Forecast of Skills Demand in the High Tech Sector in Canterbury: Phase Two

Paul Dalziel
Caroline Saunders
Eva Zellman

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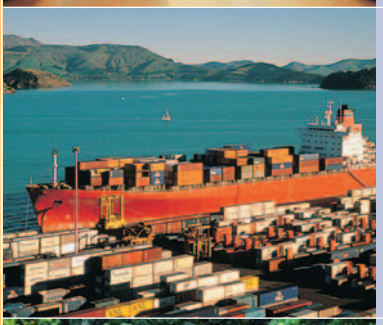

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Executive Summary

Introduction

1. This report presents the results of a second survey carried out by the AERU research unit of Lincoln University to map skills demand in the Canterbury ICT sector. This research was commissioned the Electrotechnology Industry Training Organisation (ETITO) Growth Pilot, funded by the Tertiary Education Commission, to develop mechanisms to ensure the timely delivery of an appropriate number of suitably qualified individuals required by enterprises in the Canterbury ICT sector. It builds on a similar survey in 2004.

The Canterbury ICT sector

2. New Zealand Trade and Enterprise has identified four industry clusters in the Canterbury area, including an electronics cluster and a software cluster, often referred to together as the Canterbury high-tech sector. For the purposes of the ETITO Growth Pilot, the ICT sector is defined as those firms in Canterbury that are either: (i) engaged in the research and design, and/or the production, of high-tech electronics products; or (ii) engaged in creating specialist software products.

Defining skills

3. The AERU research team adopted a three-part approach to defining skills, reflecting the partnership between industry and tertiary education organisations that is the basis of the project. The three parts are (i) occupations; (ii) qualifications; and (iii) attributes.

4. The classification of occupations was the same as in the 2004 survey, which was created using a draft framework prepared by Statistics New Zealand and the Australian Bureau of Statistics. It is based on four major divisions: Management; ICT Research and Design; ICT Sales and Marketing; and ICT Production and Support.

5. Qualifications used in the study were divided into two streams: technical qualifications and business qualifications. The level of qualifications in both streams ranged from in-house training to Masters or PhD degree.

6. A list of 20 attributes was adopted, based on a categorisation produced by the Conference Board of Canada. This list classifies a number of "employability skills" under three generic headings: fundamental skills; personal management skills; and teamwork skills.

Determining the sector's population

7. The research team used a telephone survey to construct a comprehensive database of the electronics and software firms in Canterbury. Firms that described themselves as involved in both electronics and software were categorised as electronics firms. In total 196 firms were identified; 83 firms in electronics and 113 in software. This was 41 more firms than in the 2004 survey.

8. Total direct employment in the electronics industry in Canterbury was recorded as 2,669 staff. Total direct employment in the software industry in Canterbury was recorded as 1,271 staff. The electronics sector is more established, with 59.5 per cent of the firms founded before 1995, compared to 26.4 per cent of software firms.

Current ICT occupations in Canterbury

9. In September 2006, the AERU research team sent questionnaires to the firms in its population database. The overall response rate was 40.3 per cent, which is very good for an industry survey of this type. The returned surveys covered 58.8 per cent of current employment in the Canterbury ICT sector.

10. Section 4.1 of the report presents four tables recording the estimated current employment in the Canterbury electronics industry, classified into the four core groups of management (258 staff), ICT research and development (1,106 staff), ICT sales and marketing (174 staff) and ICT production and support (1,130 staff).

11. Section 4.2 of the report presents four tables recording the estimated current employment in the Canterbury software industry, classified into the four core groups of management (215 staff), ICT research and development (843 staff), ICT sales and marketing (118 staff) and ICT production and support (94 staff).

Predicted ICT occupations from current firms

12. The survey asked respondents to estimate what their employment patterns might be in five years time. Where responses gave a range (for example, 5-10 extra software engineers), the lower figure was used to adopt a conservative estimate.

13. The electronics firms were relatively conservative in their forecasts, estimating an increase of 3.6 per cent per annum. This is in contrast to the software businesses, which predicted an increase in aggregate employment of 10.7 per cent per annum for the next five years.

14. Sections 5.1 and 5.2 present tables recording the predicted employment by electronics and software firms respectively. The projected increase in the combined four occupation groups by firms that currently exist in the Canterbury electronics industry is 516, or 19 per cent. The projected increase of firms that currently exist in the Canterbury software industry is 842 staff, implying a growth rate of 66 per cent.

Modelling the impact of new entrants

15. The study modelled the impact on occupation structure if there is a similar pattern of new firms in the high-tech sector over the next five years as occurred between 1999 and 2003. The 2006 survey found no new firms in 2005, and so the estimates in this chapter are conservative. Most of the firms founded in the last five years (40 out of 46) employ 10 or fewer workers, and only one new firm has more than 50 employees at present.

16. The number of managers in the high-tech sector is predicted to grow by 34.8 per cent in the electronics sector and by 66.2 per cent in the software sector. Sales and marketing managers and project managers are predicted to be in strong demand in both cases, while there is also a strong demand for product managers in the electronics sector.

17. The results predict that research and development staff in the electronics sector will grow by 30.7 per cent over the next five years. Nearly a third of the increase is software engineers (106 new positions). The overall increase in research and development staff predicted in the software industry is 73.5 per cent.

18. A striking feature of the electronics industry is the large number of software engineers and programmers it employs (425). This indicates the importance of embedded software in the high-tech sector. The software industry is also expecting to increase its demand for software engineers, by 206 positions. This suggests that the combined electronics and software industry demand for software engineers will increase by 50 per cent, from 628 at present to 941 in five years.

19. Both sectors indicate much larger percentage increases in their sales and marketing staff of 41 per cent and 136 per cent respectively. Taken together, the projections indicate increases in marketing specialists, ICT pre-sales consultants and ICT customer support technicians of between 46 and 51 positions each. The software sector stands out in its projection for 71 new ICT sales representatives (compared to only 5 in the electronics sector).

20. The electronics sector employs a significant number of production workers, particularly product assemblers and testers (796 people). This is projected to rise steadily over the next five years (13 per cent), but not at the same rate as overall growth in the industry (26 per cent). ICT production and support is not so significant in the software firms.

Qualifications

21. The analysis of demand for qualifications used the same mapping from occupations to qualifications as in 2004. This was based on an expectation that industry standards for qualifications are unlikely to change significantly over two years. Thus, the mapping in the report was based on the returned questionnaires in 2004 from the large electronics firms. The data were analysed separately for technical and business qualifications.

22. A striking feature is the very strong demand for engineering degrees for all except production and support employees. This is not surprising for research and development staff, but the firms also expect large proportions of their management and their sales and marketing employees to have a degree in engineering. Degree qualifications in science, technology, computing or software are also in high demand, although a diploma is sufficient for some positions in sales and marketing.

23. Firms do not seem to expect their production and support employees to have business qualifications, but sales and marketing employees are expected to have a commerce or business degree, and research and development employees require some business training. Management are expected to have an undergraduate or postgraduate qualification in commerce or business.

24. Over the next five years, the high-tech sector in Canterbury is expected to require 473 more engineering degrees, 426 more degrees in science, technology, computing or software, and 321 more degrees in commerce or business. These figures do not take into account normal employment turnover or retirements.

25. There is also demand for sub-degree qualifications, including 257 certificates or diplomas in technical ICT subjects and 519 certificates or diplomas in business subjects. The firms also seem more confident about providing in-house training in technical areas (701 in total) than in business areas (only 151 in total). This is reflected in a much greater demand for external short courses in business (426 extra people) than in technical subjects (122 extra people).

General employee attributes

26. The large firms were requested to rank the five most important attributes for employees within their firm out of a set of 20. The most important was positive attitude and behaviour, included by 24 out of the 30 responding firms. Three other attributes were mentioned by 17 or more responses: problem solving skills, ability to work with others, and person-to-person communication. These top four attributes stood out from the list since they were mentioned by twice as many respondents as the next group of attributes.

27. The survey to the large firms allowed respondents to specify the specialist skills or knowledge they thought particularly important for their employees. Both the large firms and the smaller firms were also requested to provide any other comments relating to their demand for skilled employees in the high-tech sector in Canterbury. The responses from these parts of the surveys are summarised.

Comparison with the 2004 survey

28. The final chapter compares the main results of the 2006 survey with the 2004 survey. The first significant difference is the larger population database in 2006. The database in 2004 contained 155 firms (excluding 8 firms who chose not to participate), whereas in 2006 there were 196 firms (excluding 7 firms who chose not to participate).

29. The second significant difference is the response rate of the large software firms. The response rate from these firms was very good at 42.9 per cent in 2006. This means the projections for software demand are more robust than in 2004.

30. The employment structure data for the electronics industry are very similar in 2004 and 2006. These data show that sales and marketing is still the smallest category, but that it has grown its share at the expense of each of the other categories. There is a significant difference in the software data, however, which shows a reduction in the share devoted to research and development from three-quarters to two-thirds. This is likely to have been a consequence of the small response rate from the large software firms in 2004.

31. At the aggregate level, the projected growth rates are both higher in 2006 than in 2004, but not by a large amount. The electronics growth rates were 21.0 and 25.8 per cent in 2004 and 2006; for the software sector they were respectively 76.0 and 78.4 per cent. Both industry groups see the strongest growth being in the area of sales and marketing; the software industry has repeated that it expects to more than double its employment of sales and marketing staff over the next five years.

32. Compared to 2004, the respondents in the 2006 survey have reported approximately twice as many qualifications required in five years time. The pattern of high demand for graduates with engineering degrees and with some knowledge of commerce (short course, certificate or degree) is apparent in both sets of data.

Chapter 1
Introduction

The Electrotechnology Industry Training Organisation (ETITO) is coordinating a Growth Pilot funded by the Tertiary Education Commission (TEC) to develop mechanisms to ensure the timely delivery of an appropriate number of suitably qualified individuals across the range of competence required by enterprises in the Canterbury ICT sector. The objective is to ensure that growth and productivity of companies in this sector are not hindered by skill shortages, building on an earlier project by two of the current authors, Caroline Saunders and Paul Dalziel, *The High Tech Sector in Canterbury: A Study of its Potential and Constraints* (August 2003).

In 2004, the AERU research unit at Lincoln University was contracted to undertake the first phase in Stream One of the Growth Pilot, headed **Industry Skill Demand**. The primary objective of the Industry Skill Demand stream is to produce a comprehensive picture of current and forecast industry skill demand in the Canterbury ICT Sector to steer the provision of education services and talent pipeline efforts. Consequently, the AERU carried out a survey in November 2004 to map skills demand in the Canterbury ICT sector. The results were reported in P. Dalziel, C. Saunders and G. Taylor, *Forecast of Skills Demand in the High-Tech Sector in Canterbury* (AERU Research Report 275, March 2005).

