisory committees to provide input on the industry relevance of the curriculum. Finally, IS schools and faculties have a heavy reliance on casual academic staff, many of whom have industry experience that they bring to the classroom.

In summary, Australian universities tend to be well advanced in preparing work ready graduates for the IS industry and are well-placed to respond to increased interest in studying for a career in IS, if that interest can be engendered. The efforts of the ILG, the ICT industry and the tertiary sector over the next few years will determine if that interest will eventuate.

Conclusion

In Australia the response has commenced with the formation of the Industry Leadership Group which has commenced work in implementing the ICT Skills Foresighting Working Group report's (DCITA, 2006) key recommendations to develop and facilitate improved ICT information and participation in ICT occupations and careers. The ILG represents a commitment from the educational institutions, professional bodies and the IS industry to collaborate in addressing the issue. Four projects have been initiated and are expected to report in late 2007. One of its tasks will be to harmonise statements about IS and ICT careers to provide a consistent and positive message to prospective students about the challenging and interesting work that an IS career can provide.

In addition to promoting a more positive image of the IS industry, two related issues need to be addressed. Firstly, since much of the outsourcing and offshoring involves the basic technical skills of entry-level positions (Abraham *et al*, 2006), an unintended consequence is the elimination of opportunities for entry-level graduates to develop business and project skills (Zwieg *et al*, 2006). The critical entry-level requirements continue to be programming and other technical skills with technical qualifications still highly valued in entry-level candidates. How are graduates to gain their first position and then rapidly acquire the communication skills, business domain knowledge and project management skills required to progress?

Secondly, the number of females in the IS profession is low and the number is declining. Females represent between 26% (DCITA, 2006) and 32.4% (ITAA, 2005) of the IS workforce whilst representing around 47% of the workforce overall (DCITA, 2006; ITAA, 2005). The number of females in senior IS positions is also low, around 20% (DCITA, 2006). This despite the fact that heterogeneous teams fare better than single-sex ones at problem solving, and that females are better at team building and communications (Economist, 2006).

Both these issues need to be addressed promoting a business-focussed, vibrant and important industry overall.

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