

Department of Computer Science,
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Te Whare Wānanga o Ōtāgo

Technical Report OUCS-2006-10

Computer Science Graduate Shortage

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<http://www.cs.otago.ac.nz/research/techreports.html>

Report on Computer Science Graduate Shortage

Compiled by: Simon McCallum

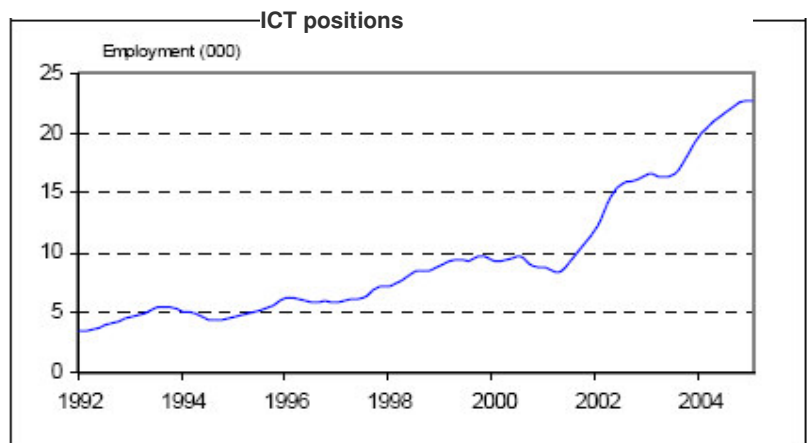
Background

There has been a sudden and dramatic drop in the numbers of students enrolling in ICT degrees in the last 5 years. At the same time there has been a strong increase in the number of people employed in ICT positions. This divergence in the supply and demand for programming staff, raises a serious concern over the number of well trained programmers that will be available for employment within New Zealand in the next 5 years. These trends are global and will impact on the New Zealand economy severely and will limit growth.

Employment Situation

In October 2006 there were 4203 IT jobs being advertised on the two main employment websites in New Zealand. Seek (www.seek.co.nz) has 3112 and jobstuff(www.jobstuff.co.nz) has 1091¹. Some of these will be duplicated advertisements but the figures give an indication of demand. A recent review of ten professions² by the Department of Labour summarised the IT profession as: Genuine skill shortage

- Fill rate of **53%** (below 80% is considered a shortage)
- Currently Employing **22,000**
- Training rate **9.4%**
- Retirement rate: **0.3%**
- Female: **26%**
- Skill Shortage is both Immediate Short term and Long term
- **1.8** Qualified applicants per position
- Pay increase **6.3%**³



Source: Household Labour Force Survey, Statistics New Zealand.

Graph from department of labour

The position for IT is actually even worse than this report claims. The Training rate of 9.4% is based on graduates in 2004 which is double the estimated number of first years in 2006⁵, approximately 900, giving a training rate of just 4%. It is interesting to see the relatively slight effect the dot com collapse had on the total number of ICT employees shown in the graph above. The small dip in 2001 is followed by sustained growth throughout the rest of the 2000's.

The University of Otago has been approached by more than 20 employers looking to raise their profile on campus. IBM, Orion Health, Unisys, HP, and many smaller companies are directly targeting students in their final year with recruitment drives. In comparison, in the previous year to June 2005 we were approached by only two.

¹ Trademe Jobs has 858 IT adverts already and has only been in operation for a couple of months.

² Overview of the findings from ten professional occupation skill shortage assessment reports, November 2005