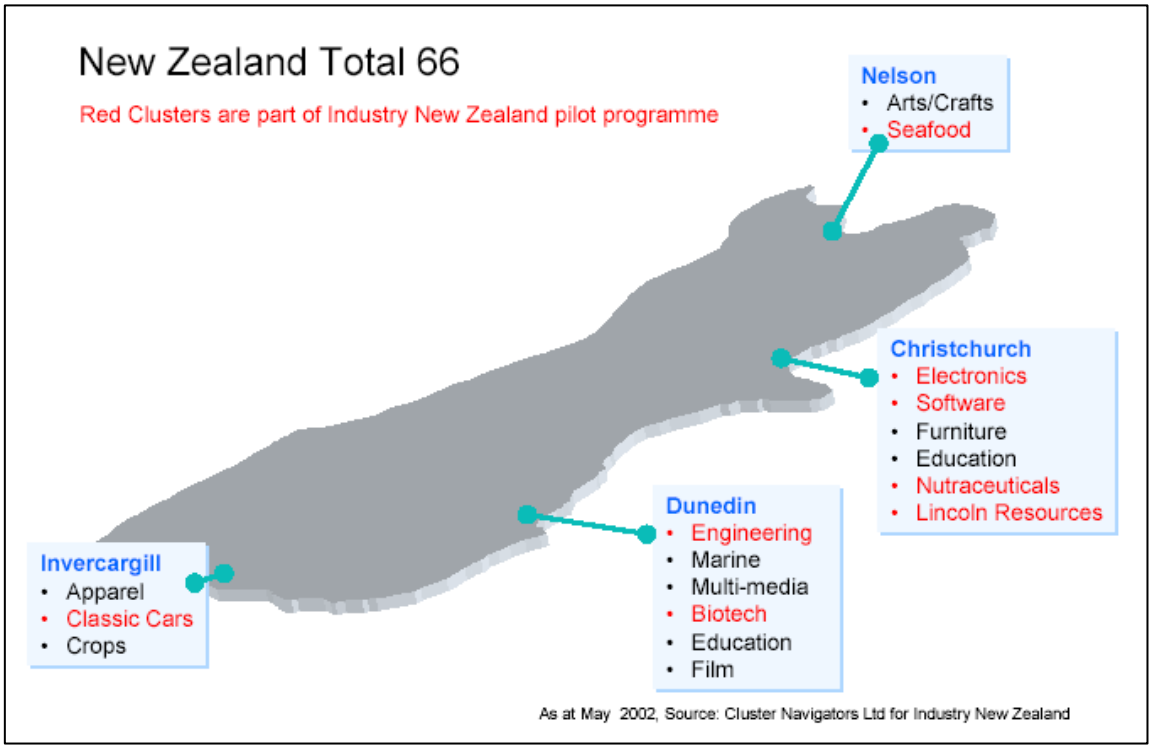
In 2006, the AERU was commissioned to repeat the 2004 survey. This report presents the results of the 2006 survey, following the same format as Research Report 275. It begins in Chapter 2 with the definition of the Canterbury ICT sector adopted for the Growth Pilot project. Chapter 3 explains the categories of occupations, qualifications and employee attributes used in both studies. Chapter 4 describes the population profile of electronics and software firms identified for the 2006 survey, which was larger than for the 2004 study by 41 firms. Chapters 5 and 6 present the current and expected occupation structure of the firms currently in the sector, using survey data from these firms. Chapter 7 models the impact of potential new entrants over the next five years. This allows Chapter 8 to project the demand for qualifications in the Canterbury ICT sector over this period, using the same mapping mechanism developed for the 2004 survey. Chapter 9 describes the most important general employee attributes reported by the sector's larger firms. A later report will analyse the comparisons between the two surveys in more detail, but Chapter 10 completes this report by summarising the main differences in the aggregate predictions.

Chapter 2
The Canterbury ICT Sector

The term ICT is often used in an 'umbrella' sense, covering a wide range of converging technologies (in a vertically integrated sense) and their enabling effect across many industries and sectors (horizontal/enabling effect). There are multiple contested definitions. The ICT Taskforce, for example, defined ICT as 'products and services that are underpinned by the combination of electronics and/or software and/or telecommunications' (2003, p. 6). This definition is too broad for ICT in the Canterbury Growth Pilot project.

In July 2002, Industry New Zealand (now New Zealand Trade and Enterprise) published work by Ifor Ffowc-Williams and Guy Redding listing regional specialisations (or industry clusters as they are often called) for New Zealand. Four of the clusters were selected for an Industry New Zealand pilot programme in the Canterbury area: electronics, software, nutraceuticals and Lincoln resources (see Figure 1). It has become common to refer to the first two industries together as the Canterbury high-tech sector.

Figure 1: The South Island clusters identified by NZTE



Source: Cluster Navigators (2004, p. 8).

There has been a series of initiatives to foster the development of the Canterbury high-tech sector. Connect Canterbury is a joint initiative of New Zealand Trade and Enterprise and the Canterbury Development Corporation that aims to accelerate the growth of high-potential companies by building partnerships and connecting them to the key relationships that will add most to their growth (*www. connectcanterbury.com*). Electronics South is an industry group convened by the Canterbury Development Corporation (*www.electronicssouth.com*). Canterbury Software Incorporated is a non-profit organisation aimed at helping the

Canterbury software sector (*www.canterburysoftware.org.nz*). The Canterbury Innovation Incubator provides support for emerging technology-based companies and entrepreneurs (*www.cii.co.nz*). NZTE hosts a monthly series of high-tech breakfasts during the year (*www.nzte.govt.nz/section/11900.aspx*).

In 2003 Professors Saunders and Dalziel of Lincoln University were commissioned to prepare a report on the potential and constraints of the high-tech sector in Canterbury. That report recommended greater collaboration between the high-tech sector and tertiary education organisations in the region. In December 2003, the Canterbury ICT Cluster was set up with this as one of its core tasks. The report also recommended the preparation of a proposal for a new research institution under the government's Partnership for Excellence programme. On 11 July 2006, UCi3, the New Zealand ICT Innovation Institute hosted by the University of Canterbury, was launched as the country's national centre for excellence in Information and Communications Technology. It aims to link academic and industry expertise to enhance high-tech capabilities and developments (*www.ict.canterbury.ac.nz*).

The ICT in Canterbury Growth Pilot project is another initiative in this series. As the TEC application document noted, the project has its roots in an industry initiative. The project, the outcomes of which may well have application in other regions, is based in Canterbury where two nationally recognised and established industry clusters in electronics and software exist. These two 'component parts' of the broader ICT sector are therefore the focus of the current industry skill demand research project because of their disproportionate significance to the Canterbury region.

This focus does not preclude informal collaboration with other parts of the ICT sector and other sectors which benefit from or reply upon products and services from the hi-tech sector. Nevertheless, for the purposes of the ETITO Growth Pilot project, the ICT sector is defined as those firms in Canterbury that are either:

- engaged in the research and design, and/or the production, of high-tech electronics products; or
- engaged in creating specialist software products.

Chapter 3
Defining Skills

The AERU research team has maintained the three-part approach to defining skills that was adopted for the 2004 survey: (i) occupations; (ii) qualifications; and (iii) attributes.

3.1 Occupations

At the time of the 2004 survey, Statistics New Zealand and the Australian Bureau of Statistics were working on a project to develop an Australian and New Zealand Standard Classification of Occupations (see SNZ, 2004). That project had published a draft classification system, which was used to create a framework of occupations for the study. The framework has four major divisions:

- Management
- ICT Research and Design
- ICT Sales and Marketing
- ICT Production and Support

There is a further classification of occupations within each division (see Table 1 below). This classification was developed after consultation with the Education Subcommittee of the Canterbury ICT Cluster and a small number of high-tech firms in Christchurch. It was then trialled in a survey conducted by the Institute of Professional Engineers.

The four major divisions capture the core components of high-tech firms. The questionnaires used in the study also allowed participating firms to add other categories to the classification in Table 1 if this was useful for their particular organisation. The only example where this appeared to be significant involved large electronics firms whose research and development workforce includes specialists relevant to the application for which the research and design is taking place; for example, surveyors in a research team working on a GPS application, or Digital Signal Processing engineers in a communications application.

Table 1: Occupations used in the study

Management	Chief Executive Officer
	Research and Development Manager
	Sales and Marketing Manager
	Production Manager
	ICT Manager
	Project Manager
	Product Manager
	Other
ICT Research and Design	Telecommunications Engineer
	Electronics Engineer
	Electrical Engineer
	Hardware Engineer
	Test Engineer
	Software Architect
	Software Engineer
	Software or Applications Programmer
	ICT Systems Analyst
	Multimedia Designer or Animator
	Digital Media (Including Web) Designer
	ICT Technical Writer
	Other
ICT Sales and Marketing	Marketing Research Analyst
	Marketing Specialist
	ICT Sales Representative
	ICT Pre-Sales Consultant
	ICT Customer Support Technician
	Other
ICT Production and Support	Production Engineer
	Electronics Technician
	Trades Worker
	Product Assembler or Tester
	ICT Support Engineer
	ICT Support Technician
	Computer Network Specialist
	Data or ICT Systems Administrator
	Other

3.2 Qualifications

The occupations in section 2.1 above imply two different qualification streams: technical qualifications and business qualifications. Some occupations (particularly in management) require qualifications from both streams. Table 2 lists the qualifications identified for 2004 study in consultation with industry and education representatives. These same qualifications were adopted in the 2006 analysis.

Table 2: Qualifications used in the study

Technical	Business
In-house training	In-house training
External short course	External short course
Vendor qualification e.g. Cisco	
Certificate in ICT subjects	Certificate in business subjects
Diploma in ICT subjects	Diploma in business subjects
Computing/Software degree	Commerce degree
Science/Technology degree	MEM degree
Technology degree	MBA degree
Engineering degree (four years)	
Graduate diploma	Graduate diploma
Masters or PhD degree	Masters or PhD degree

3.3 Attributes

The AERU research team undertook a web-based search for international examples of categories for generic labour market skills. The most useful categorisation that was found comes from the Conference Board of Canada, which has classified a number of "Employability Skills" under three generic headings: fundamental skills; personal management skills; and teamwork skills (*www.conferenceboard.ca/nbec*). The Lincoln research team slightly adapted that classification system to focus on 20 attributes as listed in Table 3 below.

All of the attributes in Table 3 might be expected to be valuable in almost any organisation. The purpose of this part of the study was to identify which, if any, of these are recognised as particularly important in the Canterbury high-tech sector. This could provide useful information for potential future employees of high-tech firms (and their educators).

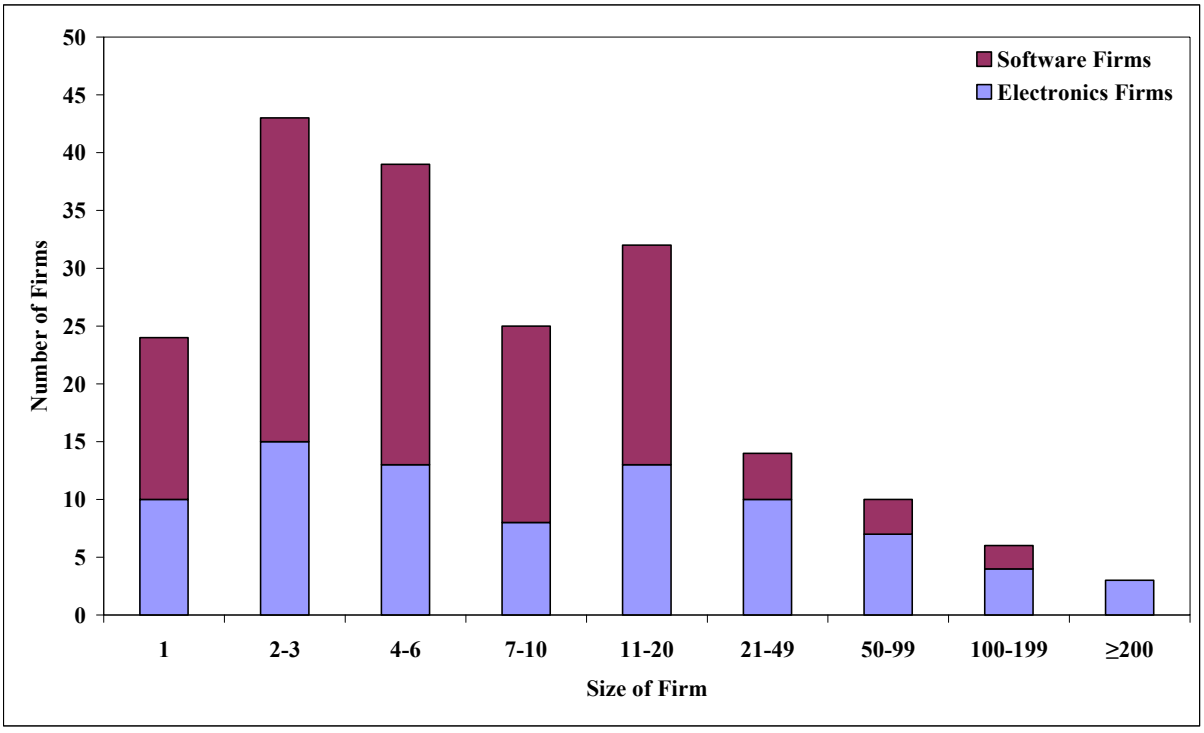
Table 3 Attributes used in the study

Fundamental Skills	Personal Management Skills	Teamwork Skills
Person to person communication	Positive attitude and behaviour	Ability to work with others
Information evaluation and management	Being responsible	Ability to participate in projects and tasks
Understanding and using numbers	Being adaptable	Leadership in group projects
Problem-solving skills	Continuous learning and upskilling	Willingness to follow instructions
Business writing skills	Time management to meet deadlines	Cross-cultural communication
Technical writing skills	Working safely	Multi-tasking skills
Entrepreneurial Attitude		Skills for presenting to an audience

