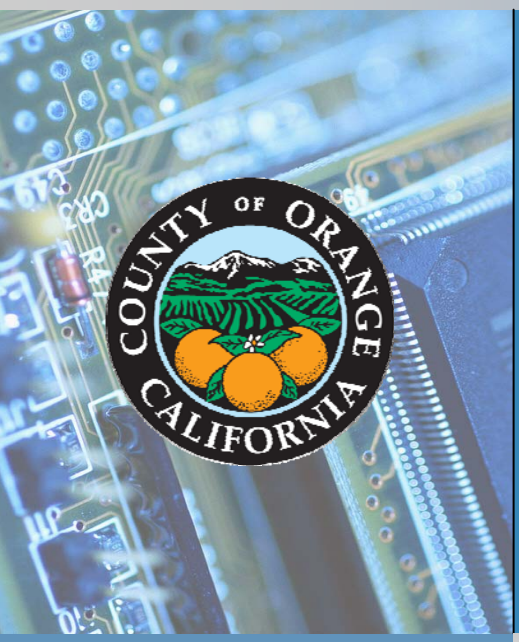
Orange County
Workforce Investment Board
Linking Business & People



Computer Cluster Collaborative Labor Market Research

REPORT

Conducted for the Orange County Workforce Investment Board

December 2007

[bw] RESEARCH PARTNERSHIP

TABLE OF CONTENTS

List of Figures ii
List of Tables iii
Executive Summary 1
Introduction 1
Key Findings 1
Conclusions 6
Computer Cluster Profile 9
Computer Cluster Employment 10
Cluster Employment in Orange County Compared to State Levels 18
Type of Work Performed 19
Industries Served 23
Historical Industry Growth 24
Industry Growth Expectations 26
Growth through 2016 26
Expectations for the Next 12 Months 27
Workforce Issues and Challenges 29
Working Relationships Outside the United States 31
Workforce Opportunities 32
Interest in Potential Training and Education Programs 32
Occupational Assessment 33
Occupational Outlook 35
Occupational Skills and Education Requirements 40
Occupational Summary 43
Assemblers and/or Electrical & Electronic Assemblers 44
Computer Programmers 46
Computer Software Engineers 48
Computer Support Specialists 50
Customer Service Representatives 52
Database Administrators 54
Electrical and Electronic Engineering Technicians 56
Inspectors, Testers and Graders 58
Research and Development Technicians 60
Sales Managers 62
Sales Representatives 64
Career Ladders 66
Education and Training Providers 68
Methodology 72
Appendix A: Topline Results A-1

LIST OF FIGURES

Figure 1 Firms with Five or More Employees by Zip Code 12
Figure 2 Number of Employees by Zip Code 13
Figure 3 Average Firm Size by Zip Code 14
Figure 4 Computer & Computer Parts Manufacturing: Employees by Zip Code 15
Figure 5 Computer Services: Employees by Zip Code 16
Figure 6 Software Products & Design Services: Employees by Zip Code 17
Figure 7 Type of Work Performed at Business Location 19
Figure 8 Type of Work Performed: Consulting and Customer Services by Zip Code 20
Figure 9 Type of Work Performed: Production or Manufacturing by Zip Code 21
Figure 10 Type of Work Performed: Sales by Zip Code 22
Figure 11 Industries Served 23
Figure 12 Computer Cluster Employment in the County: 1996-2006 24
Figure 13 Orange County Projected Computer Cluster Growth: 2006-2016 26
Figure 14 Employer Growth Expectations; Next 12 Months 27
Figure 15 Employer Growth Expectations; Next 12 Months by Zip Code 28
Figure 16 Workforce Challenges for Computer Cluster Employers 29
Figure 17 Frequency of Recruiting from Outside the County 30
Figure 18 Hiring Practices for Non-Entry Positions 30
Figure 19 Office Location Outside the United States 31
Figure 20 Working Relationship with Vendors/ Consultants Outside the United States 31
Figure 21 Employer Interest in Potential Training and Education Programs 32
Figure 22 Difficulty Finding Applicants who Meet Hiring Standards 35
Figure 23 Firms Hiring More Employees in Each Occupation in the Next 12 Months 36
Figure 24 Estimated Growth Needs by Occupation: Next 12 Months 37
Figure 25 Occupational Employment, Difficulty Hiring, and Expected Growth 39
Figure 26 General Skill Deficiencies Among Recent Hires 40
Figure 27 Typical Education Requirements: At Least Some College by Occupation 41
Figure 28 Preferences for Specific Associates or General Bachelors 42
Figure 29 Education and Training Providers by Location 71

LIST OF TABLES

Table 1 Occupational Assessment....5
Table 2 Sectors and Sub-Sectors in the Orange County Computer Cluster....9
Table 3 Orange County Computer Cluster Employment: 2006....10
Table 4 Number of Computer Cluster Establishments: 2006....11
Table 5 Computer Cluster Employment Index....18
Table 6 Change in Computer Cluster Employment: 1996-2006....25
Table 7 Projected Computer Cluster Employment Growth: 2006-2016....26
Table 8 Employer Growth Expectations; Next 12 Months....27
Table 9 Percentage of Firms Employing Each Occupation....34
Table 10 Estimated New Jobs and Median Annual Wages by Occupation....38
Table 11 Key for Figure 25....39
Table 12 Occupational Assessment....43
Table 13 Education and Training Providers: ROP....68
Table 14 Education and Training Providers: Community Colleges....68
Table 15 Education and Training Providers: Universities....69
Table 16 Education and Training Providers: Private Training Providers....70
Table 17 Project Methodology....72

EXECUTIVE SUMMARY

INTRODUCTION

In June 2007, the Orange County Workforce Investment Board (OCWIB) partnered with BW Research to conduct a workforce study of the computer cluster, including both an industry and occupational analysis.

The primary research objectives of the study were to:

- Assess current and projected computer cluster workforce needs within Orange County;
- Develop and analyze indicators of potential shortages or gaps in occupational supply and demand;
- Identify potential solutions to workforce challenges that can be addressed by the Workforce Investment Board.

Data compiled for this report were drawn from external sources, including information from California's Employment Development Department, the Bureau of Labor Statistics, the Occupational Information Network, and regional and statewide occupational outlook guides. Two phases of primary research were conducted as part of this project - qualitative executive interviews with industry leaders, prominent employers, and human resource directors within the computer cluster and a quantitative telephone and Internet survey of 200 Orange County computer cluster employers with five or more employees.

KEY FINDINGS

The computer cluster in Orange County is comprised of agencies that provide computer and computer parts manufacturing, software products and design services, and computer services to support a variety of industries throughout the economy.

Industry Analysis

- Approximately 1 in 30 workers (3.3%) in Orange County is employed within the computer cluster. Countywide, the computer cluster employs 50,470 workers.
- The 50,470 computer cluster workers are distributed across 3,314 establishments within the County, averaging 15.2 employees per establishment.
- Most of the computer cluster employment is found in computer and computer parts manufacturing (21,392 workers, 42.4% of computer cluster employment) and software products and design services (19,958 workers, 39.5% of computer cluster employment). Computer services accounts for the smallest piece of computer cluster employment, at 18.1 percent (9,120 employees).
- Computer cluster employment in Orange County accounts for 3.3 percent of total non-farm employment (50,470 out of 1,520,100 total employees), which is slightly below the statewide average of 3.8 percent (567,558 of 15,072,800 non-farm employees).

- Among the computer cluster's three main sectors, Orange County has a higher concentration of computer and computer parts manufacturing as compared to the state level (42.4% vs. 32.6%). This is driven mostly by employment in semiconductor and other electronic component manufacturing within this sector.
- Among the computer cluster employers surveyed by BW Research, 63 percent classified the type of work performed at their business location as "Consulting or customer services," 51 percent indicated "Sales," 50 percent "Produce of manufacture products or services (including software applications)," and 18 percent cited "Research and development."
- When asked to indicate the industries that their firm provides goods or services for, employers cited industries throughout all sectors of the economy.
    - Seventy percent of employers indicated that they provide goods or services for the computer or technology industry, 50.5 percent serve the manufacturing industry and 41.5 percent provide goods or services for the retail or wholesale trade industry.

Industry Growth

- The late 1990s showed a rise in computer cluster employment within the County. Employment peaked in 2000 at 64,310, declined to 47,431 in 2004, and increased to 50,470 in 2006.
- Over the ten year period from 1996 to 2006, computer cluster employment within the County increased 8.6 percent, resulting in 4,005 new jobs.
- The highest percentage of growth was in the software products and design services sector (35.8% growth; 5,258 new jobs), followed closely by the computer services sector (32.9.5% growth; 2,257 new jobs). The computer and computer parts manufacturing sector experienced a 14.1 percent decline (a loss of 3,510 jobs).
- Within the County, growth in the computer cluster as a whole is expected to increase 33.0 percent from 2006 to 2016, resulting in 16,790 new jobs.
- Among the three sectors within the computer cluster, software products and design services is projected to increase by the highest percentage as well as result in the most new jobs (33.0% growth, 9,502 new jobs).
- Computer services is projected to increase by 25.3 percent growth, resulting in 2,325 new jobs and computer and computer parts manufacturing is forecasted to increase by 23.4 percent, resulting in 4,963 new jobs from 2007 to 2016.
- The majority of employers surveyed, 52.5 percent, expect to increase the number of permanent employees at their business location over the next 12 months, 42.5 percent expect to stay the same, and two percent expect to have less permanent employees at their location 12 months from now.
- Overall, computer cluster employers expect to increase their workforce by 7.6 percent over the next 12 months. Applying the percentage to the forecasted 2007 computer cluster employment level yields 3,879 new jobs over the next 12 months.

Workforce Issues and Challenges

- Two out of three Orange County computer cluster employers (67.0%) have difficulty "Recruiting non-entry level employees with adequate experience and understanding of the industry."
- Sixty-two percent of employers indicated difficulty "Recruiting employees with reasonable salary requirements."
- Eighteen percent of employers indicated that they "Always" or "Frequently" recruit individuals from outside Orange County (i.e., at least 50% of the time) and an additional 22.5 percent "Sometimes" (25% to 49% of the time) recruit from outside the County.
- When hiring for non-entry level positions, 46.0 percent of employers typically recruit from outside their organization, 21.0 percent promote from within, and 28.5 percent revealed an even split between the two.
- Overall, more employers recruited from outside to fill their non-entry level positions than promoted from within their organization.
- Nearly one in five employers surveyed indicated that they have an office location outside the United States.
- Almost one out of every two computer cluster employers has a working relationship with a vendor or consultant outside of the United States.

Workforce Opportunities

- Employers expressed the most overall interest in working with the regional Workforce Investment Board and/ or community colleges to develop a certificate program for entry-level programmers or technicians in the industry (46.5% interest).
- Forty-two percent of computer cluster employers also expressed interest in an associate's degree program created for working technicians or programmers to become managers (41.5%) and on-site customized training for current employees (41.5%).

Occupational Assessment

The primary research component of this study focused on eleven computer cluster occupations. To be selected for inclusion, the occupations had to meet at least one of the following criteria: large employment in the region, above average growth, or be an occupation easily served by the Workforce Investment Board's education and training programs.