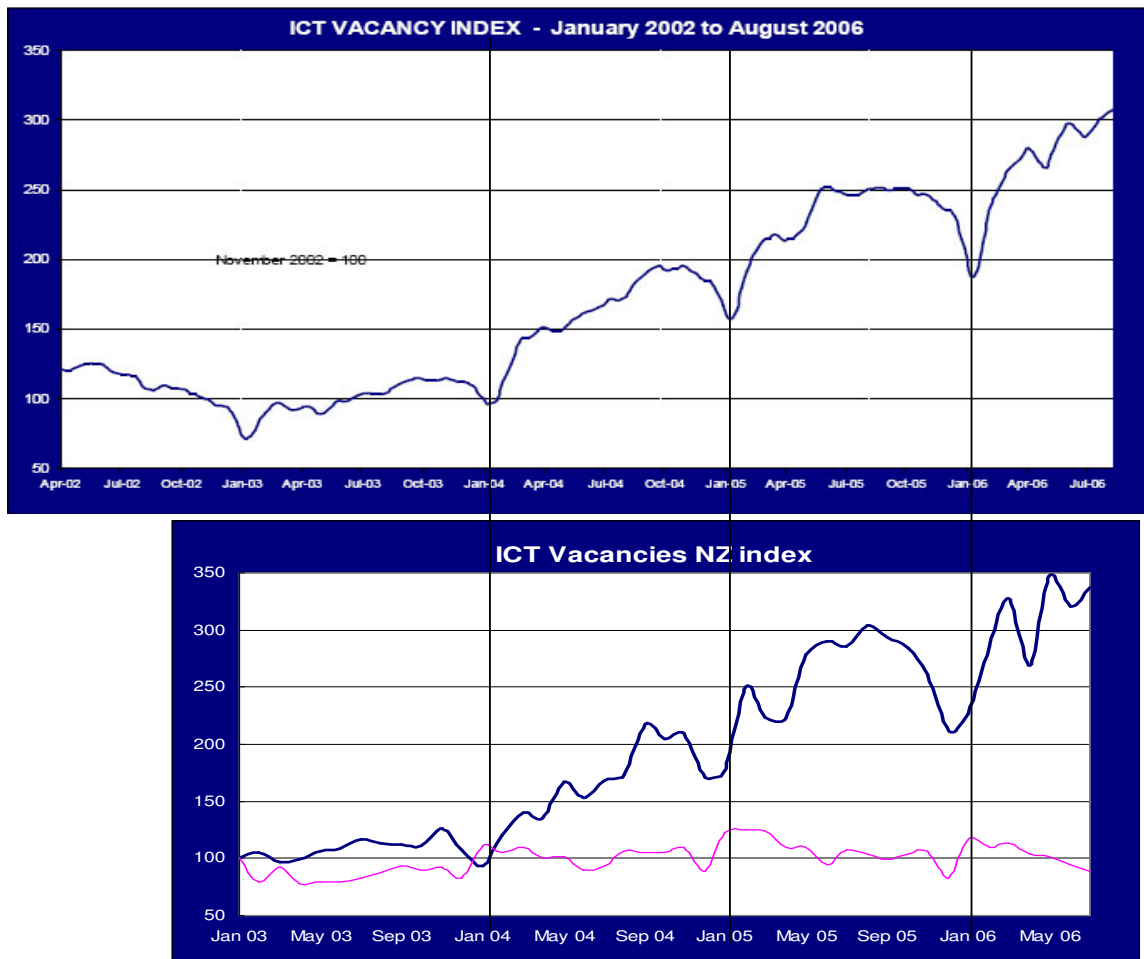
³ <http://www.stuff.co.nz/stuff/0,2106,3792055a28,00.html>

⁴ <http://www.dol.govt.nz/PDFs/professional-report-it.pdf>

⁵ Prof John Hine Victoria <http://computerworld.co.nz/news.nsf/news/12DEA4B35CC91D01CC2571CE000F7EF0>

Vacancies

Australian numbers of ICT vacancies:⁶



The equivalent New Zealand vacancy information, including indexed total vacancies (Jan 04 =100).⁷

These two graphs show the indexed number of vacancies being advertised online for each month of the last 3-4 years. These graphs show that by August 2006 the number of vacancies for ICT positions is 3 times that seen in Jan 2004, while the total number of advertised jobs (bottom line in NZ graph) remains fairly static. It is also worth noting the similarity between the Australia and New Zealand data, suggesting joint issues and similar economic conditions.

Other countries including South Africa and the UK are reporting similar figures with shortfalls predicted. The estimates in the UK are that

There is a significant skills gap in the UK that is especially marked in IT and software development. Research estimates that **150,000** extra employees are needed in IT each year, but only **20,000** graduates in computer science and STEM subjects graduate from UK universities.

Developing the Future⁸

These numbers suggest that New Zealand will have to compete with all our Western trading

⁶ <http://www.workplace.gov.au/workplace/Category/Publications/LabourMarketAnalysis/VacancyReports>

⁷ <http://www.dol.govt.nz/publications/jvm/job-ad-monthly-report.asp>

⁸ Developing the Future. A report on the UK Software Development Industry, 5th July 2006

partners for the shrinking pool of skilled IT staff. Even in developing economies such as India⁹ and China¹⁰ there are reports of IT Skills shortages.