Chapter 4
Determining the Sector's Population

The 2004 survey involved 155 firms, of which 66 firms were in electronics and 89 were in software (firms that described themselves as involved in both electronics and software were categorised as electronics firms). As well as the sources used in 2004, the AERU had access in 2006 to the Kompass NZ database and to a list of Christchurch firms provided by the HiGrowth Project Trust. The update identified 68 electronics and software firms not included in the earlier database. Virtually all of these firms were founded before 2004. The AERU telephoned all of the firms on the updated database. Of the 155 firms in the 2004 survey, two companies have merged with each other, two companies are no longer offering electronic or software services, one company had moved to Wellington, and 16 companies appear no longer to exist. Hence, 135 of the original firms remain in the upgraded database of 203 firms. Of the 203 firms, 7 declined to participate in the study, so that data were obtained for 196 businesses, of which 83 are in electronics and 113 are in software.

Figure 2: Distribution of ICT firms in Canterbury by firm size



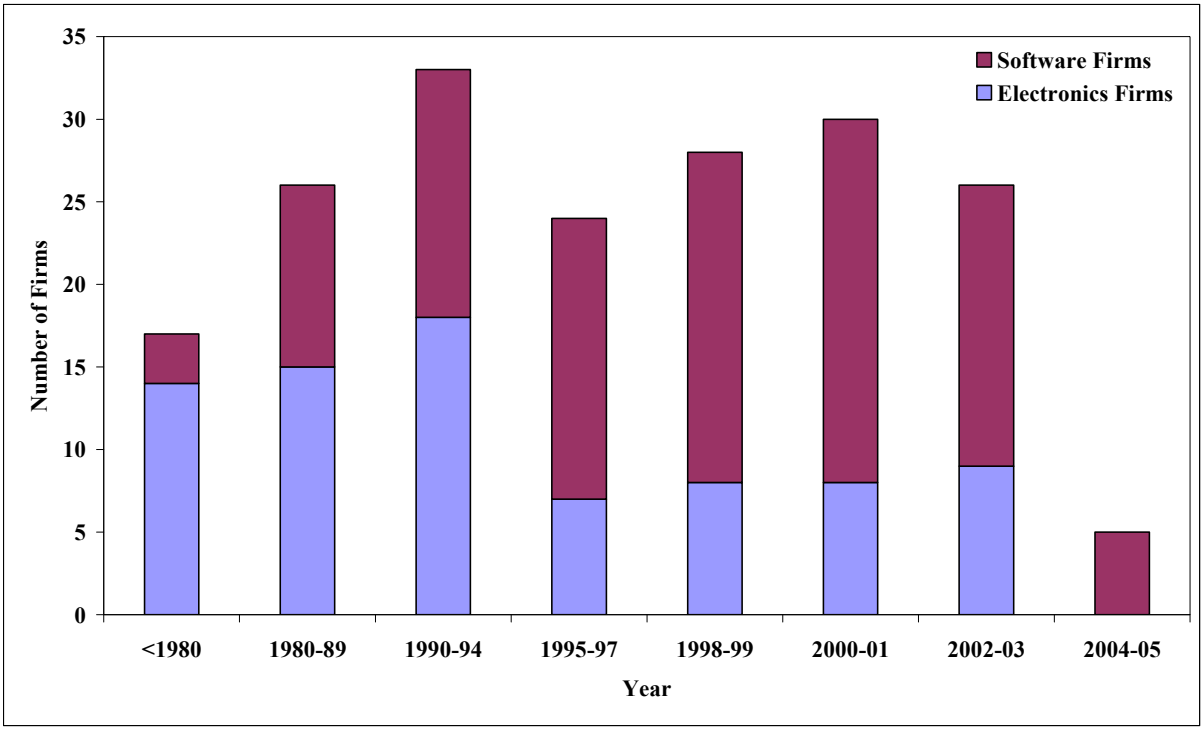
Prior to the survey being distributed, each of these 196 businesses was telephoned to ask for their employment levels, address and the year in which the firm was founded. Figure 2 presents the distribution of electronics and software firms by size in the population database. The size is that taken from the results of the telephone survey, unless the total number returned in the subsequent survey described in the following chapter was different (in which case the latter number is used). It should be noted that the employment figures are for staff directly involved in producing the electronics or software output; in particular, office or accounts staff are not included in the data below.

The software sector has a large number of relatively small firms; 42 have three or fewer staff, and another 26 have between 4 and 6 staff. Only nine firms have more than 20 staff, and the largest of these reported less than 200 staff directly involved in the core ICT functions of management, research and development, sales and marketing, and production and support. Total direct employment in the software industry in Canterbury was recorded as 1,271 staff.

The electronics sector is more evenly spread across the first five categories in Figure 2 (up to 20 staff). There are 24 firms with more than 20 staff, including 7 firms with 100 or more, and 3 firms with 200 or more. Total direct employment in the electronics industry in Canterbury was recorded as 2,669 staff.

Figure 3 presents the distribution of electronics and software businesses by the year in which the firm was founded (excluding four electronics firms and three software firms that were unable to provide this information in the telephone survey). The electronics sector is more established, with 59.5 per cent of the firms founded before 1995, compared to 26.4 per cent of software firms. Forty per cent of the software firms (44 out of 110) had not been established before the new millennium. There was also considerable growth in the electronics sector, with 17 new firms established in the Canterbury region between 2000 and 2003.

Figure 3: Distribution of ICT firms in Canterbury by year established



The AERU research team was not able to identify many new-start firms since the last survey in 2004. The updated database has just 5 software firms and no electronics firms that were founded in 2004 or 2005. This may be due to the delay in updating the sources used for preparing the database, or it may reflect a genuine slowdown in new company formation during a period when the exchange rate was considerably higher than it had been over the previous two years. The data for earlier years suggested that Canterbury might expect an average of 24 new companies in the high-tech sector over a two-year period.

Chapter 5
Current ICT Occupations in Canterbury

In September 2006, the AERU research team sent questionnaires to the firms in its population database to obtain information on current and projected demand for skilled workers in the ICT sector. Large firms that had indicated in the telephone survey that they had 11 or more workers were sent a full-length survey. Firms with 10 or fewer workers were sent a shorter email survey that asked for employment by category. A small number of firms had been willing to participate in the telephone survey but advised that they did not want to receive the email survey, and this was respected. Reminders were sent out to firms that had not returned the questionnaire within a week.

Table 4: Survey response rates

Firm Size	Electronics	Software
1	30.0%	28.6%
2-3	33.3%	25.0%
4-6	69.2%	38.5%
7-10	25.0%	47.1%
> 10	51.4%	42.9%
TOTAL	45.8%	36.3%

Table 4 shows the response rates by firm type and size. These rates are important, because the responses obtained in each of the above categories (that is, by firm size and firm type) were scaled up by a factor reflecting total employment of that category as revealed in the telephone survey.

The response rate of the larger software firms was particularly good. In 2004, none of the large software firms had returned the full questionnaire, and only one had filled in the shorter questionnaire. The response rate above 40 per cent in this category provides a more robust database for the results reported here.

Note that there was a relatively low response rate for the electronics businesses with 7-10 employees (2 out of 8 firms). In this case, estimates for the 6 non-responding firms were estimated using the returned surveys of the other two firms in the category, plus returned responses of three electronics firms with 6 employees.

The overall response rate was 40.3 per cent (including the firms who asked not to receive the email survey), which is very good for an industry survey of this type. Further, because the response rates for the largest firms were very high (including 7 of the largest 9 firms), the overall response rate covered 58.8 per cent of current employment in the sector.

5.1 The electronics industry

Tables 5, 6, 7 and 8 present the estimated current employment in the electronics industry, classified into the four core groups of management, research and development, sales and marketing, and production and support. Note that the data in the tables are presented as whole numbers, so that the sum of firms' employment can differ from the total figures due to rounding.

In Table 5 it can be seen that most of the identified management positions occur in the firms with more than 10 employees (86 per cent). This reflects the definition of management, which for this project required that the main responsibility is to manage the work of others. The typical small firm has a working director. Part of this person's time will be spent on managing the company and other administrative needs, but the majority of it is spent on productive work; thus the person appears in one of the categories in the next three tables.

Table 5: Electronics: Current: Management

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
CEO	0	5	6	7	34	**52**
R&D Manager	0	0	1	1	35	**38**
Sales & Marketing Manager	0	3	1	0	24	**29**
Production Manger	0	0	0	2	30	**32**
ICT Manager	0	3	3	4	11	**21**
Project Manager	0	0	0	0	40	**40**
Product Manager	0	0	0	0	43	**43**
Other	0	0	0	0	3	**3**
TOTAL	**0**	**11**	**12**	**14**	**221**	**258**

Larger firms have the resources to fund full-time management positions, depending on their size. Most have a CEO position. Once the firm is greater than 10 employees, the firm may specialise their management functions further, with managers for research and development, sales and marketing, and production. Project and product managers make up just under a third of the managers in Table 5.

An earlier report on the Canterbury high-tech sector by Saunders and Dalziel (2003, p. 18) reported the industry view that New Zealand has a competitive advantage internationally in high-tech research, design and quality control. Hence, the ICT Research and Development group of occupations is critical for the success of firms in this sector. Table 6 presents the research's estimate that 1,106 people work in research and design in the electronics firms.

Table 6: Electronics: Current: ICT research and development

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Telecommunications Engineer	0	0	0	0	42	**42**
Electronics Engineer	7	8	24	11	95	**144**
Electrical Engineer	0	0	2	1	13	**16**
Hardware Engineer	0	3	0	0	69	**72**
Test Engineer	0	0	0	0	124	**124**
Software Architect	0	3	0	0	30	**33**
Software Engineer	0	3	4	8	353	**367**
Software/Application Programmer	0	0	0	0	58	**58**
ICT Systems Analyst	0	0	0	0	20	**20**
Multimedia Designer/Animator	0	0	0	0	16	**16**
Digital Media Designer	0	0	0	2	13	**16**
ICT Technical Writer	0	0	0	0	53	**53**
Other	3	0	6	6	130	**145**
TOTAL	**10**	**17**	**35**	**29**	**1,015**	**1,106**

Again total employment is dominated by firms which have more than 10 employees (92 per cent). Note that 7 of the 10 one-person firms were comprised of an electronics engineer working on their own. Electronics engineers, hardware engineers and test engineers are significant groups in the electronics R&D sector. There is a greater number, however, of software engineers (367 employees), which make up almost one-third of all research and development employees. Indeed, the electronics firms employ more software engineers than the software firms (see Table 10 below). In part, this is due to the convention adopted in this report that firms involved in electronics and software are classified as electronics firms, but also probably reflects the importance of embedded software technology in high-tech electronics design.

Table 6 records that the largest firms employ 130 people in ICT research and development who are categorised as 'Other'. As noted in section 2.1 earlier in this report, these are generally people with specialist skills relevant to the application for which the research and design is taking place; for example, surveyors in a research team working on a GPS application, or Digital Signal Processing engineers in a communications application. Another significant occupation in this category was mechanical engineer.