- The majority of employers indicated difficulty finding qualified applicants for all but three of the occupations.
    - Approximately 62 percent of employers expressed difficulty finding qualified computer software engineers, the highest in the survey.

  - Employers indicated comparable levels of total difficulty for electrical and electronic engineering technicians (57.8%) and research and development technicians (57.2%), followed closely by sales managers (56.3%), sales representatives (55.1%), and inspectors, testers, and graders (53.9%).

- Among the firms employing each occupation, at least one in four expect to increase the number of workers in each position over the next 12 months, with over 50 percent expecting to hire more computer software engineers (53.2%) and sales representatives (52.9%).
- Employers anticipated double-digit growth for all but one of the eleven occupations, with the highest growth percentages expected for computer software engineers (22.5% growth), sales representatives (19.5% growth), and database administrators (18.5% growth).
- Among the occupations examined in this study, computer software engineers have the highest employment (13,870) and the second highest median wage ($86,365). Sales managers have the highest median wage at $118,403 per year.
- When asked to reflect on recent hires at their organization, employers indicated that new hires tend to be most deficient in technical writing skills (39.0%), interpersonal communication skills (32.5%), and creative problem-solving skills (31.5%).
- Over 70 percent of employers indicated that a bachelor's or master's degree was expected for computer programmers (77.4%), computer software engineers (74.5%), and research and development technicians (71.4%).
- Computer cluster employers indicated a preference for an associate's degree specific to the position over a general bachelor's degree for nine of the eleven occupations and were undecided on one other (research and development technicians). Sales manager was the only occupation where a general bachelor's degree was preferred.
- The preference for a specific associate's degree was most pronounced for:
  - Electrical and electronic engineering technicians (64.4% vs. 26.7%);
  - Assemblers or electrical and electronic assemblers (64.1% vs. 15.4%);
  - Inspectors, testers and graders (56.4% vs. 15.4%);
  - Computer support specialists (55.6% vs. 30.0%);
  - Computer software engineers (53.2% vs. 29.8%).

Potential Occupational Shortages

Although there is no single equation that can be applied to identify the probability that an occupation will be undersupplied in the future, a combination of the data sources evaluated in this project[1] allows for an estimate of those occupations that have the highest potential to be undersupplied in the future.

Table 1 Occupational Assessment

RED OCCUPATIONS **Occupations that provide the strongest indication that they will be under-supplied in the future**
Computer Software Engineers
Sales Representatives
Electrical & Electronic Engineering Technicians
Sales Managers
YELLOW OCCUPATIONS **Occupations that provide some indication that they will be under-supplied in the future**
Inspectors, Testers and Graders
Computer Programmers
Research & Development Technicians
Customer Service Representatives
Assemblers or Electrical & Electronic Assemblers
Database Administrators
Computer Support Specialists
GREEN OCCUPATIONS **Occupations that provide little to no indication that they will be under-supplied in the future**
Each of the eleven occupations can be classified as either red or yellow.

[1] A combination of quantitative and qualitative factors from secondary data sources as well as the employer data from both the executive interviews and quantitative survey.

CONCLUSIONS

BW Research offers the following conclusions and recommendations to the Orange County Workforce Investment Board (OCWIB) from the research for the Computer Cluster Collaborative.

Over the last ten years, the computer cluster in Orange County has seen substantial growth (1996 through 2000) in its workforce followed by a significant decline (2001 to 2004) in employment. The employment cycle faced by Orange County's computer industry is consistent with other high technology regions such as Silicon Valley to the north and San Diego to the south.

The computer cluster in Orange County has rebounded and is again seeing an increased demand for new workers as well as showing signs of a tight labor market.

- Two out of three employers in Orange County indicated at least some difficulty recruiting non-entry level employees.
- Almost half of employers indicated at least some difficulty recruiting entry level employees.
- Over half of employers indicated difficulty finding qualified applicants for specific occupations such as computer software engineers (62%), electric and electrical engineering technicians (58%), and sales representatives (55%), just to name a few.

Employment expectations are on the rise for the computer cluster in Orange County as the next 12 months show significant increases in overall employment (7%) as well as strong growth for the next ten years (33%). From 2007 to 2016, the industry expects to create over 16,000 new jobs in software and design services (9,500 jobs), computer and computer parts manufacturing (4,900 jobs) and computer services (2,300 jobs).

The computer industry in Orange County is also transitioning from an industry that was driven by computer and computer parts manufacturing, in 1996 this sector accounted for 54 percent of the total industry employment, to an industry that has more and more employment in computer-related services. By 2016 software products and design services is expected to employ over 30,000 people and over 60 percent of the industry's employment will be found in computer services or software products and design services. The computer industry is also becoming more integrated within the regional economy as industry employers focus on industries outside of manufacturing and computers and information technology. Over 25 percent of computer cluster employers indicated they provided goods or services to the following industries;

- Retail or wholesale trade (42%);
- Healthcare (34%);
- Professional services other than computers (31%);
- Logistics and/or transportation (28%);
- Biotechnology and/or the life sciences (28%);
- Education (26%).

EDUCATION AND TRAINING NEEDS OF THE INDUSTRY

The need for improving science and math education has been a central part of the national discussion associated with economic competitiveness; however the computer cluster employer survey also revealed a real need to improve communication skills particularly written communication skills. Employers indicated that recent hires are less able to effectively communicate with groups outside of their immediate audience.

Education and training programs should focus on developing the ability to write memos and summarize findings that can be easily understood by a wider audience. In essence, taking technical jargon and interpreting it so that just about anyone can understand what is being communicated. Employers also indicated that recent hires who have relied on communicating through short, informal written messages, such as those through email or text messaging devices, find it daunting to write in a more formal tone that can be disseminated to a wide audience. While technical prowess and quantitative skills remain an essential attribute for many occupations in this cluster, the ability to effectively communicate to a wide audience should be emphasized in the training and education for the computer industry.

Employers throughout the industry emphasized the need for hands-on experience and training that is specific to the occupation and even the specific sectors within the computer cluster. Employers were asked if they would prefer individuals for each occupation that had an Associates degree that is specific to a given position or a more generalized bachelor's degree as the typical education of an applicant. Generally, employers preferred the specific training associated with an associate's degree. Employers preferred a specific associate's degree for nine of the eleven occupations evaluated, one showed an equal preference between the two degrees, and sales manager was the only occupation where employers preferred the more generalized education from a bachelor's degree.

Employers also indicated that specific training programs should be combined with some sort of hands-on experience through an internship, job shadowing, or special projects that allow students to develop a closer connection to the industry. OCWIB should look to take a lead in coordinating greater integration between education and training providers and industry employers so students and individuals preparing for work in the computer cluster have opportunities to develop hands-on experience through internships, job shadowing and employer guided special projects.

THE VALUE OF EMPLOYEE DEVELOPMENT PRACTICES

Employers in the computer cluster increasingly require an agile and responsive workforce that can develop new skills as the market changes while understanding their firm's role in the technology economy. However, as employers face an increasingly tight labor market, particularly for occupations with higher education requirements; recruiting from outside their organization for every non-entry level position becomes more expensive and less cost-effective for employers.

Currently less than one quarter of computer cluster employers primarily promote individuals from within their organization for non-entry level positions. Smaller employers, typically in one of the computer service sectors (computer services or

software development and design services) indicated they were interested in a certificate program for entry-level programmers or technicians in the computer industry or an associate's degree program created for working technicians or programmers to become managers.

By working with regional education and training providers to develop these certificate and degree programs, OCWIB could not only improve the pipeline for the computer cluster workforce, but could also be supporting the cluster's career ladders and employee retention needs by increasing the number of individuals that can enter into a career ladder or move up from one rung to the next.

COMPUTER CLUSTER PROFILE

The computer cluster in Orange County is comprised of agencies that provide computer and computer parts manufacturing, software products and design services, and computer services to support a variety of industries throughout the economy.

The industry definition used in this study is based on the North American Industry Classification System's (NAICS) definition of several industries. The NAICS system has been used since 1997 by the U.S. Government to group businesses and calculate economic activity among industries in the U.S. economy. NAICS is an economic classification system based on a single economic concept. Economic units that use like processes to produce goods or services are grouped together.

Table 2 displays the sectors and sub-sectors within the computer cluster along with accompanying NAICS codes.

Table 2 Sectors and Sub-Sectors in the Orange County Computer Cluster

Sector	Sub-Sector	NAICS Code
Computer & Computer Parts Manufacturing	Semiconductor Machinery Manufacturing	333295
	Computer and Peripheral Equipment Manufacturing	3341
	Semiconductor and Other Electronic Component Manufacturing	3344
	Manufacturing and Reproducing Magnetic and Optical Media (Software Reproducing)	3346
Computer Services	Internet Publishing and Broadcasting	5161
	Internet Service Providers and Web Search Portals	5181
	Data Processing, Hosting, and Related Services	5182
	Research and Development in the Physical, Engineering, and Life Sciences	54171
	Computer Training	611420
Software Products & Design Services	Software Publishers	5112
	Computer Systems Design and Related Services	5415

COMPUTER CLUSTER EMPLOYMENT

Countywide, the computer cluster employs 50,470 workers, which is 3.3 percent of the total non-farm employment in Orange County. Approximately 1 in 30 workers in Orange County is employed within the computer cluster.

Most of the computer cluster employment is found in computer and computer parts manufacturing (21,392 workers, 42.4% of computer cluster employment) and software products and design services (19,958 workers, 39.5% of computer cluster employment). Computer services accounts for the smallest piece of computer cluster employment, at 18.1 percent (9,120 employees).

Table 3 Orange County Computer Cluster Employment: 2006

	2006 Employment	Percent of Computer Cluster Employment
Computer & Computer Parts Manufacturing	**21,392**	**42.4%**
NAICS 333295: Semiconductor Machinery Manufacturing	369	0.7%
NAICS 3341: Computer and Peripheral Equipment Mfg.	5,520	10.9%
NAICS 3344: Semiconductor and Other Electronic Component Manufacturing	15,011	29.7%
NAICS 3346: Manufacturing and Reproducing Magnetic and Optical Media (Software Reproducing)	492	1.0%
Computer Services	**9,120**	**18.1%**
NAICS 5161: Internet Publishing and Broadcasting	591	1.2%
NAICS 5181: Internet Service Providers/Web Search Portals	2,181	4.3%
NAICS 5182: Data Processing, Hosting, & Related Services	2,679	5.3%
NAICS 54171: Research and Development in the Physical, Engineering, and Life Sciences	3,387	6.7%
NAICS 611420: Computer Training	282	0.6%
Software Products & Design Services	**19,958**	**39.5%**
NAICS 5112: Software Publishers	3,073	6.1%
NAICS 5415: Computer Systems Design & Related Services	16,885	33.5%
Orange County Computer Cluster Total	**50,470**	

Source: California Economic Development Department (EDD), ES 202 Data.

The 50,470 computer cluster workers are distributed across 3,314 establishments within the County, averaging 15.2 employees per establishment.

Software products and design services account for the largest number of establishments, at 2,314. However, software products and design services firms tend to be the smallest, averaging 8.6 employees each.

Computer and computer parts manufacturing firms, on the other hand, average 53.9 employees per establishment, but have the fewest number of total establishments (397).