Enrolments

Perhaps of even greater concern is the precipitous drop in the enrolments for ICT degrees. In New Zealand, Computer Science and Information Science degrees have first year enrolments less than 50% of those in 2001. The graduating class of 2004 is made up of first year students mostly from the 2002 and 2001 year. Given this sudden drop in numbers of first year students, **the number of graduates in 2008 is expected to be fewer than half of the number in 2004.**

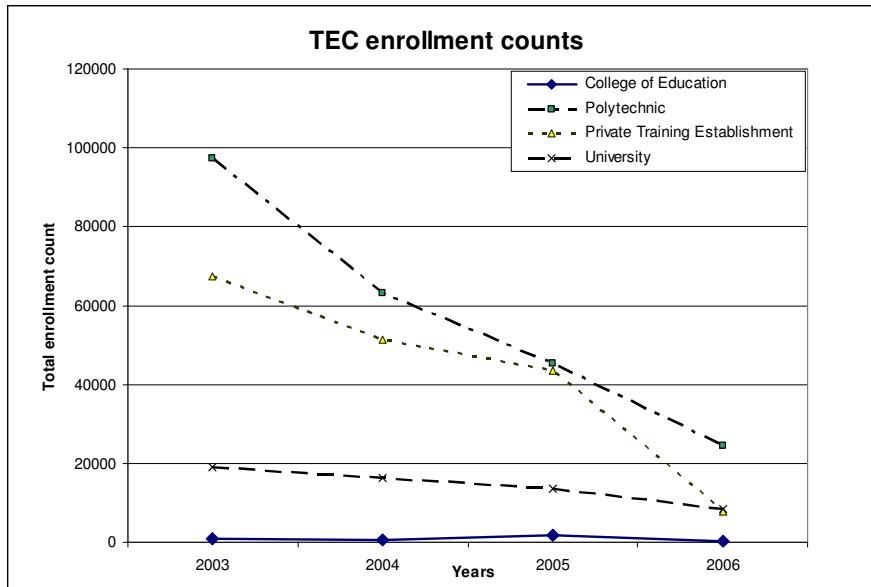
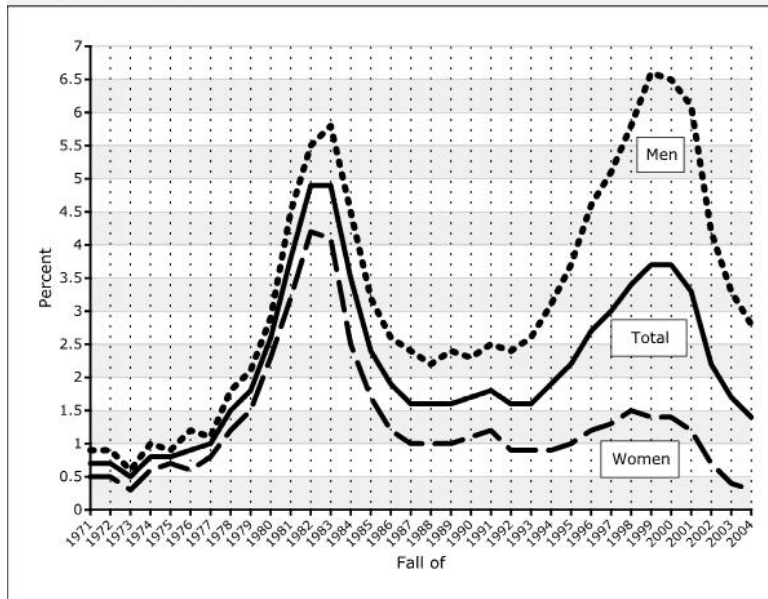


Figure 1. Computer Science Listed as Probable Major Among Incoming Freshmen
Source: HERI at UCLA

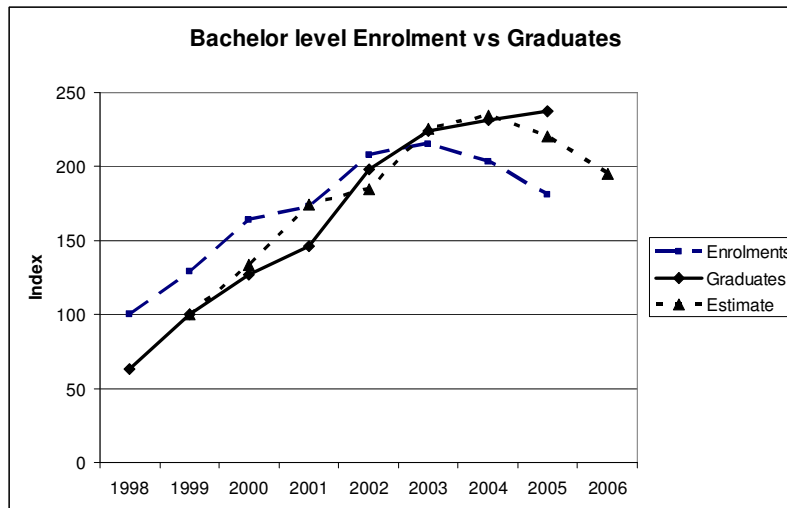


<http://www.cra.org/CRN/articles/may05/vegso>

The US figures are for a much longer time frame but the trend in the last 4 years is similar.