ICT Sales and Marketing is the smallest of the four core occupational groups in the Canterbury electronics industry, containing only 6.5 per cent of its employees. This is comparable to the proportion reported in the 2004 survey (5.0 per cent). As in the previous two groups, the bulk of these (85.6 per cent) are found in firms of size 11 or more employees, although in the smaller firms, these roles are often performed alongside other ones. Firms tend to need to be above a certain threshold in terms of turnover and number of employees to have the need for (and the resources to employ) full-time sales and marketing specialists. Even in the larger firms, however, there is a clear preference for people with ICT skills than for

marketing research analysts or marketing specialists. The later two categories make up only 22 out of 174 positions, with the rest being in the categories of ICT sales representative, ICT pre-sales consultant and (the largest category) ICT customer support technician.

Table 7: Electronics: Current: ICT sales and marketing

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Marketing Research Analyst	0	0	0	0	6	**6**
Marketing Specialist	0	0	1	0	16	**16**
ICT Sales Rep	0	0	0	0	42	**42**
ICT Pre-Sales Consultant	0	3	0	11	33	**47**
ICT Customer Support Technician	0	3	0	7	53	**63**
Other	0	0	0	0	0	**0**
TOTAL	**0**	**6**	**1**	**18**	**149**	**174**

The ICT Production and Support group presented in Table 8 below is the largest group, containing 42.3 per cent of ICT employees in Canterbury. Almost all (99 per cent) of these are employed in firms with more than 10 employees, although again in the smaller firms some of these roles are performed by people employed in other roles. This group is mainly involved the practical side of producing a product that is ready for sale and delivery. Not surprisingly therefore, most of these employees (1,000 workers or 88.5 per cent of the employees recorded in Table 8) are electronics technicians, trades workers and product assemblers or testers.

Table 8: Electronics: Current: ICT production and support

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Production Engineer	0	0	0	0	60	**60**
Electronics Technician	0	0	7	0	97	**104**
Trades Worker	0	0	3	0	98	**100**
Product Assembler or Tester	0	0	4	0	793	**796**
ICT Support Engineer	0	0	0	0	19	**19**
ICT Support Technician	0	2	1	0	7	**10**
Computer Network Specialist	0	0	0	0	20	**20**
Data or ICT Systems Admin.	0	0	0	0	19	**19**
Other	0	0	0	0	2	**2**
TOTAL	**0**	**2**	**15**	**0**	**1,114**	**1,130**

5.2 The software industry

Tables 9, 10, 11 and 12 present the estimated current employment in the software industry, classified into the four core groups of management, research and development, sales and marketing, and production and support. Note again that the data in the table are presented as whole numbers. Hence the sum of firms' employment may differ from the total figure in the final column due to rounding errors.

The software industry in Canterbury is not dominated by large firms to the same extent as the electronics industry. Only 28 out of 113 software businesses in the survey employed more than 10 people, compared to 37 out of the 83 electronics firms. Table 9 shows that the smallest software firms (like the electronics ones) tend not to have dedicated managers, although only 58 per cent of all software managers are estimated to be employed in firms with more than 10 employees (compared to 86 per cent for electronics firms). CEOs and project managers are the most important management positions in the software industry.

Table 9: Software: Current: Management

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
CEO	4	11	19	16	25	**75**
R&D Manager	0	0	0	2	8	**10**
Sales & Marketing Manager	2	2	11	3	12	**30**
Production Manger	0	3	0	2	9	**15**
ICT Manager	0	0	0	2	7	**9**
Project Manager	0	0	1	5	40	**47**
Product Manager	0	0	5	2	19	**26**
Other	0	0	0	0	3	**3**
TOTAL	**5**	**16**	**37**	**33**	**124**	**215**

Table 10: Software: Current: ICT research and development

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Telecommunications Engineer	0	0	0	0	4	**4**
Electronics Engineer	0	0	0	0	10	**10**
Electrical Engineer	0	0	0	0	0	**0**
Hardware Engineer	0	3	0	0	29	**33**
Test Engineer	0	0	10	2	36	**48**
Software Architect	0	2	1	0	38	**41**
Software Engineer	5	8	26	31	191	**261**
Software/Application Programmer	1	3	20	11	270	**305**
ICT Systems Analyst	0	0	6	3	49	**59**
Multimedia Designer/Animator	1	2	0	3	5	**11**
Digital Media Designer	1	13	1	19	12	**46**
ICT Technical Writer	0	0	0	4	14	**18**
Other	0	0	0	7	0	**7**
TOTAL	**9**	**31**	**66**	**79**	**658**	**843**

The ICT Research and Development occupational group accounts for two-thirds of the total employment in the software industry. This may be related to the smaller size of software firms compared to those in electronics, and suggests that most employees are involved in software development, while performing other tasks such as management and marketing alongside this main activity.

As expected, this group of occupations in the software industry is dominated by software engineers (261 employees) and software/application programmers (305 employees), which jointly contribute 67 per cent of all employment in this group. It wasn't always clear in the returned shorter surveys whether a software employee should be classified as a software engineer or as a software/application programmer. In the longer surveys, the firms were asked to make this distinction themselves. When there was ambiguity in a shorter survey, the research team sought to define software engineers as those producing custom software products while those employees who appeared to be programming using the software products of others were classified as software/application programmers.

Table 11: Software: Current: ICT sales and marketing

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Marketing Research Analyst	0	0	0	0	3	**3**
Marketing Specialist	0	0	0	2	9	**11**
ICT Sales Rep	0	7	0	2	52	**60**
ICT Pre-Sales Consultant	0	0	6	7	10	**23**
ICT Customer Support Technician	0	1	9	4	7	**20**
Other	0	0	0	0	0	**0**
TOTAL	**0**	**7**	**15**	**15**	**81**	**118**

ICT Sales and Marketing is a relatively small employment group in the Canterbury software industry currently, with the total of 118 employees representing about one person per firm. Because most firms in the industry are very small, such roles tend to be performed as part of other ones, most notably those in the ICT Research and Development group. The 42 firms with three or fewer employees have only 7 ICT Sales and Marketing people between them, while the 28 firms with more than 10 employees have 81 of these positions. Sales representative is the largest occupation in Table 11, employing 60 people or one-half of those in sales and marketing. As for the electronics firms, there are relatively few marketing research analysts and marketing specialists employed by the software businesses.

Table 12: Software: Current: ICT production and support

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Production Engineer	0	0	0	0	0	**0**
Electronics Technician	0	0	3	0	9	**11**
Trades Worker	0	0	0	0	0	**0**
Product Assembler or Tester	0	0	0	0	2	**2**
ICT Support Engineer	0	0	0	2	10	**12**
ICT Support Technician	0	0	6	7	3	**16**
Computer Network Specialist	0	0	0	4	33	**37**
Data or ICT Systems Admin.	0	4	0	0	11	**16**
Other	0	0	0	0	0	**0**
TOTAL	**0**	**4**	**9**	**13**	**67**	**94**

ICT Production and Support is the smallest occupational group in the Canterbury software industry, but the total number in this category in the 2006 survey (94 people) is significantly higher than in the 2004 survey (only 27 people, or 4 per cent of the total). The largest category in Table 12 is computer network specialist, and it is possible that in software firms these employees may also be performing a research and development function, or a sales support function.

Chapter 6
Predicted ICT Occupations from Current Firms

The surveys asked respondents to estimate what their employment patterns might be in five years time, in each occupation. Where responses gave a range (for example, '5-10 extra software engineers' in the email short survey), the lower figure was used to obtain conservative estimates. Similarly, if this question was unanswered, it was assumed that the number of employers will not change over the next five years.

Figure 4: Predicted distribution of current ICT firms by firm size

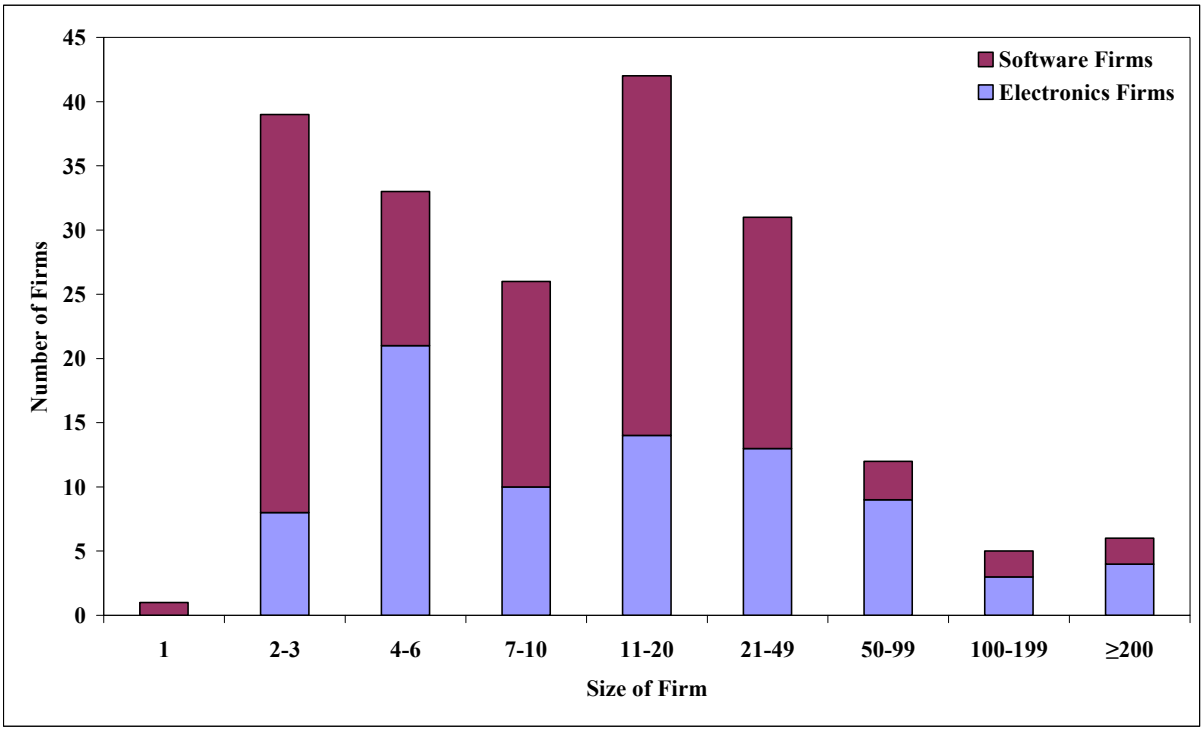


Figure 4 maps the expected sizes of the high-tech firms in five years time. The sample size is one less than in Figure 2 on page 9, since one electronics firm reported that it expected to be employing no staff in five years. As would be expected, the distribution has moved to the right compared to Figure 2. As in 2004, the results also show that the electronics firms were relatively conservative in their forecasts, estimating an increase of 19.3 per cent over five years (3.6 per cent per annum). This is in contrast to the software businesses, which predicted an increase in aggregate employment of 66.3 per cent (10.7 per cent annual growth). The large software firms (more than 10 employees) shared this optimism, forecasting growth of above 50 per cent over the full five years.

The projected employment structure for these firms is presented in the following tables. Once again, the data in the table are presented as whole numbers, so that the sum of firms' employment may differ from the total figure in the final column due to rounding errors.

6.1 The electronics industry

The survey data indicate that the management occupations in the Canterbury firms currently in the electronics industry are projected to grow by 67 employees or 26 per cent in five years (see Table 13). This is similar to the survey in 2004, which projected that the management occupations would grow by 29 per cent in five years. In Table 13, the largest growth in both absolute and percentage terms occurs to project managers (up 24, or 57.5 per cent). Sales and marketing managers increase by 16, 55 per cent, and product managers rise by the same number, which is 36 per cent for that group.