Computer services firms fall in the middle, with 603 total establishments, averaging 15.1 employees each.

Table 4 Number of Computer Cluster Establishments: 2006

	Number of Establishments 2006	Average Employment per Establishment
Computer & Computer Parts Manufacturing	**397**	**53.9**
NAICS 333295: Semiconductor Machinery Manufacturing	6	61.5
NAICS 3341: Computer and Peripheral Equipment Mfg.	69	80.0
NAICS 3344: Semiconductor and Other Electronic Component Manufacturing	284	52.9
NAICS 3346: Manufacturing and Reproducing Magnetic and Optical Media (Software Reproducing)	38	12.9
Computer Services	**603**	**15.1**
NAICS 5161: Internet Publishing and Broadcasting	45	13.1
NAICS 5181: Internet Service Providers/Web Search Portals	152	14.3
NAICS 5182: Data Processing, Hosting, & Related Services	109	24.6
NAICS 54171: Research and Development in the Physical, Engineering, and Life Sciences	272	12.5
NAICS 611420: Computer Training	25	11.3
Software Products & Design Services	**2,314**	**8.6**
NAICS 5112: Software Publishers	113	27.2
NAICS 5415: Computer Systems Design & Related Services	2,201	7.7
Orange County Computer Cluster Total	**3,314**	**15.2**

Source: California Economic Development Department (EDD), ES 202 Data.

Figure 1 below shows a geographic representation of the number of firms with at least five employees by zip code.

Figure 1 Firms with Five or More Employees by Zip Code

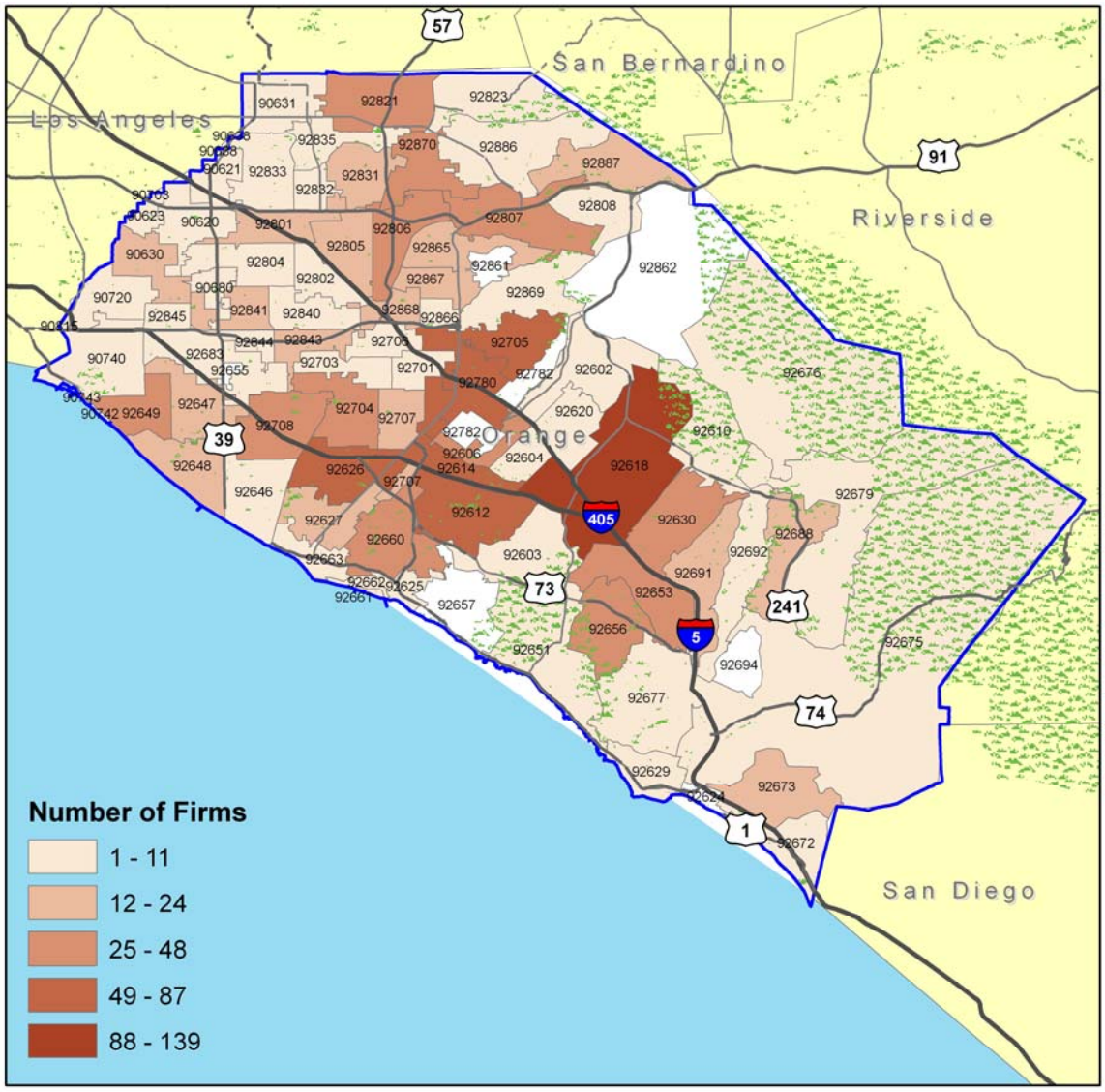


Figure 2 below displays a geographic representation of the number of computer cluster employees by zip code.

Figure 2 Number of Employees by Zip Code

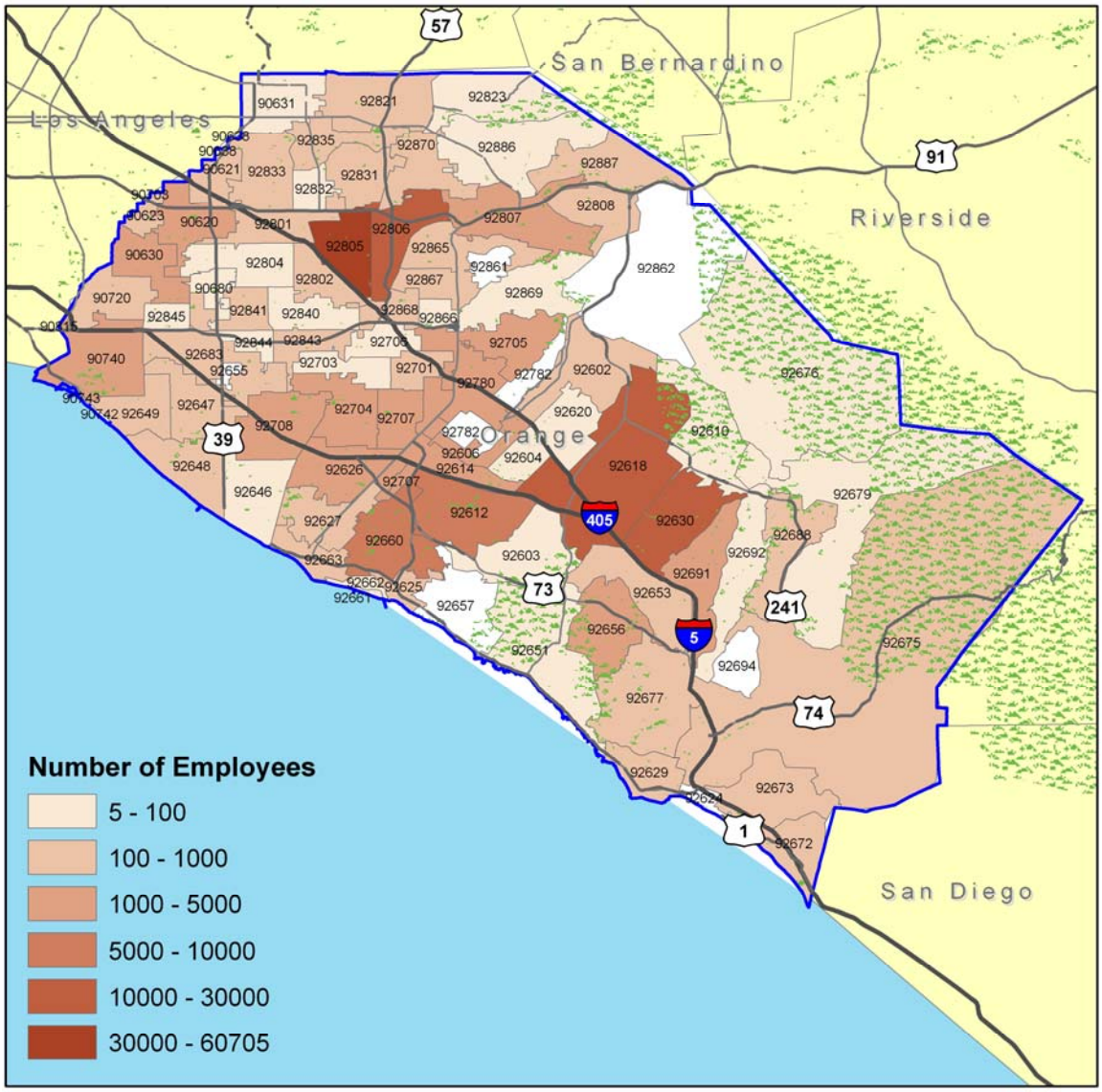
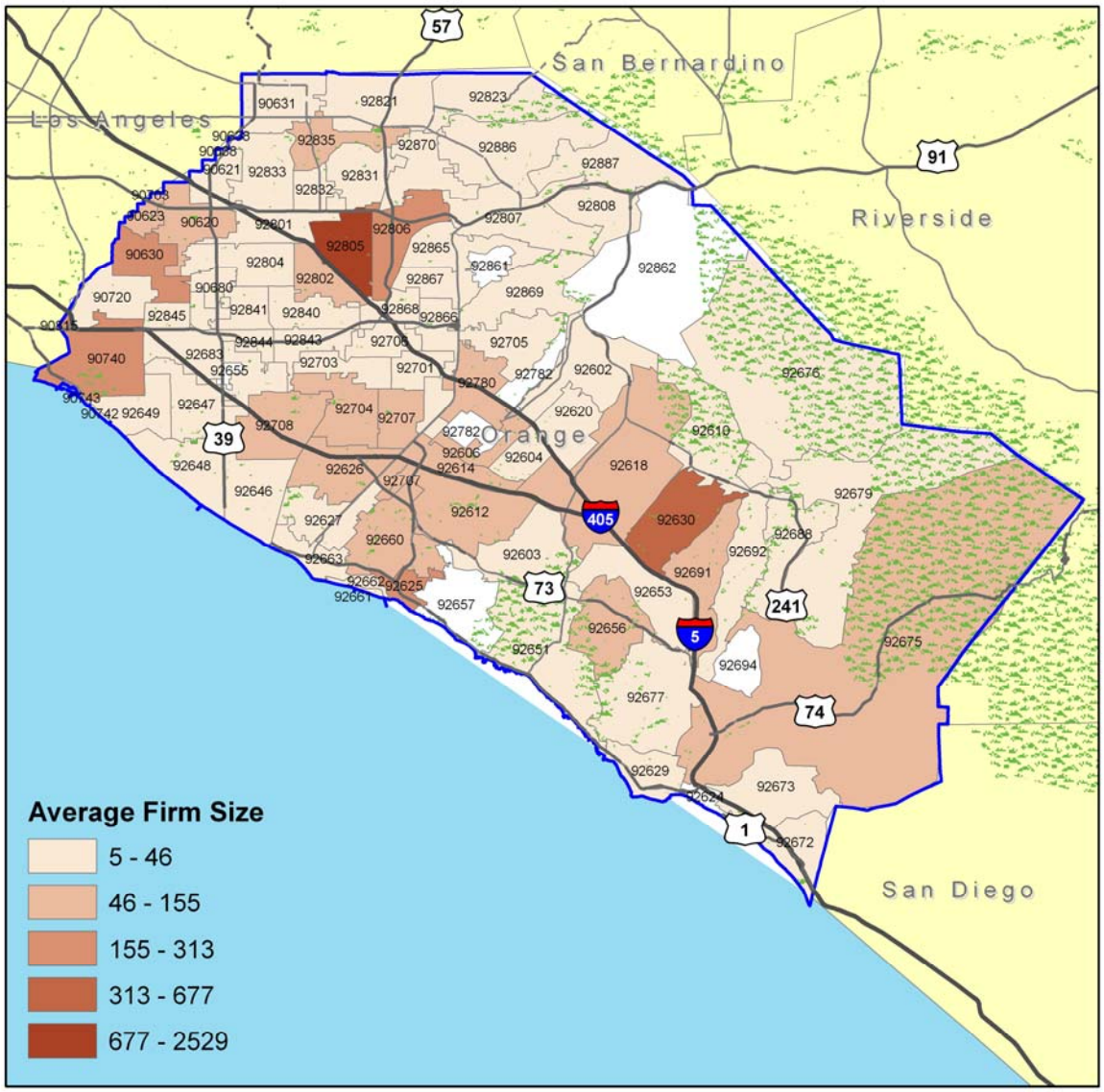