⁹ <http://australianit.news.com.au/articles/0,7204,20042766%5E15334%5E%5Enbv%5E15306-15317,00.html>

¹⁰ <http://www.computerworld.com.au/index.php/id;1597502262;relcomp;1>



Ministry of education figures

When we focus on Bachelor level qualifications there is an enrolment peak in 2003. Estimating the graduate numbers in the future by simply shifting and scaling enrolment we can see that there will be a sharp drop in 2006 and given a model of first year numbers to enrolment totals we can expect this to continue to drop for the next two years.

The following countries have had either government or media reports of dropping first year CS enrolments:

- US – 50% drop (2000-2005) – CRA research
<http://www.cra.org/CRN/articles/may05/vegso>
- UK – 60% (2002-2006)
- Canada 20% (2002-2004)
- Australia 40-50% drop
- NZ 50% (2001-2006)
- Most EU countries have between 30%-50% – European Computer Science Summit 2005
<http://se.ethz.ch/~meyer/publications/acm/ecss-full.pdf>

Why are the students not enrolling?

There are many reasons why students may not be enrolling in ICT. It has been suggested that these include:

- Lack of knowledge about ICT careers among parents and advisors.
- Perception that there are no jobs in ICT.
- Image of ICT as “geeky”.
- Image of ICT as hard work for low pay.
- No clear pathway from Secondary to Tertiary ICT degrees.
- Lack of competent ICT teachers in secondary schools.
- Increase in training for technical trades (New Zealand Specific).

There are many possible solutions to these problems. Given that these problems are mostly world wide, it is unlikely that any one solution will solve these problems. The best we can hope to do is shorten the duration of the shortage of graduates.

Proposed Solutions:

- Perception that there are no jobs in ICT:
 - Media coverage of the shortage of graduates.
 - Companies approaching local schools careers expos to discuss ICT careers.
 - Informing high school careers advisors of the careers available.
- Image of ICT as “geeky”:
 - Media coverage of non-geeky ICT professionals.
 - Companies presenting professional image.
 - Universities incorporating ICT courses as part of all degrees.
- Image of ICT as hard work for low pay:
 - As above but showing the actual salaries of graduates.
 - Propagating information about the maturity of ICT companies and the actual work/life balance.
- No clear pathway from Secondary to Tertiary ICT degrees:
 - Improving the curriculum for year 12 and 13 in secondary school (AUT and EDS working on this).
 - Informing careers advisors about the types of courses at TEOs.
 - Developing closer relationships between TEO and secondary schools.
- Lack of competent ICT teachers in secondary schools:
 - Increasing the number of ICT students in general.
 - Adding more ICT components to secondary teaching teacher qualifications.
 - Increasing the funding for ICT training of high school teachers.
 - Developing a much more comprehensive training environment for high school teachers.
- Lack of knowledge about ICT careers among parents and advisors:
 - Most of the above with an emphasis on media coverage.
- Increase in training for technical trades:
 - Local issue in New Zealand. No real solution, as the trades need these people also.

Some of the above solutions will result in an immediate increase in student numbers, while others are systemic and result in an increase in the longer term.

At this stage industry and academia need to be working together to develop more solutions, and to approach central government to assist in implementing some of these solutions.

Summary

This is a fairly bleak picture for ICT companies. Without action we can expect that fill rates will drop below 30% for vacancies over the next 3 years. Wage bills will increase as a result and margins will be squeezed. The wage increase of 6.3% to June is likely to be closer to 8% next year and possibly 10% the year after. Unless the IT sector takes significant action now this problem will restrict growth and cause wage costs to skyrocket.

The demand spike is still lower than that experienced in the US and Australia during the dot com boom, but there is one significant difference, in 1999 student numbers were **increasing**. Now the enrolments are decreasing and so the labour squeeze will be much greater.

The government’s focus on the GIF sectors does not take this looming shortage into consideration. The government’s HiGrowth strategy has a target of 100 ICT companies turning over \$100 million per year by 2012 or 10% of GDP. Let us assume that each person in the company is on average

responsible for \$150K revenue per year¹¹. Thus we need 66,000+ staff in ICT companies. We currently have 22,000 and in the next three years will produce about 3,500 ICT graduates. Even if only 1/3 of the employees have ICT qualifications this will only be an increase of 10,500 staff. Once you have included migration (currently less than 200 per year) this will be only 33,000 employees. Given current enrolment numbers it would take until 2018 before we have enough graduates to get anywhere near this target.

These numbers should be a call to arms for the IT sector. Industry and academia need to work together to increase the numbers of students so there are qualified people to employ and sustain growth.

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¹¹ <http://www.softwaremag.com/2003-12-rev-per-employee.htm>