Table 13: Electronics: Predicted: Management

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
CEO	0	5	8	7	36	**56**
R&D Manager	0	0	1	1	36	**39**
Sales & Marketing Manager	3	3	3	6	30	**45**
Production Manger	0	0	0	2	33	**35**
ICT Manager	0	3	3	4	16	**25**
Project Manager	0	3	0	0	60	**64**
Product Manager	0	0	0	0	59	**59**
Other	0	0	0	0	3	**3**
TOTAL	**3**	**14**	**15**	**20**	**273**	**325**

The projected increase in the electronics industry's ICT Research and Development group (Table 14) is the highest at 258 people. This is an increase of 23 per cent, which is a jump on the 2004 survey (14 per cent). The biggest increase is for software engineers, with the number for this group rising from 367 at present to 447 in five years. The number of electronics engineers is also expected to increase by more than 30 over the same period. As noted on page 14 of this report, the 'Other' category includes people with specialist skills relevant to the application for which the research and design is taking place. The electronics firms employing R&D staff in this category reported strong increases in demand for these specialists (36.8% growth).

Table 14: Electronics: Predicted: ICT research and development

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Telecommunications Engineer	0	0	0	0	50	**50**
Electronics Engineer	5	20	27	11	115	**179**
Electrical Engineer	10	0	1	1	19	**32**
Hardware Engineer	7	5	0	0	69	**81**
Test Engineer	7	0	0	0	151	**158**
Software Architect	0	3	0	0	44	**47**
Software Engineer	0	5	9	13	420	**447**
Software/Application Programmer	0	0	0	0	66	**66**
ICT Systems Analyst	0	0	0	0	18	**18**
Multimedia Designer/Animator	0	0	0	0	16	**16**
Digital Media Designer	0	0	0	2	18	**20**
ICT Technical Writer	0	0	0	0	52	**52**
Other	20	0	10	8	161	**199**
TOTAL	**48**	**32**	**48**	**36**	**1,199**	**1,364**

Table 15 indicates that the ICT Sales and Marketing employment group has the highest projected growth rate over the next five years for the Canterbury electronics industry, at 34 per cent. This is lower than in the 2004 survey (which projected growth of 57 per cent). The biggest difference is that the large firms in 2004 were expected to increase the number of their ICT sales reps by 16 (89 per cent), but in the 2006 survey they are reporting fewer people in this category than are currently employed. There continues to be a strong expectation from the larger firms that they will employ more marketing research analysts and marketing specialists (by 23 in total) than at present.

ICT Production and Support, presented in Table 16, is the largest occupation group (just) in the electronics sector. As signalled in the 2004 survey, this group is projected to be overtaken by Research and Development within five years. The growth in Table 16 is 12 per cent (a little higher than the 8 per cent in 2004). This will take the size of this group to 1,263 employees, which is less than the 1,364 employees that the Research and Development group is expected to have. Virtually all of the extra employees in production and support are expected to be in the firms with more than 10 employees. The largest numerical increase is expected to be employment of product assemblers or testers (65 extra workers, an increase of 8.1 per cent).

Table 15: Electronics: Predicted: ICT sales and marketing

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Marketing Research Analyst	0	0	0	0	14	**14**
Marketing Specialist	3	0	1	2	31	**37**
ICT Sales Rep	0	0	1	5	39	**45**
ICT Pre-Sales Consultant	3	0	0	18	39	**60**
ICT Customer Support Technician	3	0	1	11	62	**77**
Other	0	0	0	0	0	**0**
TOTAL	**10**	**0**	**3**	**36**	**184**	**234**

Table 16: Electronics: Predicted: ICT production and support

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Production Engineer	0	0	0	0	64	**64**
Electronics Technician	0	0	7	0	112	**119**
Trades Worker	0	0	3	0	127	**130**
Product Assembler or Tester	0	0	11	0	850	**861**
ICT Support Engineer	0	0	0	0	26	**26**
ICT Support Technician	2	5	2	0	9	**17**
Computer Network Specialist	0	0	0	0	23	**23**
Data or ICT Systems Admin.	0	0	0	0	16	**16**
Other	0	0	0	0	6	**6**
TOTAL	**2**	**5**	**22**	**0**	**1,234**	**1,263**

The projected increase in the combined four occupation groups by firms that currently exist in the Canterbury electronics industry is 516 or 19 per cent. This is comparable to the expected growth of 15 per cent in 2004. It takes the total employment to 3,185, compared to the 2,669 people currently estimated to be employed by these firms.

6.2 The software industry

Table 17 presents the predicted numbers of managers in the software businesses in five years time. The projected growth of managers is 50 per cent, or 108 extra positions. This is higher than in the 2004 survey, which projected growth in this category of just 20 per cent. Like the electronics firms, strong demand is expected for project managers, increasing from 47 at present to 107 in five years, an increase of 127 per cent. Growth for this group is particularly

noticeable in the middle-sized firms (4-6 employees) who are projected to increase their employment of project managers from 1 at present to 29 in five years.

Table 17: Software: Predicted: Management

OCCUPATION	SIZE OF FIRM					TOTAL
	1	**2-3**	**4-6**	**7-10**	**>10**	
CEO	4	13	19	16	27	**79**
R&D Manager	0	0	0	4	11	**16**
Sales & Marketing Manager	2	2	14	5	22	**45**
Production Manger	0	3	3	2	16	**24**
ICT Manager	0	0	0	2	10	**12**
Project Manager	0	3	29	8	67	**107**
Product Manager	0	0	5	2	28	**35**
Other	0	0	0	0	5	**5**
TOTAL	**5**	**22**	**69**	**40**	**187**	**323**

ICT Research and Development is the main activity of the Canterbury software industry. As expected, therefore, most of the numerical growth is projected to occur within this group of occupations, up 524 people or 62 per cent. This compares to 52.5 per cent in the 2004 survey. The medium-sized firms (4-6 and 7-10 employees) expect to more than double their R&D staff over the next five years, and most of the growth expected by the 1-person firms is also anticipated to be in their R&D staff. Employment of software engineers and of software/ application programmers is expected to increase by 174 and by 114 positions respectively. The increase in software engineers is 66.5 per cent, which is considerably higher than the same figure in 2004 (39 per cent). The 2006 survey records an expected increase in digital media designers of 73 new staff, which is the same figure as in 2004.

Table 18: Software: Predicted: ICT research and development

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Telecommunications Engineer	0	0	0	0	9	**9**
Electronics Engineer	0	0	0	0	22	**22**
Electrical Engineer	0	0	0	0	0	**0**
Hardware Engineer	0	7	0	0	14	**20**
Test Engineer	0	0	35	2	67	**104**
Software Architect	0	3	4	2	70	**80**
Software Engineer	16	12	49	47	311	**435**
Software/Application Programmer	5	13	45	17	339	**419**
ICT Systems Analyst	0	2	6	8	78	**94**
Multimedia Designer/Animator	1	2	0	8	10	**21**
Digital Media Designer	8	17	6	68	21	**119**
ICT Technical Writer	0	0	0	6	31	**37**
Other	0	0	0	7	0	**7**
TOTAL	**30**	**55**	**146**	**164**	**972**	**1,367**

Table 19 records that over the next five years the ICT Sales and Marketing occupations in current Canterbury software firms are projected to increase by 147 employees, which is an increase of 124 per cent (compared to 97 per cent in 2004). Nearly half of this growth is in ICT sales representatives, up 68 (or 111 per cent), while marketing specialists are expected to triple in numbers, from 11 at present to 34 in five years. Thus firms appear to be intending to employ more full-time sales and marketing people as their business grows, especially the medium-sized and large firms. There was no indication that the very small software firms (1 employee or 2-3 employees) are intending to employ pre-sales consultants in the next five years, whereas the larger firms are expecting to double the number of these positions.

As noted above, the ICT Production and Support side of the Canterbury software industry employs the least people of the four occupational groups. This is projected to remain the case for existing firms in five years time, with growth in this group (67 per cent, or 62 extra positions) expected to be about the same as for the sector in total (66 per cent). The only increase of any note are 27 additional computer network specialists (an increase of 73 per cent), all but one of which is expected to be employed by the firms with more than 10 employees.

Table 19: Software: Predicted: ICT sales and marketing

OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Marketing Research Analyst	0	0	0	0	5	**5**
Marketing Specialist	0	2	6	8	18	**34**
ICT Sales Rep	7	13	6	7	95	**128**
ICT Pre-Sales Consultant	0	0	10	15	24	**49**
ICT Customer Support Technician	0	4	18	11	15	**49**
Other	0	0	0	0	0	**0**
TOTAL	**7**	**19**	**40**	**41**	**157**	**265**

Table 20: Software: Predicted: ICT production and support

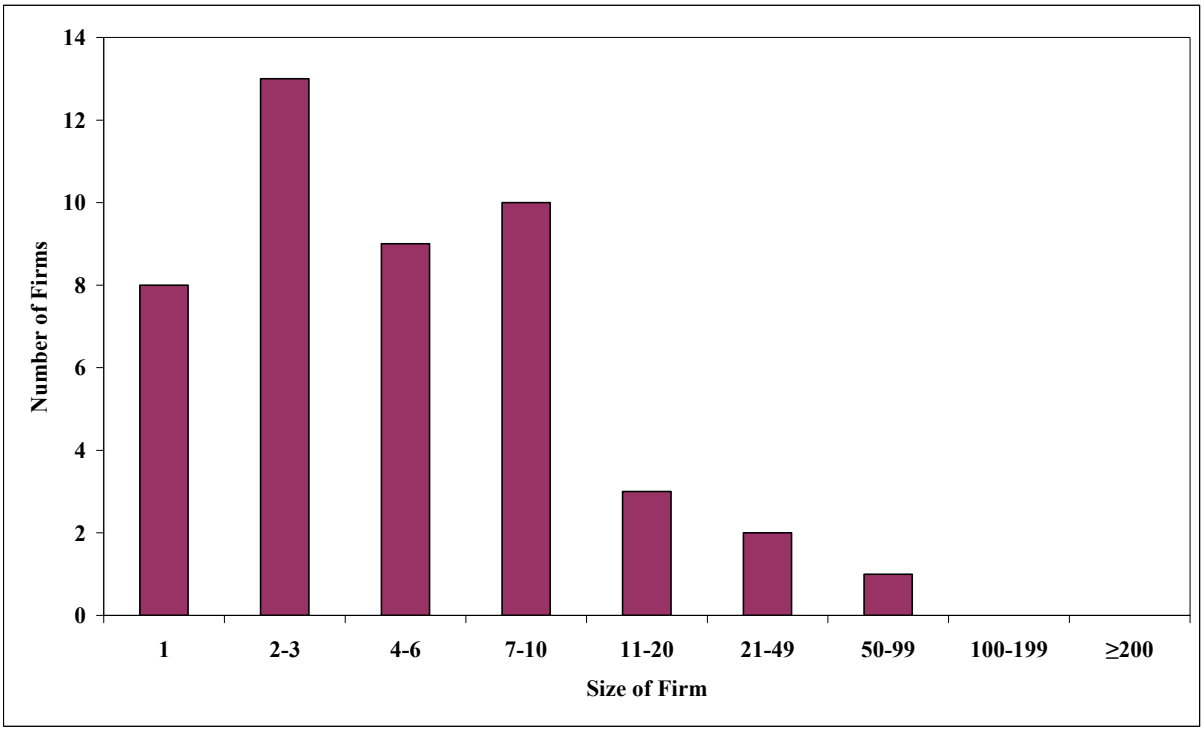
OCCUPATION	SIZE OF FIRM					TOTAL
	1	2-3	4-6	7-10	>10	
Production Engineer	0	0	0	0	0	**0**
Electronics Technician	0	0	3	0	17	**20**
Trades Worker	0	0	0	0	0	**0**
Product Assembler or Tester	0	0	0	0	3	**3**
ICT Support Engineer	0	0	0	2	15	**17**
ICT Support Technician	0	0	6	13	5	**25**
Computer Network Specialist	0	0	0	5	58	**64**
Data or ICT Systems Admin.	0	5	3	0	21	**28**
Other	0	0	0	0	0	**0**
TOTAL	**0**	**5**	**11**	**21**	**119**	**156**

The total projected increase in these four employment groups of firms that currently exist in the Canterbury software industry is 842 staff, implying a growth rate of 66 per cent. This increases the industry from 1,269 people to 2,111. This growth is greater than the electronics sector, both in absolute and percentage terms. Before calculating the total impact in the ICT sector, the following chapter considers the impact of new entrants.