Figure 3 shows a geographic representation of the average number of computer cluster employees by zip code.

Figure 3 Average Firm Size by Zip Code



The figures to follow display the number of employees by zip code for each of the three computer cluster sectors.

Figure 4 displays the number of computer and computer parts manufacturing employees by zip code.

Figure 4 Computer & Computer Parts Manufacturing: Employees by Zip Code

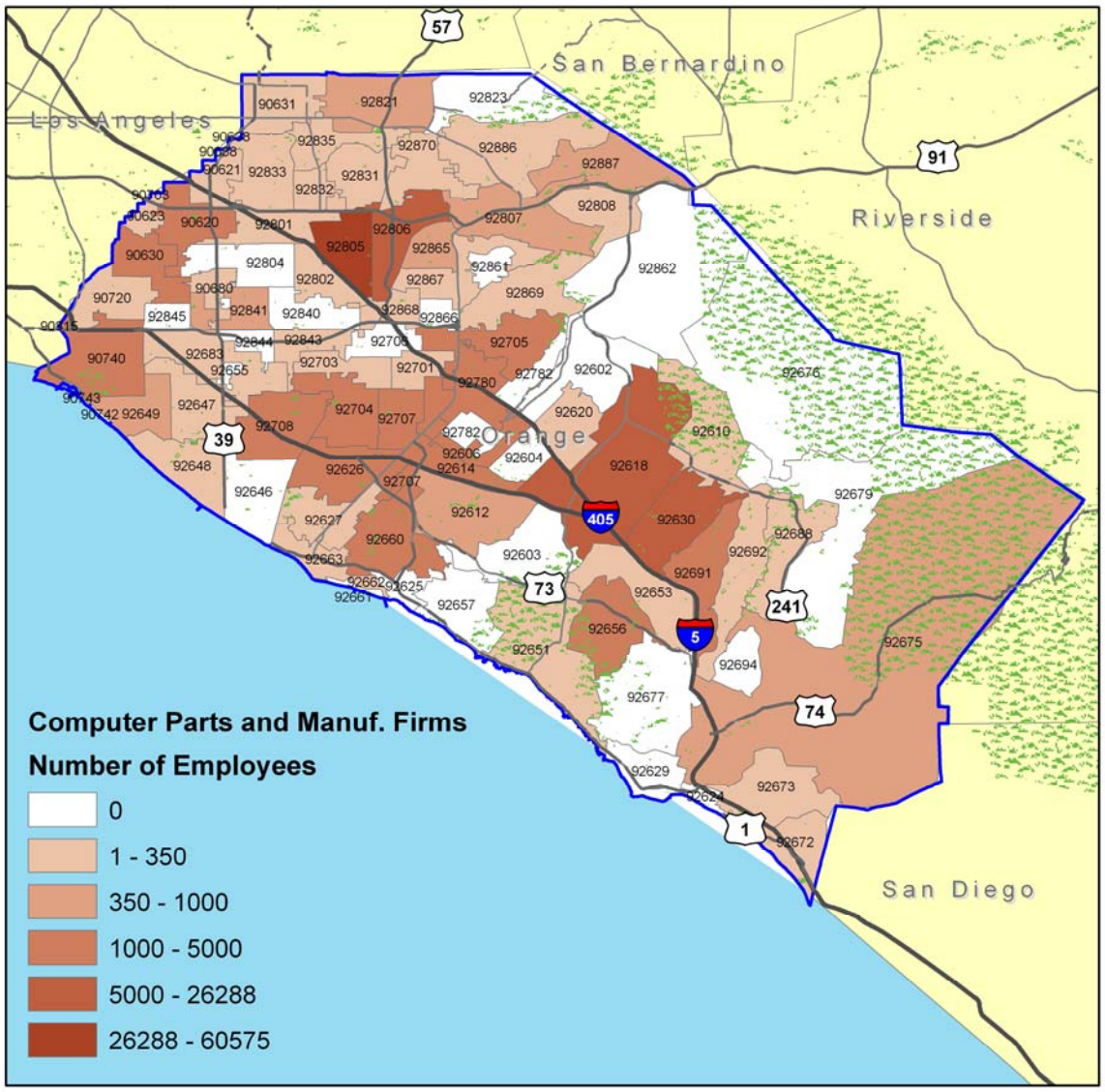


Figure 5 displays the number of computer services employees by zip code.

Figure 5 Computer Services: Employees by Zip Code

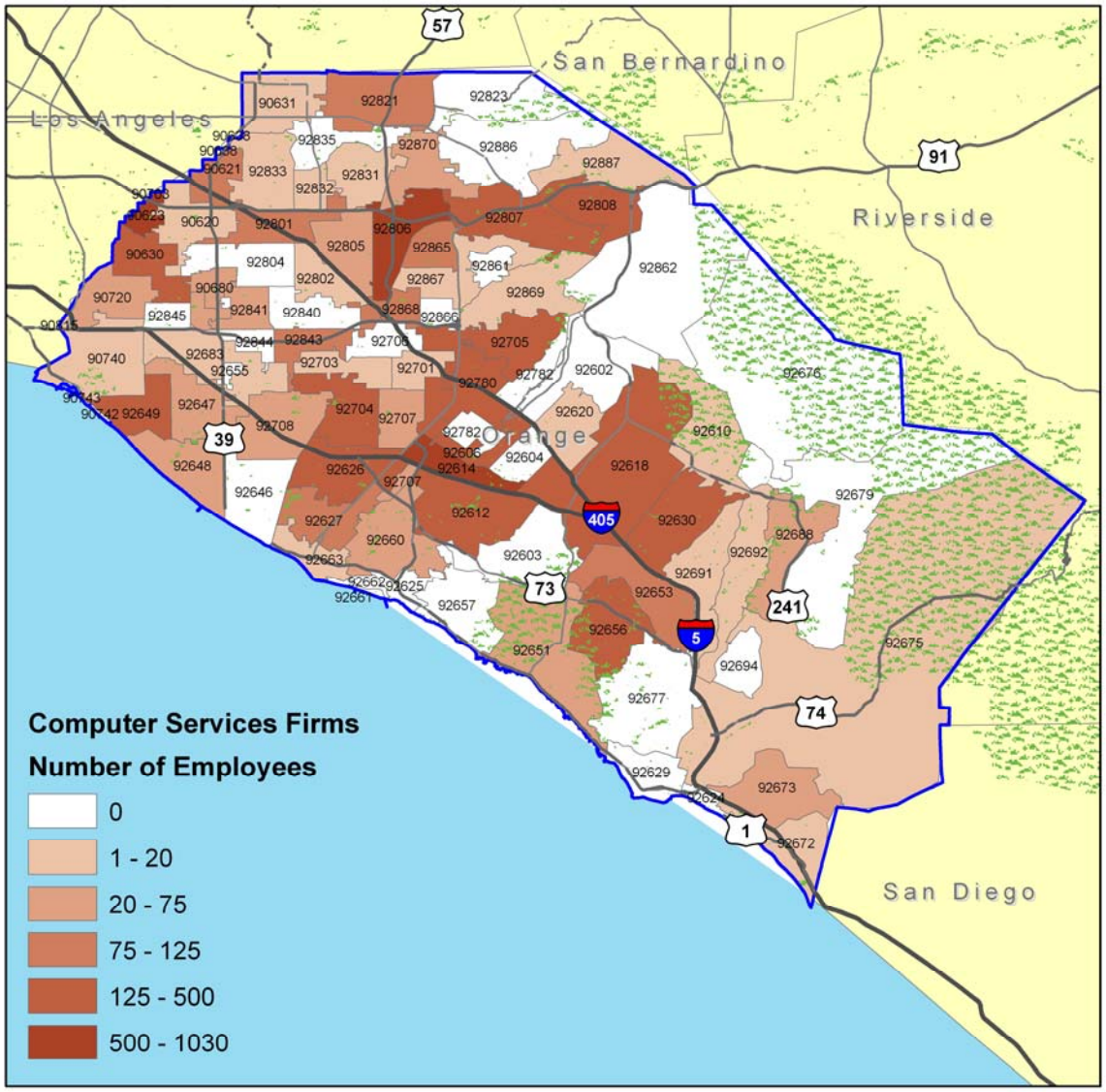
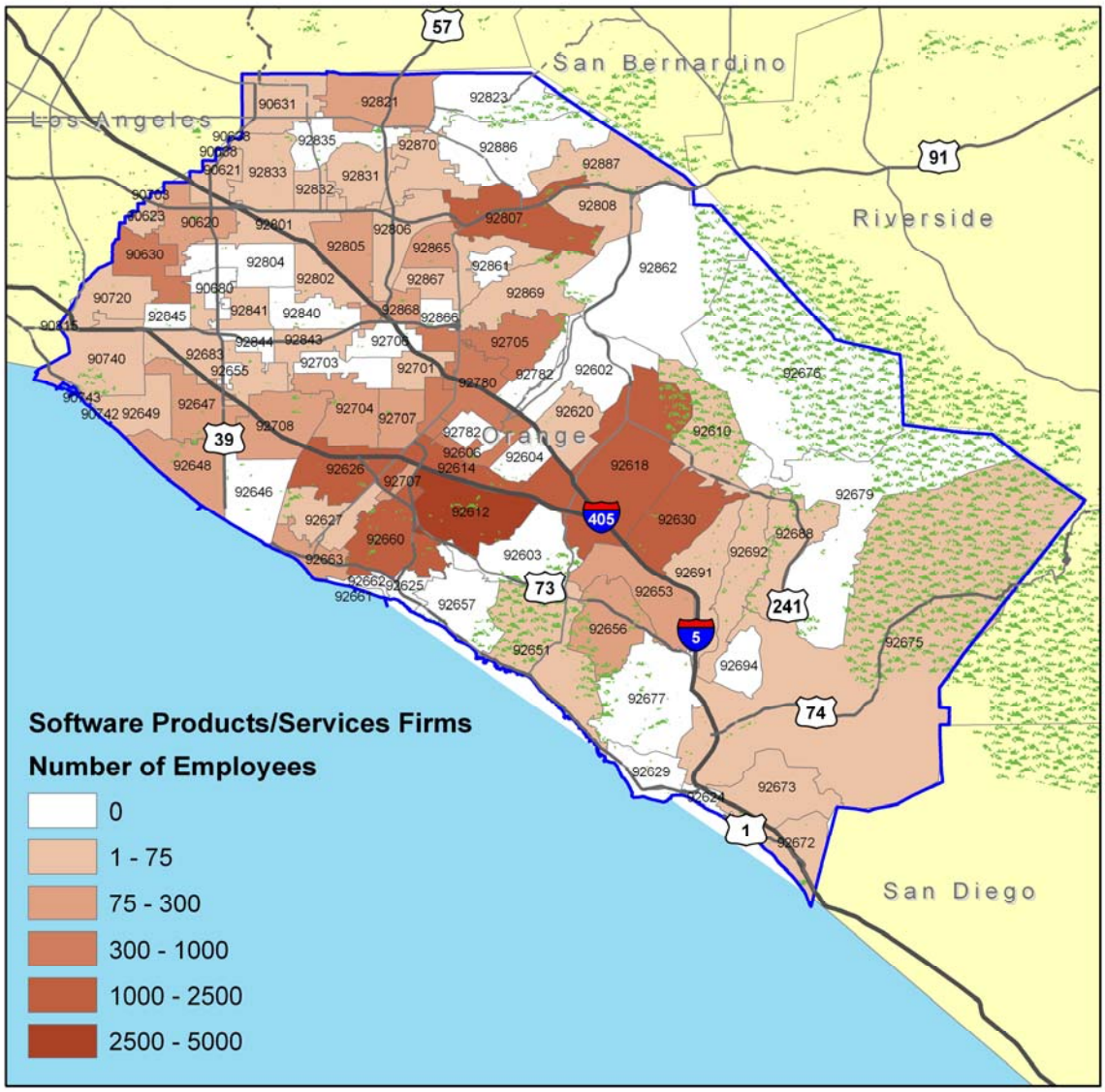