Chapter 7
Modelling the Impact of New Entrants

Figure 3 on page 10 records that 46 firms in the study's population were established in the last five years (2001 to 2005). This is fewer than the number of young firms in the 2004 survey (59, with one large firm excluded in line with the conservative approach adopted in the study's methodology). This report has already noted that the AERU research team was unable to find any new firms established in 2005, and so the estimates in this chapter may be too low. The estimates are obtained by assuming there is a similar pattern of new firms in the high-tech sector established over the next five years as in the last five years. Figure 5 below shows the size distribution of the firms that were established between 2000 and 2005 (inclusive). Most of the firms (40 out of 46) employ 10 or fewer workers, and only one firm has more than 50 employees at present.

Figure 5: Size distribution of firms established between 2000 and 2005



The current occupation pattern in these 46 firms was used as a proxy for the occupation pattern of new entrants over the next five years. These figures were then added to the survey data for existing firms (as discussed in the previous chapter) to produce total employment by occupation in the electronics and software industries respectively. The results of this modelling are presented in Tables 21 to 28.

Table 21: Electronics: Management

OCCUPATION	Current	5 Years	Change	Growth
CEO	52	64	12	22.1%
R&D Manager	38	42	4	11.0%
Sales & Marketing Manager	29	47	18	61.8%
Production Manger	32	38	6	18.2%
ICT Manager	21	28	8	36.6%
Project Manager	40	66	25	62.4%
Product Manager	43	61	18	40.7%
Other	3	3	0	5.0%
TOTAL	**258**	**348**	**90**	**34.8%**

Table 22: Software: Management

OCCUPATION	Current	5 Years	Change	Growth
CEO	75	97	23	30.2%
R&D Manager	10	16	7	65.8%
Sales & Marketing Manager	30	51	21	68.8%
Production Manger	15	26	11	73.6%
ICT Manager	9	13	4	47.7%
Project Manager	47	111	64	135.3%
Product Manager	26	37	11	44.8%
Other	3	5	2	53.0%
TOTAL	**215**	**357**	**142**	**66.2%**

The number of managers in the high-tech sector is predicted to grow by 34.8 per cent in the electronics sector and by 66.2 per cent per cent in the software sector. Sales and marketing managers and project managers are predicted to be in strong demand in both cases, while there is also a strong demand for product managers in the electronics sector.

Table 23: Electronics: ICT research and development

OCCUPATION	Current	5 Years	Change	Growth
Telecommunications Engineer	42	52	10	23.5%
Electronics Engineer	144	196	52	36.1%
Electrical Engineer	16	34	18	107.8%
Hardware Engineer	72	85	13	17.8%
Test Engineer	124	164	40	32.4%
Software Architect	33	49	16	49.9%
Software Engineer	367	474	106	28.9%
Software/Application Programmer	58	69	11	18.2%
ICT Systems Analyst	20	19	-1	-2.9%
Multimedia Designer/Animator	16	16	1	5.0%
Digital Media Designer	16	22	7	41.8%
ICT Technical Writer	53	54	1	2.1%
Other	145	211	66	45.2%
TOTAL	**1,106**	**1,446**	**339**	**30.7%**

Table 23 predicts that research and development staff in the electronics sector will grow by 30.7 per cent over the next five years. Nearly a third of the increased demand is for software engineers. There is strong demand for people with specialist skills relevant to the application for which the research and design is taking place (the 'Other' category in Table 23), as well as for the core occupations in this sector of electronics engineer and test engineer.

A striking feature of the electronics industry is the large number of software engineers and programmers it employs (425 in total). This indicates the importance of embedded software in the high-tech ICT sector, which is expected to remain important in the future, judging by the large number of extra positions projected for software engineers in the electronics sector (106 extra staff).

Table 24 reveal that the software industry is also expecting to increase its demand for software engineers, by 206 positions. Taken together, these figures suggest that the combined electronics and software industry demand for software engineers will increase by 50 per cent, from 628 at present to 941 in five years. This is a much stronger increase in demand for software engineers than had been reported in 2004 (which projected a 27 per cent increase in this category).

Table 24: Software: ICT research and development

OCCUPATION	Current	5 Years	Change	Growth
Telecommunications Engineer	4	9	4	103.0%
Electronics Engineer	10	23	12	119.7%
Electrical Engineer	0	0	0	N.A.
Hardware Engineer	33	22	-11	-32.6%
Test Engineer	48	111	64	133.1%
Software Architect	41	82	41	101.2%
Software Engineer	261	467	206	78.9%
Software/Application Programmer	305	440	134	44.0%
ICT Systems Analyst	59	98	40	68.1%
Multimedia Designer/Animator	11	24	13	111.9%
Digital Media Designer	46	135	89	192.3%
ICT Technical Writer	18	40	22	125.0%
Other	7	11	4	61.2%
TOTAL	**843**	**1,462**	**619**	**73.5%**

The overall increase in research and development staff predicted in the software industry is 73.5 per cent. As would be expected the bulk of employment is made up of software engineers and software/application programmers, and these are also the two categories predicted to have the largest increases in demand over the next five years (340 out of the 619 extra positions). The firms also report significant increases in the number of digital media designers (89 extra staff) and test engineers (64 extra staff).

These predicted increases in research and development staff are noteworthy, but both sectors indicated much larger percentage increases in their sales and marketing staff (Tables 25 and 26 below) of 41 per cent and 136 per cent respectively. Taken together, the projections indicate increases in marketing specialists, ICT pre-sales consultants and ICT customer support technicians of between 46 and 51 positions each. The software sector stands out in its projection for 71 new ICT sales representatives (compared to only 5 in the electronics sector). This is the largest quantitative increase in the two tables.

Table 25: Electronics: ICT sales and marketing

OCCUPATION	Current	5 Years	Change	Growth
Marketing Research Analyst	6	14	8	130.0%
Marketing Specialist	16	38	22	135.4%
ICT Sales Rep	42	47	5	11.8%
ICT Pre-Sales Consultant	47	64	17	35.8%
ICT Customer Support Technician	63	81	19	30.1%
Other	0	0	0	N.A.
TOTAL	**174**	**244**	**71**	**40.6%**

Table 26: Software: ICT sales and marketing

OCCUPATION	Current	5 Years	Change	Growth
Marketing Research Analyst	3	5	2	53.0%
Marketing Specialist	11	35	24	221.0%
ICT Sales Rep	60	131	71	117.3%
ICT Pre-Sales Consultant	23	54	31	134.9%
ICT Customer Support Technician	20	53	32	158.7%
Other	0	0	0	N.A.
TOTAL	**118**	**278**	**160**	**135.5%**

The electronics sector employs a significant number of production workers, particularly product assemblers and testers (796 people). This is projected to rise steadily over the next five years (13 per cent), but not at the same rate as overall growth in the industry (26 per cent), or even in the ICT electronics production and support occupations generally (17 per cent). The electronics firms also indicate an increase in demand for trades workers, which has been an area of skill shortage in the Canterbury region (Higgins and Dalziel, 2002) and in New Zealand (Department of Labour, 2004).

ICT production and support is not so significant in the software firms. Well over half of the projected increase comes from computer network specialists and data or ICT systems administrators, who are often performing a research and development role (rather than support) in these firms.

Table 27: Electronics: ICT production and support

OCCUPATION	Current	5 Years	Change	Growth
Production Engineer	60	67	7	11.9%
Electronics Technician	104	125	20	19.3%
Trades Worker	100	135	35	34.4%
Product Assembler or Tester	796	901	104	13.1%
ICT Support Engineer	19	27	9	46.6%
ICT Support Technician	10	18	8	76.8%
Computer Network Specialist	20	24	4	20.4%
Data or ICT Systems Admin.	19	16	-2	-11.7%
Other	2	6	5	305.0%
TOTAL	**1,130**	**1,319**	**189**	**16.7%**

Table 28: Software: Production and support

OCCUPATION	Current	5 Years	Change	Growth
Production Engineer	0	0	0	N.A.
Electronics Technician	11	21	10	92.9%
Trades Worker	0	0	0	N.A.
Product Assembler or Tester	2	3	2	103.0%
ICT Support Engineer	12	18	6	50.4%
ICT Support Technician	16	28	12	70.9%
Computer Network Specialist	37	67	30	81.6%
Data or ICT Systems Admin.	16	29	14	88.2%
Other	0	0	0	N.A.
TOTAL	**94**	**167**	**74**	**78.6%**

Table 29 summarises the projected growth for the two industries, and for the total ICT sector in Canterbury. These growth rates are slightly higher than the estimates in 2004. The projected growth rate for electronics is 25.8 per cent in Table 29 (compared to 21.0 per cent in the 2004 survey). The projected growth rate for software is 78.4 per cent (compared to 76.0 per cent in 2004). The total expected growth in employment of 1,684 employees, or 42.8%, in five years represents an annual growth rate of 7.4 per cent per annum. Allowing for labour productivity growth on top of this figure suggests that ICT is likely to remain one of the main engines of economic growth in the province.

Table 29: Electronics and software: Totals

OCCUPATION	Current	5 Years	Change	Growth
Electronics Totals	2,669	3,358	689	25.8%
Software Totals	1,269	2,264	995	78.4%
TOTAL ICT SECTOR	**3,938**	**5,622**	**1,684**	**42.8%**

Chapter 8
Qualifications

The 2004 survey asked the large firms to indicate what technical and business qualifications are essential in each occupation (see Table 2 on page 7 of this report). The 2006 survey did not repeat this request, but instead the AERU research team used the 2004 returns. This decision was based on an expectation that industry standards for qualifications are unlikely to change significantly over two years. It resulted in a shorter survey to the large firms, which may have contributed to the much higher response rate achieved with this group in the software sector in 2006 compared to 2004.

The 2004 data indicated that more than one qualification is required for most occupations. It is common, for example, to require a technical qualification and a business qualification, depending on the work performed. In some cases, there were several options to meet the qualification requirement (an engineering degree, *or* a science/technology degree, *or* a computing software degree, for example); in other cases the respondent expected a particular degree (an engineering degree, for example). For some occupations, the survey indicated that more than one qualification on either the technical or the business side was expected (a computing/software degree *and* in-house business training, for example).

The 2004 methodology took this range of responses into account to arrive at an aggregate estimate of the industry demand for qualifications. The data were analysed separately for technical and business qualifications. Where a returned survey form indicated options, these options were coded as 0.5 (two options) or 0.33 (three options). Where the returned form indicated more than one required technical qualification, or more than one required business qualification, both requirements were recorded as 1. The responses were then collated to determine the percentage of persons in each of the four core occupation groups (that is, management, research and development, sales and marketing, production and support) expected to hold particular qualifications. These percentages for the essential qualifications are reported in Tables 30 and 31.

The data in each cell indicates the percentage of people in the occupation group that are expected to hold the particular qualification. Thus, from the first data cell in Table 30, 3.6 per cent of people in the management occupations are expected to have a technical research degree (Masters or PhD). The columns sum to values greater than 100 per cent because of the possibility that firms require more than one qualification for some occupations.

The most striking feature of Table 30 is the very strong demand for engineering degrees for all except the production and support employees. This is not surprising for the research and development employees, but the firms also expect large proportions of their management and their sales and marketing employees to have an engineering degree. Degree qualifications in science, technology, computing or software are also in high demand, although a diploma is sufficient for some positions in sales and marketing.

From Table 31, firms do not seem to expect their production and support employees to have business qualifications, but sales and marketing employees are expected to have a commerce or business degree, and research and development employees require some exposure to business training. Management are expected to have an undergraduate or postgraduate qualification in commerce or business.