Figure 6 displays the number of software products and design services employees by zip code.

Figure 6 Software Products & Design Services: Employees by Zip Code



CLUSTER EMPLOYMENT IN ORANGE COUNTY COMPARED TO STATE LEVELS

Computer cluster employment in Orange County accounts for 3.3 percent of total non-farm employment (50,470 out of 1,520,100 total employees), which is slightly below the statewide average of 3.8 percent (567,558 of 15,072,800 non-farm employees).

To compare the relative percentage of computer cluster employment in Orange County to the state level, an index value was created for each cluster sector and sub-sector. An index value of 1.00 indicates that the percentage within a particular sector in Orange County is equal to the percentage at the state level, whereas a value of 0.75 would be interpreted as 75 percent of the state's concentration.

Among the computer cluster's three main sectors, Orange County has a higher concentration of computer and computer parts manufacturing as compared to the state level (42.4% vs. 32.6%). This is driven mostly by employment in semiconductor and other electronic component manufacturing within this sector (NAICS 3344, 51% higher concentration in Orange County compared to the state level). Other areas where the County's concentration is higher than the state's are highlighted in grey in the table below.

Table 5 Computer Cluster Employment Index

	Orange County % Computer Cluster Employment	Statewide % Computer Cluster Employment	Index Value
Computer & Computer Parts Manufacturing	**42.4%**	**32.6%**	**1.30**
NAICS 333295: Semiconductor Machinery Mfg	0.7%	1.4%	0.51
NAICS 3341: Computer and Peripheral Equipment Manufacturing	10.9%	10.1%	1.09
NAICS 3344: Semiconductor and Other Electronic Component Manufacturing	29.7%	19.7%	1.51
NAICS 3346: Manufacturing and Reproducing Magnetic and Optical Media	1.0%	1.4%	0.69
Computer Services	**18.1%**	**27.6%**	**0.66**
NAICS 5161: Internet Publishing & Broadcasting	1.2%	1.2%	0.98
NAICS 5181: Internet Service Providers and Web Search Portals	4.3%	6.0%	0.72
NAICS 5182: Data Processing, Hosting, and Related Services	5.3%	3.7%	1.44
NAICS 54171: Research and Development in the Physical, Engineering, & Life Sciences	6.7%	16.4%	0.41
NAICS 611420: Computer Training	0.6%	0.3%	2.10
Software Products & Services	**39.5%**	**39.8%**	**0.99**
NAICS 5112: Software Publishers	6.1%	7.2%	0.85
NAICS 5415: Computer Systems Design and Related Services	33.5%	32.6%	1.03
Computer Cluster Total Employment	**50,470**	**567,558**	

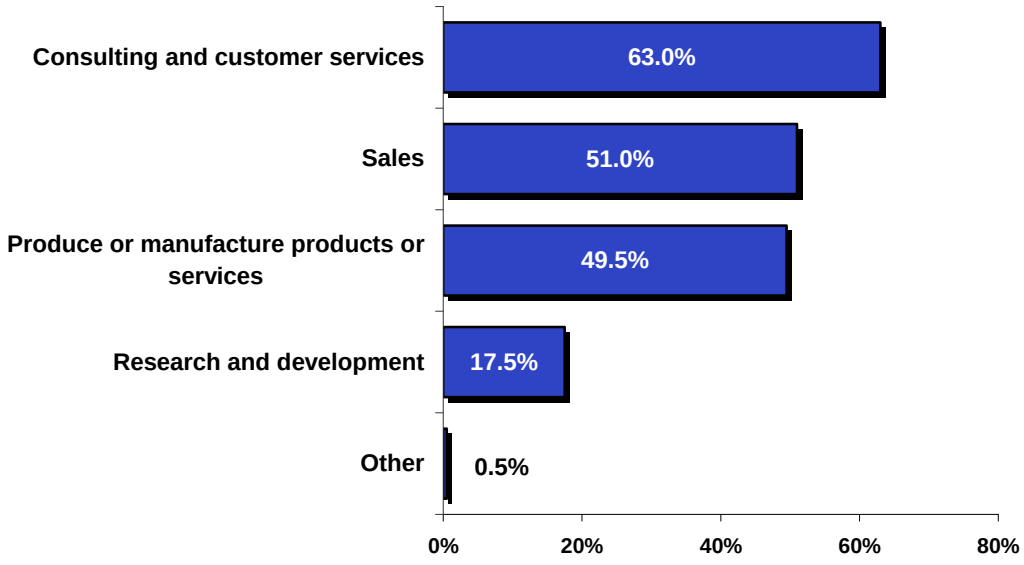
Source: California Economic Development Department (EDD), ES 202 Data.

TYPE OF WORK PERFORMED

Among the computer cluster employers surveyed by BW Research, 63 percent classified the type of work performed at their business location as "Consulting or customer services," 51 percent indicated "Sales," 50 percent "Produce of manufacture products or services (including software applications)," and 18 percent cited "Research and development."

It should be noted that many of the employers indicated more than one classification for their business location. As such, the percentages in Figure 7 will add to more than 100 percent.

Figure 7 Type of Work Performed at Business Location



Source: BW Research Computer Cluster Survey, October 2007.

Figure 8 below displays a geographic representation of the percentage of firms from the survey that classified the type of work performed at their business location as "Consulting and customer services."

Figure 8 Type of Work Performed: Consulting and Customer Services by Zip Code

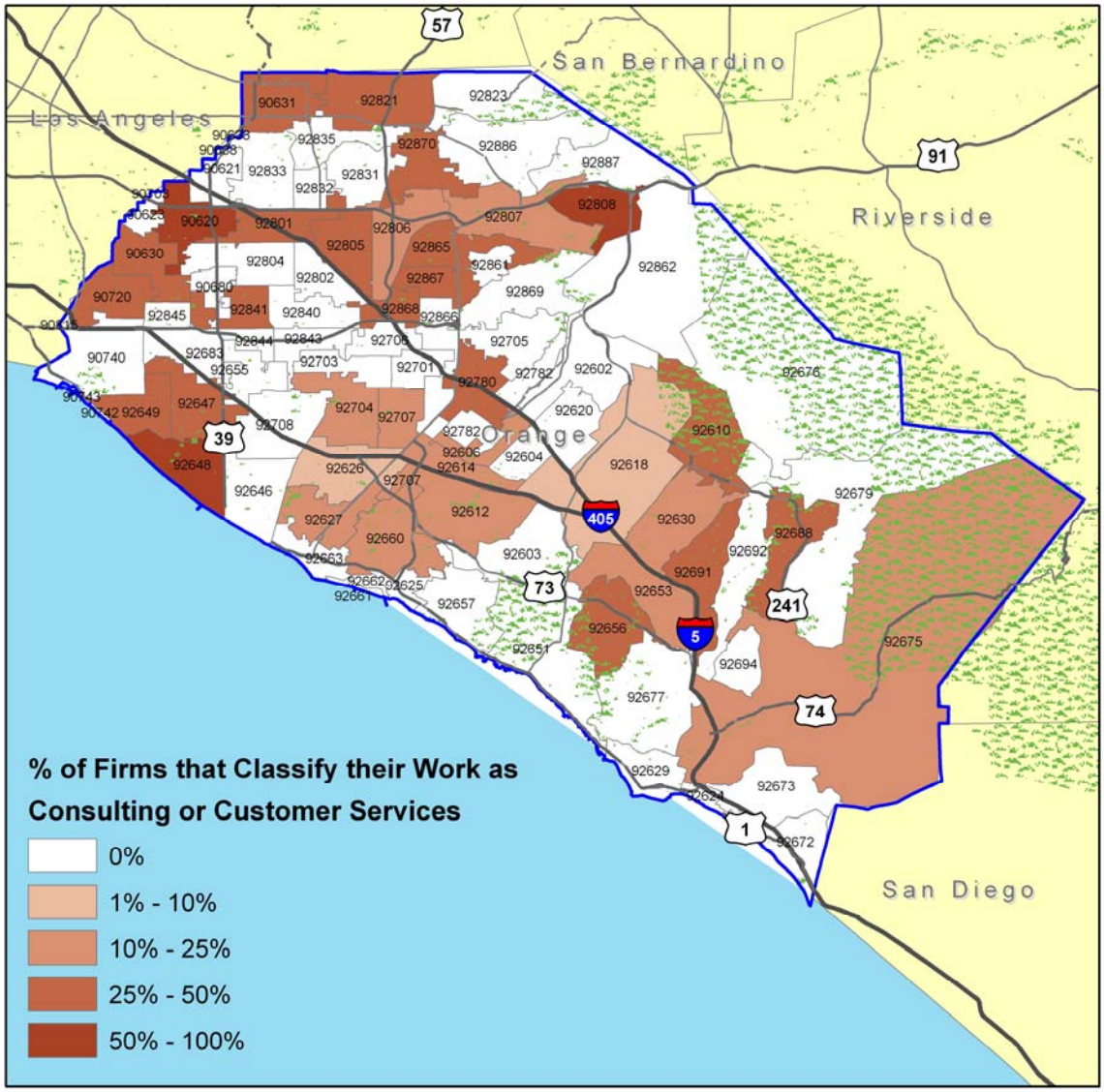


Figure 9 shows a geographic representation of the percentage of firms from the survey that indicated they "Produce of manufacture products or services (including software applications)" at their business location.