Table 30: Essential technical qualifications distribution

Technical Qualification	Mgmt	R&D	S&M	P&S
Masters or PhD Degree	3.6%	1.3%	0.0%	0.0%
Graduate Diploma	17.0%	12.4%	8.9%	4.4%
Engineering Degree	37.5%	30.7%	31.1%	7.4%
Science/Technology Degree	13.4%	11.8%	11.1%	7.4%
Computing/Software Degree	12.5%	19.0%	0.0%	9.6%
Diploma in ICT Subjects	3.6%	8.5%	20.0%	20.0%
Certificate in ICT Subjects	0.0%	0.0%	4.4%	22.2%
Vendor Qualification	7.1%	0.0%	2.2%	18.9%
External Short Course	5.4%	3.9%	13.3%	15.6%
In-House Training	10.7%	2.6%	35.6%	24.4%
Other Technical Qualification	10.7%	18.9%	4.4%	21.1%

Table 31: Essential business qualifications distribution

Business Qualification	Mgmt	R&D	S&M	P&S
Masters or PhD Degree	0.0%	0.0%	0.0%	0.0%
Graduate Diploma	6.5%	0.0%	0.0%	0.0%
MBA Degree	19.0%	0.0%	0.0%	0.0%
Masters of Engineering Mgmt	8.9%	0.0%	0.0%	0.0%
Commerce/Business Degree	33.3%	11.1%	59.3%	0.0%
Diploma in Business Subjects	14.3%	0.0%	25.9%	0.0%
Certificate in Business Subjects	0.0%	44.4%	0.0%	0.0%
External Short Course	0.0%	44.4%	0.0%	0.0%
In-House Training	21.4%	0.0%	0.0%	0.0%
Other Business Qualification	17.9%	0.0%	14.8%	0.0%

Based on the percentages in Tables 30 and 31, it is possible to project the increase in the number of qualified employees by type using the projected numbers reported in Chapter 7. These projections are presented in Tables 32 and 33. In each case, the first data column reports the total number of essential qualifications (technical and business respectively) expected to be required in five years time. The second data column calculates the number of extra qualifications this involves compared to the present number of employees in the sector.

Table 32: Essential technical qualifications in five years

Technical Qualification	Number	Increase
Masters or PhD Degree	63	21
Graduate Diploma	592	190
Engineering Degree	1,431	473
Science/Technology Degree	606	190
Computing/Software Degree	783	236
Diploma in ICT Subjects	674	188
Certificate in ICT Subjects	354	69
Vendor Qualification	343	71
External Short Course	453	122
In-House Training	701	196
Other Technical Qualification	962	272

Table 33: Essential business qualifications in five years

Business Qualification	Number	Increase
Masters or PhD Degree	0	0
Graduate Diploma	46	15
MBA Degree	134	44
Masters of Engineering Mgmt	63	21
Commerce/Business Degree	868	321
Diploma in Business Subjects	236	93
Certificate in Business Subjects	1,292	426
External Short Course	1,292	426
In-House Training	151	50
Other Business Qualification	204	76

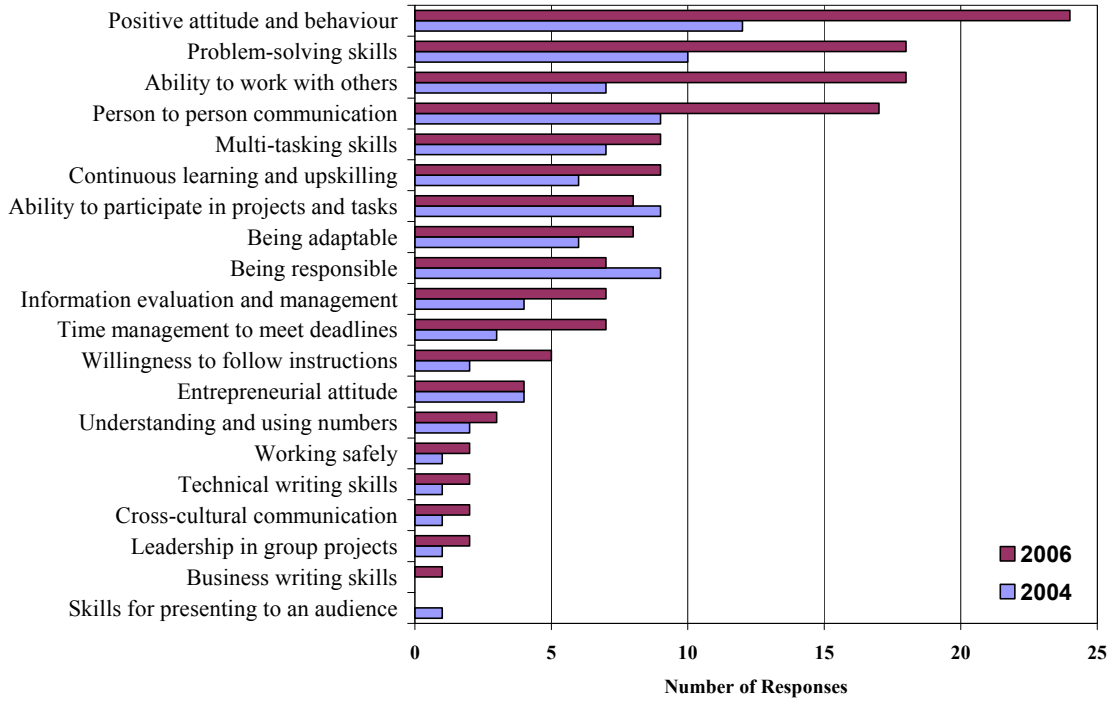
Some of the numbers are significant. Over the next five years, the high-tech sector in Canterbury is expected to require 473 more engineering degrees, 426 more degrees in science, technology, computing or software, and 321 more degrees in commerce or business. These figures do not take into account normal employment turnover or retirements.

There is also demand for sub-degree qualifications, including 257 certificates or diplomas in technical ICT subjects and 519 certificates or diplomas in business subjects. The firms also seem to be more confident about providing in-house training in technical areas (701 in total) than in business areas (only 151 in total). This is reflected in a much greater demand for external short courses in business (426 extra people) than in technical subjects (122 extra people).

Chapter 9
General Employee Attributes

The large firms were requested to rank the five most important attributes for employees within their firm out of a set of 20. The 20 attributes were presented in three columns representing fundamental, personal management and teamwork skills (see Table 3 on page 8). Some responses ranked the top five in each column, and so the top two choices for each column were included in the analysis of this chapter. This means the analysis did not attempt to weight responses by whether they were ranked first, second, third, fourth or fifth and that some responses had six attributes included rather than five. The results fell into a clear pattern that was remarkably consistent between the two surveys, as shown in Figure 6.

Figure 6: Most important general employee attributes, 2004 and 2006



The 2006 results are based on 30 questionnaires that answered this question, while the 2004 results were based on 20 questionnaires. In both surveys, the most important attribute was positive attitude and behaviour. Not only did this score the most responses but it was also consistently ranked first. Three other very highly ranked attributes that stood out in the 2006 survey were problem solving skills, ability to work with others and person-to-person communication. These top four attributes were mentioned by twice as many respondents as the next group of attributes.

The 2006 survey identified a group of seven attributes that were cited by between 7 and 9 respondents: multi-tasking skills, continuous learning and upskilling, ability to participate in projects and tasks, being adaptable, being responsible, information evaluation and management, and time management to meet deadlines.

The remaining 9 general attributes were ranked by five or fewer respondents. Willingness to follow instructions and an entrepreneurial attitude were the most frequently cited of these, followed by understanding and using numbers. In both the 2004 survey and the 2006 survey, 6 general attributes were ranked lowest: working safely; technical writing skills; cross-cultural communication; leadership in group projects; business writing skills; and skills for presenting to an audience.

As well as the question about general attributes, the survey to the large firms allowed respondents to specify the specialist skills or knowledge they thought particularly important for their employees by occupation group (that is, managers, research and design employees, sales and marketing employees, and production and support employees). Both the large firms and the smaller firms were also requested to provide any other comments relating to their demand for skilled employees in the high-tech sector in Canterbury. The answers to these questions were descriptive, and are presented below.

Skill and Knowledge of Senior Management

Twenty firms who replied to the full-length survey commented on the skills and knowledge they think are particularly important in their senior managers. These comments were eclectic covering a wide range of managerial skills. The ability to effectively manage, develop and motivate staff was included in six surveys; business management skills were mentioned five times; strong marketing skills and strategic planning skills were each included four times; three surveys stated project management skills; and two firms mentioned communication, financial and sales skills. Other capabilities mentioned in the surveys were the ability to manage growth and change, contract management and negotiation skills, risk management skills, the ability to work effectively in a team, relationship building skills, international business and language skills, and governance skills. A good understanding of production processes and the ICT market were also stated as important competencies.

Skills and Knowledge of Research and Design

Fifteen firms who replied to the full-length survey commented on desirable skills and knowledge in research and design employees. There were a number of general competencies mentioned including innovation and creativity, customer consulting skills, the ability to learn, flexibility, time management and planning skills, communication skills, analytical and evaluation skills, and reporting skills. Both the software and electronic firms mentioned that a high level of base knowledge in electronic, electrical and/or software technologies is important, as well as exposure to a range of different technologies. They also stated a range of technical competencies that are important for their firms. The technical competencies mentioned by software firms included knowledge of current legacy and software development technologies, web-enabled technology, and a range of different languages such as MySQL, postrgeSQL, .Net, PHP, and CSS (cascading style sheets). Note that none of these languages were mentioned by more than one firm. One firm also mentioned their demand for Adobe certified staff. The technical competencies required by electronics firms included knowledge of design systems and practices, 3D CAD systems, GPS, surveying, computer networking, and 'hands on' embedded application skills. None of these competencies were mentioned by more than one firm apart from knowledge of design systems and practices, which was mentioned by two firms.

Skills and Knowledge of Sales and Marketing

Eight firms who responded to the full-length survey commented on the skills and knowledge that are important in sales and marketing employees. The most common comment was the ability to understand the technologies and products that the firm works with, which was cited

by six firms. One firm also highlighted the importance of sales and marketing employees' ability to understand business process and sell business solutions rather than 'a product'. Other competencies mentioned included negotiation and influencing skills, brand development skills, creative ability, and basic financial and accounting skills. In addition, a number of general skills were mentioned such as communication, problems solving, planning, analytical and decision making skills.

Skills and Knowledge for Production and Support

Eight firms who responded to the full-length survey commented on the skills and knowledge that are important in production and support employees. Technical skills including virtualisation, VoIP, Linux/Unix, industrial engineering and computer networking were mentioned. The importance of employing staff who understand manufacturing processes, posses quality assessment and communication skills, and are reliable was also mentioned.

General Skill Requirements for Large Firms

Thirteen of the large firms also provided additional comments about their current and expected future demand for skilled employees. Most of these comments related to the difficulty of finding skilled and experienced staff. More specifically, some firms pointed out that it is particularly difficult to find surveying staff, civil engineers, embedded application developers and PHP developers. Many firms also mentioned that they tend recruit staff from overseas. On a more positive note, one firm mentioned that software firms have become better at retaining staff.

A couple of firms mentioned that is difficult to estimate future labour demand because the visibility of market demand is limited. The issue with peak and troughs in the need for labour was also pointed out by a few firms. The same firms indicated that they tend to use contractors to get around this problem, but suggested that employees with broader skill sets would be advantageous.

Firms also made comments about training institutions. For example, one firm mentioned that it is not worthwhile for training institutions to teach complex electronic skills such as chip, PCB and FPGA design because there are not enough jobs in New Zealand to warrant training people and it is better to hire people with these skills from overseas. It was also mentioned that training institutions must align their training with business needs and teach more 'hands on' skills in real world applications. One firm commented that training institutions need to be flexible with their delivery and fees to make sure companies can utilise the training that is available, and another firm highlighted the importance of creating a higher profile for the ICT sector in high schools to entice students to engage in future studies that will enable them to work in the sector.