Figure 9 Type of Work Performed: Production or Manufacturing by Zip Code

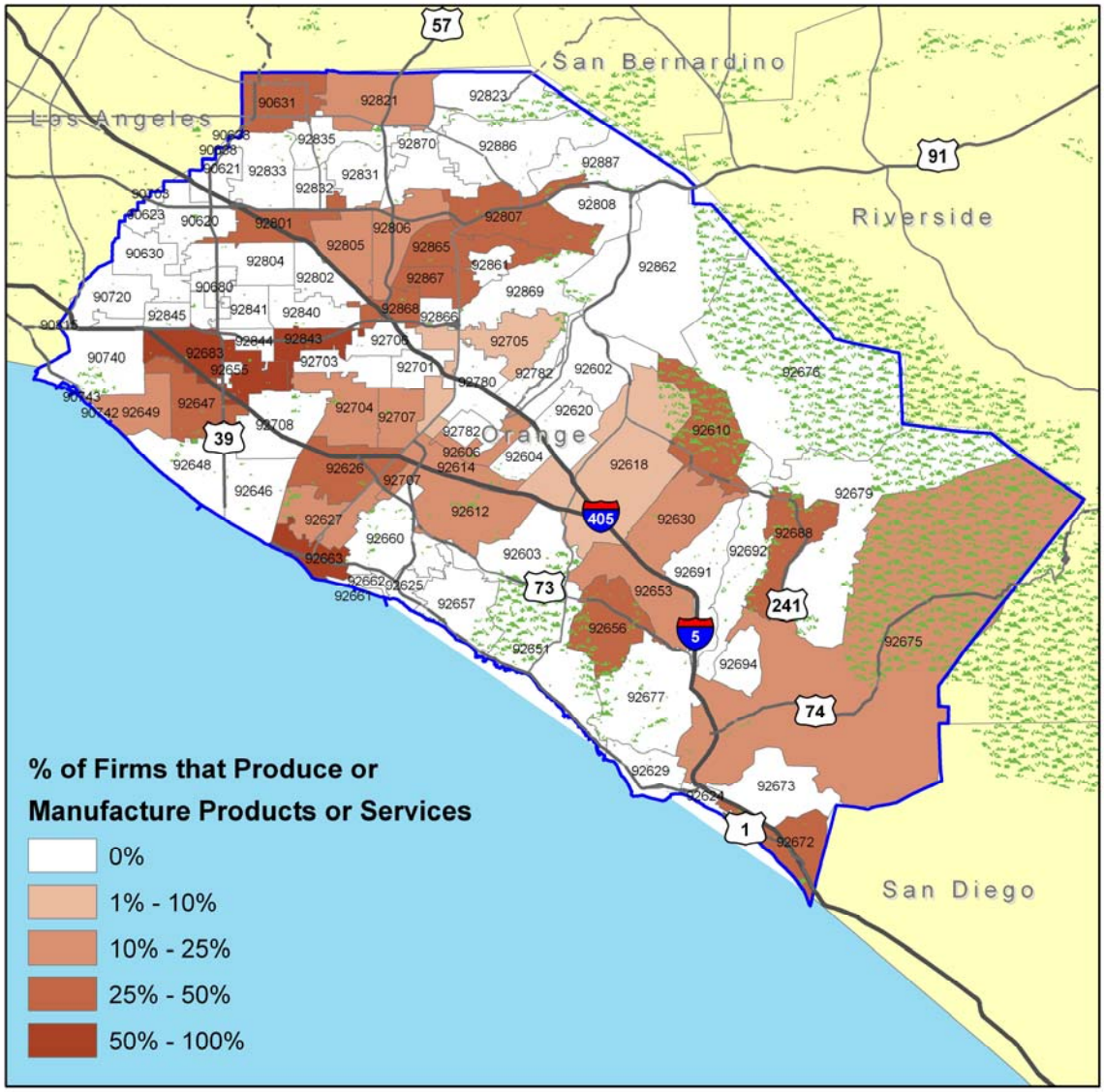
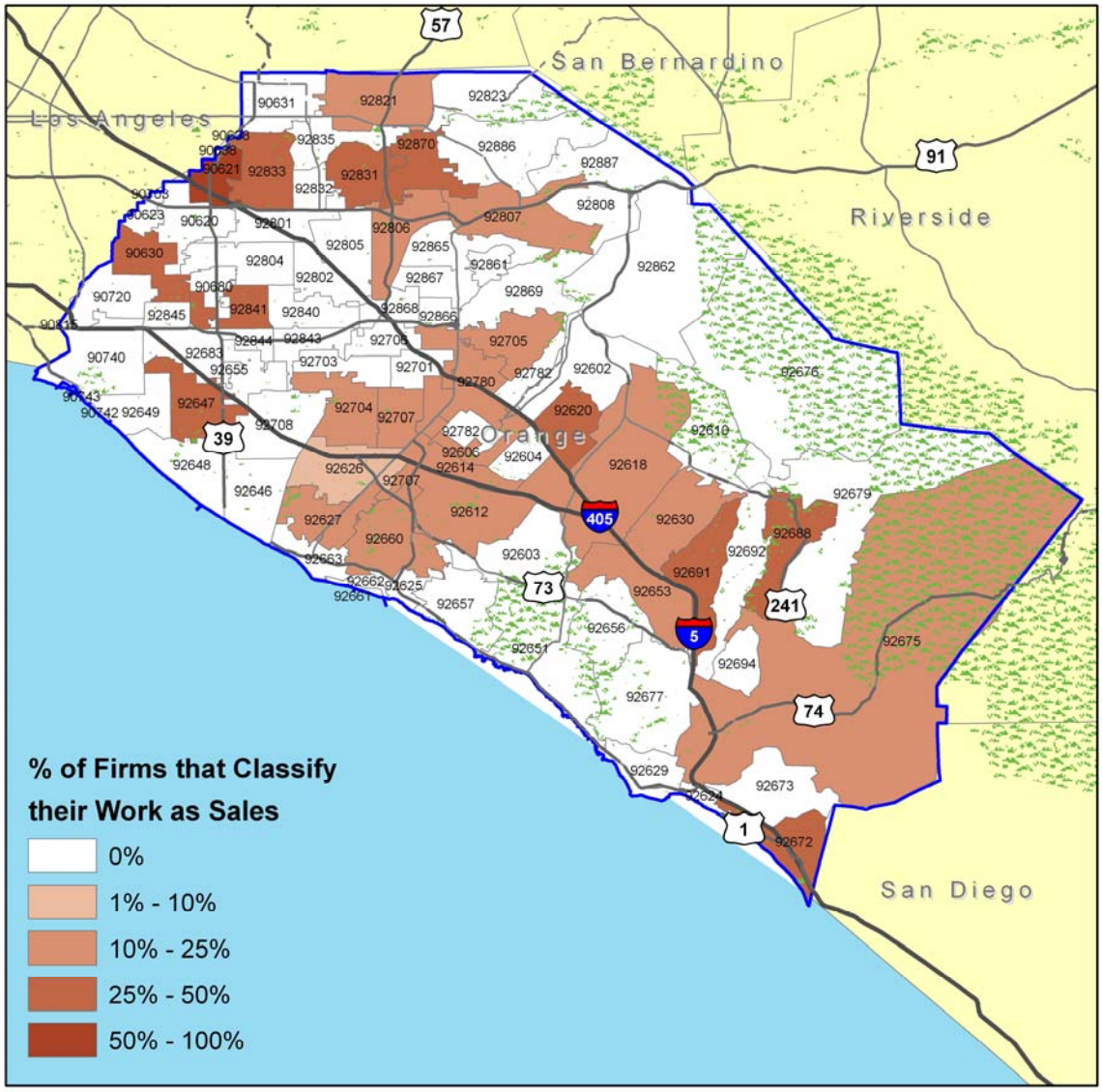


Figure 10 below displays a geographic representation of the percentage of firms from the survey that classified the type of work performed at their business location as "Sales."

Figure 10 Type of Work Performed: Sales by Zip Code

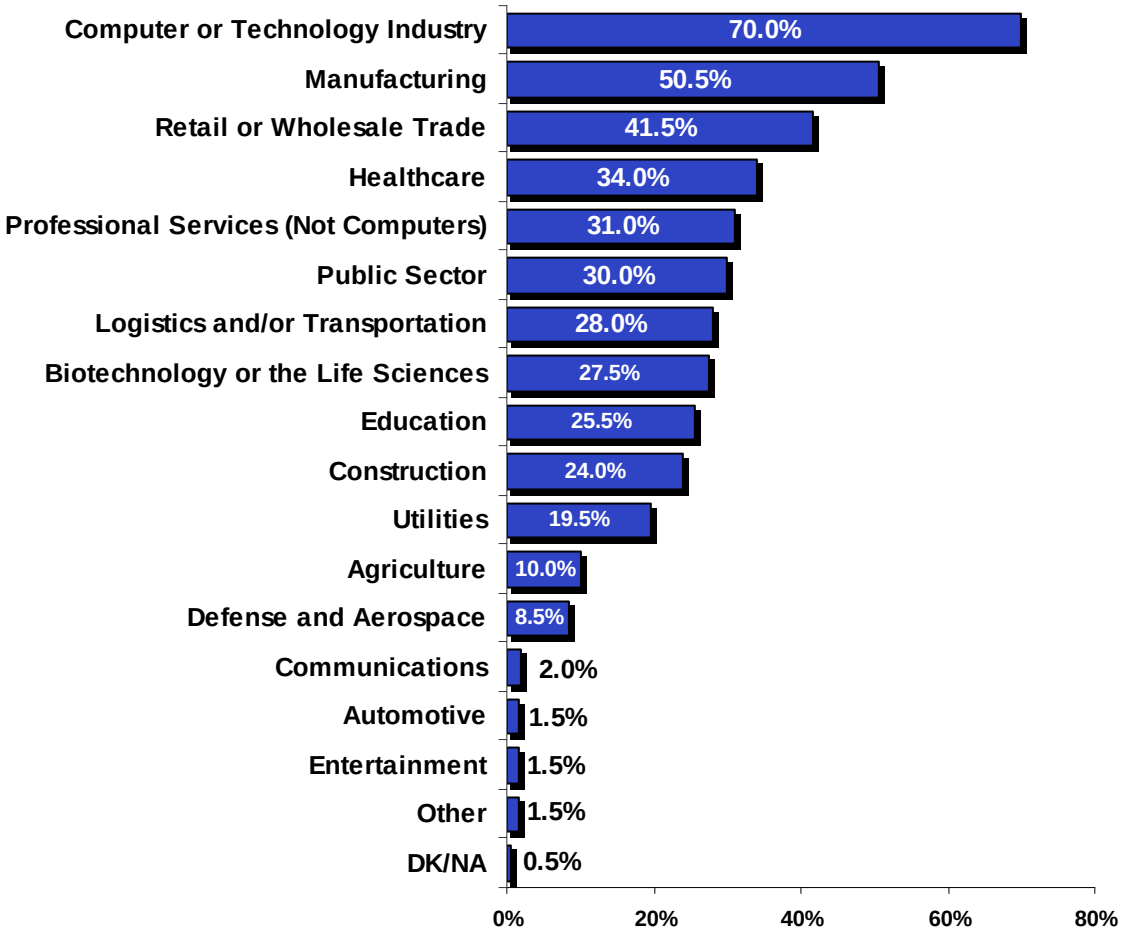


INDUSTRIES SERVED

When asked to indicate the industries that their firm provides goods or services for, employers cited industries throughout all sectors of the economy.

Seventy percent of employers indicated that they provide goods or services for the computer or technology industry, 50.5 percent serve the manufacturing industry and 41.5 percent provide goods or services for the retail or wholesale trade industry.

Figure 11 Industries Served[2]



Source: BW Research Computer Cluster Survey, October 2007.

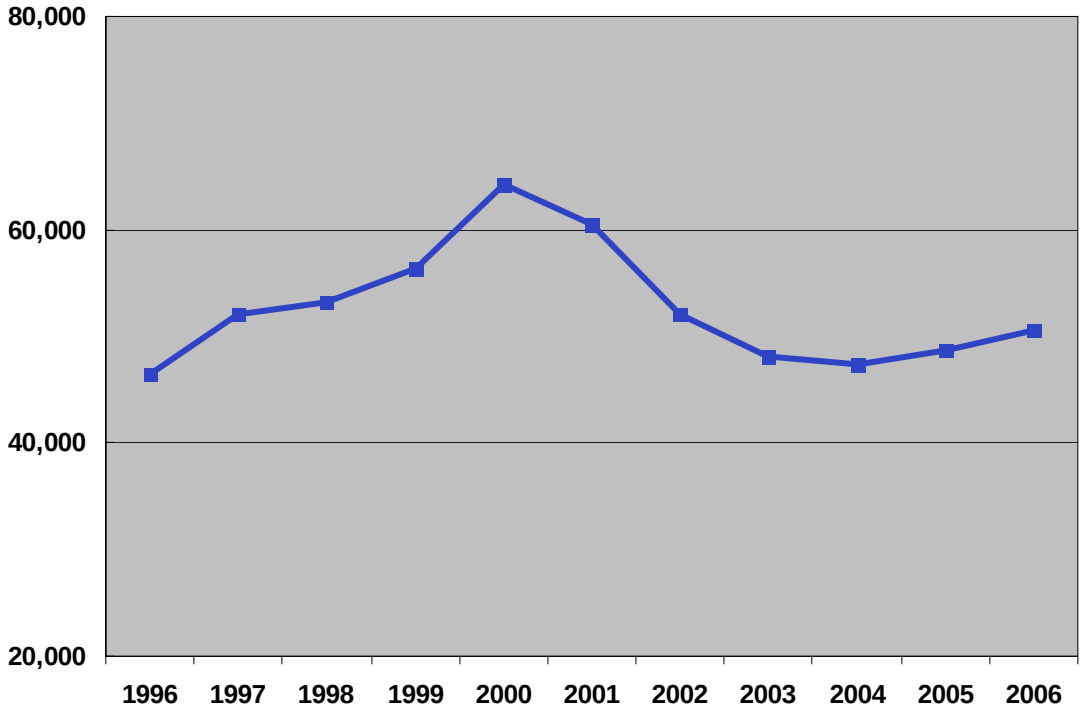
[2] Many employers indicated more than one industry for which their firm provided goods or services. As such, the percentages in Figure 11 will add to more than 100 percent.

HISTORICAL INDUSTRY GROWTH

The late 1990s showed a rise in computer cluster employment within the County. Employment peaked in 2000 at 64,310, declined to 47,431 in 2004, and increased to 50,470 in 2006.

Over the ten year period from 1996 to 2006, computer cluster employment within the County increased 8.6 percent, resulting in 4,005 new jobs.

Figure 12 Computer Cluster Employment in the County: 1996-2006



Source: California Economic Development Department (EDD), ES 202 Data.

The highest percentage of growth was in the software products and design services sector (35.8% growth; 5,258 new jobs), followed closely by the computer services sector (32.9.5% growth; 2,257 new jobs). The computer and computer parts manufacturing sector experienced a 14.1 percent decline (a loss of 3,510 jobs).

Individual NAICS codes with the highest percentage of growth were:

- NAICS 5161: Internet publishing and broadcasting: 936.8% growth, 534 jobs
- NAICS 5181: Internet service providers and web search portals: 248.4% growth, 1,555 jobs
- NAICS 54171: Research and development in the physical, engineering, and life sciences: 62.5% growth, 1,303 jobs
- NAICS 5415: Computer systems design and related services: 46.5% growth, 5,358 jobs (the most jobs gained within a given sub-sector).

Comparatively, NAICS 3346: Manufacturing and reproducing magnetic and optical media (software reproducing) experienced the highest percentage decline from 1996 to 2006 (-56.1% growth, -630 jobs). Whereas, NAICS 3344: Semiconductor and other electronic component manufacturing experienced the highest job loss over the ten year period (-1841 jobs, -10.9% growth).

Table 6 Change in Computer Cluster Employment: 1996-2006

	Average Employment		Employment Change	
	1996	2006	Numerical	Percent
Computer & Computer Parts Manufacturing	**24,902**	**21,392**	**-3,510**	**-14.1%**
NAICS 333295: Semiconductor Machinery Manufacturing	651	369	-282	-43.3%
NAICS 3341: Computer and Peripheral Equipment Mfg.	6,277	5,520	-757	-12.1%
NAICS 3344: Semiconductor and Other Electronic Component Manufacturing	16,852	15,011	-1,841	-10.9%
NAICS 3346: Manufacturing and Reproducing Magnetic and Optical Media (Software Reproducing)	1,122	492	-630	-56.1%
Computer Services	**6,863**	**9,120**	**2,257**	**32.9%**
NAICS 5161: Internet Publishing and Broadcasting	57	591	534	936.8%
NAICS 5181: Internet Srvs. Providers/Web Search Portals	626	2,181	1,555	248.4%
NAICS 5182: Data Processing, Hosting, & Related Services	3,460	2,679	-781	-22.6%
NAICS 54171: Research and Development in the Physical, Engineering, and Life Sciences	2,084	3,387	1,303	62.5%
NAICS 611420: Computer Training	636	282	-354	-55.7%
Software Products & Design Services	**14,700**	**19,958**	**5,258**	**35.8%**
NAICS 5112: Software Publishers	3,173	3,073	-100	-3.2%
NAICS 5415: Computer Systems Design & Related Services	11,527	16,885	5,358	46.5%
Orange County Computer Cluster Total	**46,465**	**50,470**	**4,005**	**8.6%**

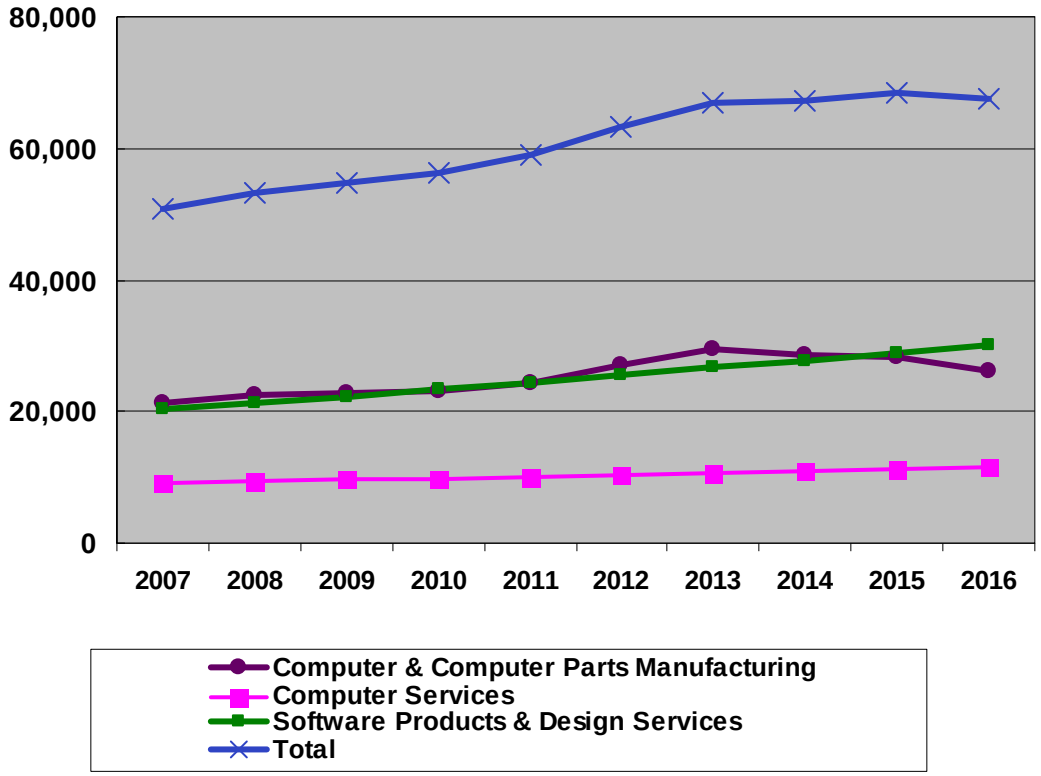
Source: California Economic Development Department (EDD), ES 202 Data.

INDUSTRY GROWTH EXPECTATIONS

GROWTH THROUGH 2016

Within the County, growth in the computer cluster as a whole is expected to increase 33.0 percent from 2006 to 2016, resulting in 16,790 new jobs. Among the three sectors within the computer cluster, software products and design services is projected to increase by the highest percentage as well as result in the most new jobs (33.0% growth, 9,502 new jobs). Computer services is projected to increase by 25.3 percent growth, resulting in 2,325 new jobs and computer and computer parts manufacturing is forecasted to increase by 23.4 percent, resulting in 4,963 new jobs from 2007 to 2016.

Figure 13 Orange County Projected Computer Cluster Growth: 2006-2016



Source: Estimated by BW Research using 2006 EDD data and Moody's Economy.com projections.