Comments were also made about essential skills and attributes required to remain competitive including innovation and creativity, project management skills, general business skills and ethics, the ability to work as a part of a team, and an inquisitive mind.

General Skill Requirements for Small Firms

Thirty-three smaller firms who completed the shorter email survey commented on the skills and knowledge that they need to enable growth and development. Many of the firms mentioned general skills such as problem solving, time management, interpersonal, English language, contract negotiation, business management, and project management skills. The ability and willingness to follow instructions, learn, and understand businesses and products were also mentioned, as well as a practical aptitude.

In terms of specialist technical skills, four firms indicated that they need staff with good basic skills in all aspects of the software development life cycle. Many of the firms highlighted their need for specific programming language skills and the most sought after skills are .Net, SQL, Linux, and PHP. Three firms revealed their demand for employees with web design skills. Electronics firms commented that they need people with good basic electronics skills including design, prototyping and compliance knowledge, as well as skills in embedded systems development.

Employees with sales and marketing skills are also important for the smaller firms with three firms highlighting the importance of these skills. Two firms indicated that they need individuals with international market development skills.

Like many of the larger firms, the smaller firms indicated that they find it difficult to find skilled and experienced employees, and a couple of the firms mentioned that they tend to use contractors.

Chapter 10
Comparison with the 2004 Survey

This report has described the methodology, data and analysis used to forecast skills demand for the high-tech sector in Canterbury over the next five years. To do this required information on the size of the high-tech sector, its predicted growth rate over the next five years and the classification of occupations in the sector. Information was also needed on the qualifications considered essential for these occupations as well as information on required skills and attributes.

The first stage was to update the database used in 2004 to estimate the extent of the high-tech sector in Canterbury broken down into software and electronic firms. The firms' names and contact details were obtained using a variety of sources and these firms were then surveyed by telephone to obtain basic information such as their level of employment and establishment date. Only 7 of the 203 firms identified declined to participate. The information obtained for the remaining 196 firms formed the basic database for the study. Of these firms 83 produced high-tech electronics products and 113 produced software (where firms stated they produced both electronics and software products, they were identified as electronic firms). The software sector has a higher number of relatively smaller firms whereas the electronic sector has firms across a wider range of size categories. Total current employment was estimated at 2,669 for the electronics sector and 1,271 for the software sector.

The next stage in the project surveyed the occupations, qualifications and skill/attribute requirements of these firms. For firms employing more than 11 people a full-length survey was administered, asking for details about employees in four core occupational groups: management, research and development, sales and marketing, and production and support employees. These firms were asked the current and predicted number of employees in these categories by occupation type and finally a general question relating to the skill/attributes that they ranked most important in their employees. Firms were also given opportunities to comment further at various points in the survey. Firms employing 10 people or less were sent a smaller email-based survey that requested information on the occupations and qualifications of current and predicted new employees over the next five years.

The overall response rate was very good, with 45.8 per cent of electronic firms responding and 36.3 per cent of software firms. There was an excellent response rate from the firms with more than 10 employees (51.4 per cent and 42.9 per cent respectively), so that the returned questionnaires covered 58.8 per cent of current employment in the sector.

In the electronics sector 10 per cent of employees were classified as management, most of whom (86 per cent) were in the larger firms. Forty-one per cent of employees were in research and development, again not surprising given the comparative advantage of Canterbury in this area. Thirty-three per cent of these were classed as software engineers. Only 7 per cent of employees were in sales and marketing and these were mostly in the larger firms. The remaining 42 per cent were production and support engineers, with 70 per cent of these being product assemblers or testers.

In the software sector 17 per cent of employees were classified as management. Sixty-six per cent of employees were in research and development, two-thirds of which were classed as software engineers or software/application programmers. Only 9 per cent of employees were in sales and marketing. The remaining 8 per cent were in production and support.

The current ICT firms in Canterbury are expecting to grow over the next five years. At a disaggregated level, growth rates vary considerably among the categories of employees. Employment in the electronics firms is expected to grow by 19.3 per cent. In the electronics sector the growth rate in managers is predicted to be 26 per cent compared to 23 per cent in research and development, 34 per cent for sales and marketing and only 12 per cent for production and support employees. The software sector is also expecting to grow but at the faster rate of 66.3 per cent. Management employees are only predicted to rise by 50 per cent, compared to 62 per cent in the research and design employees, 124 per cent for sales and marketing employees and 67 per cent for production and support employees.

In addition to the predicted growth in employment from existing firms reported in the previous paragraph, the study also analysed the impact of new firms entering the sector. The number of new firms by size over last five years, excluding one large firm, was assumed to be replicated over the next five years. This suggested an increase of 46 new firms. When these were added to the existing firms' predicted increase the overall increase in employment in the electronic sector was predicted to be 26 per cent and in the software firms 78 per cent, an overall increase in employment of 43 per cent or 1,684 employees.

To estimate the requirements for qualifications over the next five years the qualification requirement for the number of extra employees reported above was calculated by major occupational category. Information for this stage of the report was obtained from the 2004 survey to the large firms. These data were combined with information on the extra employees by occupational type to obtain total projected demand for employees by qualification.

The results of this analysis were divided into technical and business qualifications. The former show a predicted increase in demand for 190 employees with a graduate diploma and 473 employees with an engineering degree. There is additional demand for 190 employees with a general science or technology degree and 236 with a computing or software degree. An additional 188 and 69 employees with a diploma and certificate respectively in ICT subjects, 71 with vendor qualifications, 122 with external short course and 196 with in-house training were also predicted to be required.

In the case of business qualifications, there is a predicted demand for an extra 15 employees with graduate diploma or equivalent, 44 with an MBA degree, and 21 with the Masters of Engineering Management. There is an increase in demand for employees with a commerce degree of 321, 93 with a diploma in business subjects and 426 for a certificate in business subjects. There is also an increase in demand for short business courses for 426 employees.

The predicted overall increase in employment in the high-tech sector is significant at 43 per cent. The highest increase is in the potential demand for employees with an engineering degree (at 473) followed by certificate and short course in business subjects (predicted at 426 each). There are strong predicted increases in demand for graduates of commerce degrees (321), graduate diplomas in technical subjects (190), science and technology degrees (190), and computing and software degrees (236). The results also indicate ongoing demand for in-house training in technical subjects and external short courses in business subjects.

Finally, the large firms were requested to rank the five most important attributes for employees within their firm out of a set of 20. Four attributes stood out from the list. The most important was positive attitude and behaviour, included by 24 out of the 30 responding firms, with three other attributes being mentioned by 17 or more responses: problem solving skills, ability to work with others, and person-to-person communication.

It is interesting to compare these main results with the 2004 survey reported in P. Dalziel, C. Saunders and G. Taylor, *Forecast of Skills Demand in the High-Tech Sector in Canterbury* (AERU Research Report 275, March, 2005). The first significant difference between the two surveys is the larger population database in 2006. The database in 2004 contained 155 firms (excluding 8 firms who chose not to participate), whereas in 2006 there were 196 firms (excluding 7 firms who did not participate). This had an impact on the estimates for current total employment in the two industries, particularly in software firms, as shown in Table 34.

Table 34: Comparison of populations in 2004 and 2006

	2004	**2006**
Number of Electronics Firms	66	83
Number of Software Firms	89	113
Total Number of Firms	*155*	*196*
Employment in Electronics Firms	549	689
Employment in Software Firms	573	995
Total Employment	*1,122*	*1,684*

The second significant difference is the response rate of the large software firms. In 2004, all of the large software firms advised they were unable to complete a full survey, and only one was able to complete the survey sent to small firms. That experience led to a shorter survey being designed for the large firms in 2006, and this is likely to have made a difference. The response rate from software firms employing more than 10 staff was very good at 42.9 per cent. This means the projections for software demand are more robust than in 2004.

Table 35 on the next page compares the structure of current employment between the two surveys. The data for the electronics industry are very similar. There is no more than 1.5 percentage points difference in any of the employment groups, which could easily reflect industry trends over the two-year time gap. These data show that sales and marketing is still the smallest category, but that it has grown its share at the expense of each of the other three categories.

There is a significant difference in the software data, however, which shows a reduction in the share devoted to research and development from three-quarters to two-thirds. This is likely to have been a consequence of the small response rate from the large software firms in 2004, leading to an under-estimate of the shares of the industry's employment involved in management, sales and marketing, and production and support.

Table 36 compares the projected growth rates over the next five years in the two surveys. At the aggregate level, the projections are both higher in 2006 than in 2004, but not by a large amount. The electronics growth rates were 21.0 and 25.8 per cent in 2004 and 2006 respectively; for the software sector they were respectively 76.0 and 78.4 per cent. Both industry groups see the strongest growth being in the area of sales and marketing. For the electronics group, this dominance is less pronounced than in 2004 (40.6 per cent, compared to 65.0 per cent in 2004), but the software industry has repeated that it expects to more than double its employment of sales and marketing staff over the next five years.

Table 35: Comparison of employment structure in 2004 and 2006

	2004	**2006**
Electronics: Management	10.0%	9.7%
Electronics: Research and Development	41.7%	41.4%
Electronics: Sales and Marketing	5.0%	6.5%
Electronics: Production and Support	43.3%	42.4%
Electronics Totals	*100%*	*100%*
Software: Management	12.8%	16.9%
Software: Research and Development	75.3%	66.4%
Software: Sales and Marketing	8.3%	9.3%
Software: Production and Support	3.6%	7.4%
Software Totals	*100%*	*100%*

Table 36: Comparison of projected growth rates in 2004 and 2006

	2004	**2006**
Electronics: Management	35.5%	34.8%
Electronics: Research and Development	19.5%	30.7%
Electronics: Sales and Marketing	65.0%	40.6%
Electronics: Production and Support	13.9%	16.7%
Electronics Totals	*21.0%*	*25.8%*
Software: Management	40.2%	66.2%
Software: Research and Development	73.5%	73.5%
Software: Sales and Marketing	127.4%	135.5%
Software: Production and Support	135.7%	78.6%
Software Totals	*76.0%*	*78.4%*

Table 37: Comparison of extra technical qualifications in 2004 and 2006

Technical Qualification	2004	2006
Masters or PhD Degree	9	21
Graduate Diploma	89	190
Engineering Degree	224	473
Science/Technology Degree	89	190
Computing/Software Degree	108	236
Diploma in ICT Subjects	92	188
Certificate in ICT Subjects	32	69
Vendor Qualification	32	71
External Short Course	59	122
In-House Training	99	196
Other Technical Qualification	126	272

Table 38: Comparison of extra business qualifications in 2004 and 2006

Business Qualification	2004	2006
Masters or PhD Degree	0	0
Graduate Diploma	6	15
MBA Degree	17	44
Masters of Engineering Mgmt	8	21
Commerce/Business Degree	162	321
Diploma in Business Subjects	49	93
Certificate in Business Subjects	200	426
External Short Course	200	426
In-House Training	20	50
Other Business Qualification	37	76

The higher growth rates (and the larger base of current employment found in the telephone survey) mean that the projections for extra qualified staff are higher in 2006 than they were in 2004. This comparison is presented in Table 37 for the technical qualifications and in Table 38 for the business qualifications. Recall that the same mapping mechanism from occupations to qualifications was used in both surveys, and so the differences in the two tables between 2004 and 2006 are entirely due to changes in projected occupation numbers. Compared to 2004, the respondents in the 2006 survey have reported approximately twice as many qualifications required in five years time. The pattern of high demand for graduates with engineering degrees and with some knowledge of commerce (short course, certificate or degree) is apparent in both sets of data.

Repeating the 2004 survey in 2006 will allow a preliminary analysis of aggregate trends in the subset of 135 firms that were surveyed in both years. This will be the subject of a separate report by the AERU research team, which is expected to be completed in January 2007.

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