Table 7 Projected Computer Cluster Employment Growth: 2006-2016

	Annual Average Employment		Employment Change	
	2007	2016	Numerical	Percent
Computer & Computer Parts Manufacturing	21,182	26,146	4,963	23.4%
Computer Services	9,185	11,510	2,325	25.3%
Software Products & Design Services	20,516	30,018	9,502	46.3%
Orange County Computer Cluster Total	**50,884**	**67,674**	**16,790**	**33.0%**

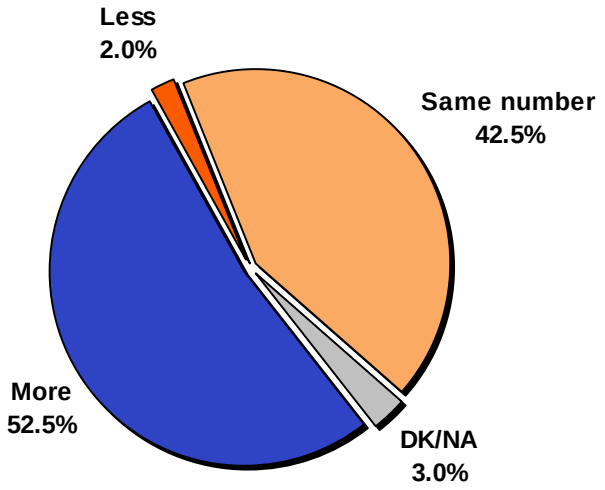
Source: Estimated by BW Research using 2006 EDD data and Moody's Economy.com projections.

EXPECTATIONS FOR THE NEXT 12 MONTHS

Results of the employer survey reveal short-term growth expectations within the computer cluster. It should be noted that growth expectations reported by employers only represent growth among current firms and do not account for growth from relocations or new firms being established.

The majority of employers, 52.5 percent, expect to increase the number of permanent employees at their business location, 42.5 percent expect to stay the same, and two percent expect to have less permanent employees at their location 12 months from now.

Figure 14 Employer Growth Expectations; Next 12 Months



Source: BW Research Computer Cluster Survey, October 2007.

Overall, computer cluster employers expect to increase their workforce by 7.6 percent over the next 12 months. Applying the percentage to the forecasted 2007 computer cluster employment level yields 3,879 new jobs over the next 12 months.

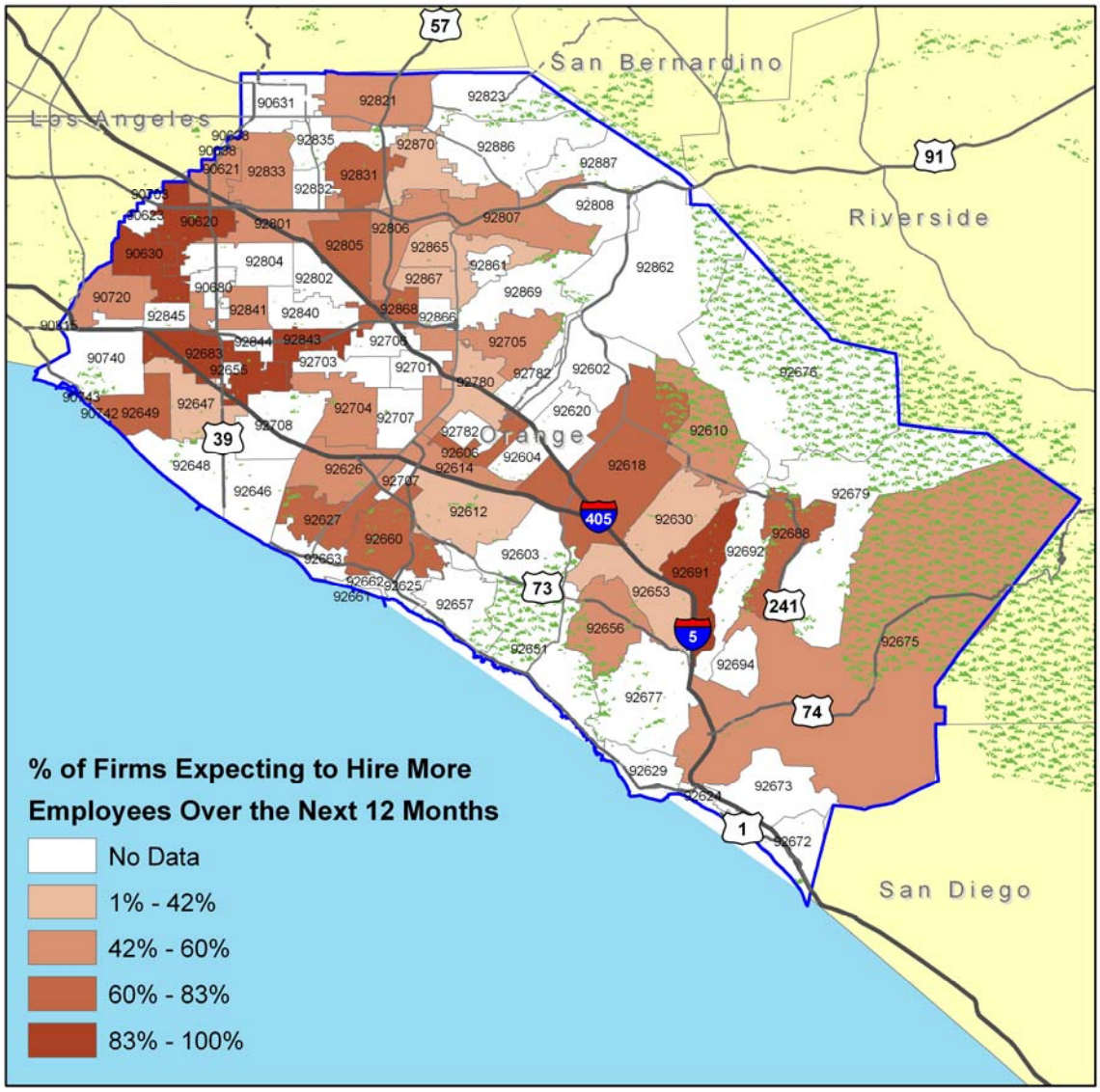
Table 8 Employer Growth Expectations; Next 12 Months

	2007 Estimated Employment	Expected Growth Next 12 Months	
		%	#
Orange County Computer Cluster	**50,884**	**7.6%**	**3,879**

Source: BW Research Computer Cluster Survey, October 2007.

Figure 15 shows the percentage of employers surveyed that expect to hire more permanent computer cluster employees over the next 12 months by zip code.

Figure 15 Employer Growth Expectations; Next 12 Months by Zip Code



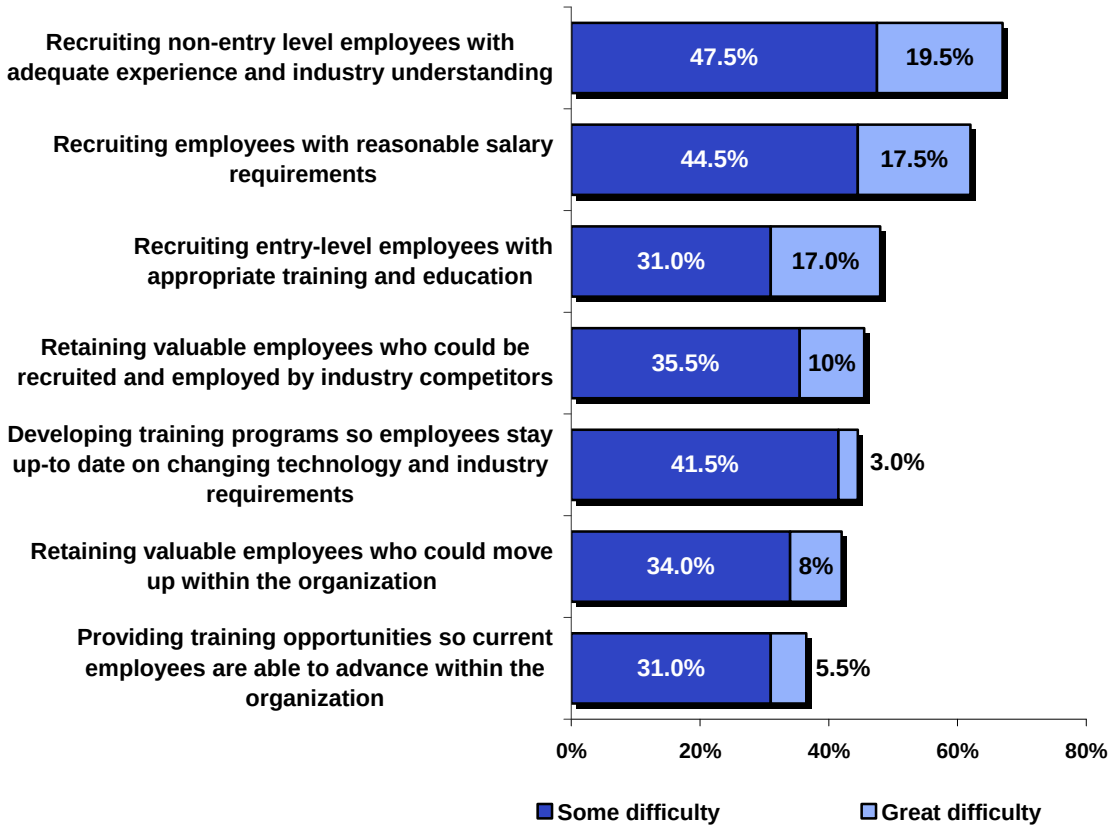
WORKFORCE ISSUES AND CHALLENGES

Figure 16 reveals the difficulty computer cluster employers indicated towards general workforce issues. Specifically, results of the survey show that recruiting employees, more so than retaining or training employees is the top challenge for computer cluster employers.

Specifically:

- Two out of three Orange County computer cluster employers (67.0%) have difficulty "Recruiting non-entry level employees with adequate experience and understanding of the industry" and
- Sixty-two percent of employers indicated difficulty "Recruiting employees with reasonable salary requirements."

Figure 16 Workforce Challenges for Computer Cluster Employers

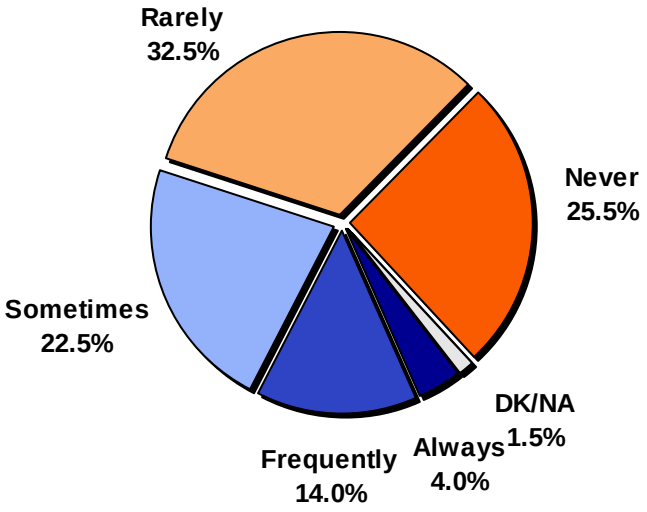


Source: BW Research Computer Cluster Survey, October 2007.

Eighteen percent of employers indicated that they "Always" or "Frequently" recruit individuals from outside Orange County (i.e., at least 50% of the time) and an additional 22.5 percent "Sometimes" (25% to 49% of the time) recruit from outside the County.

> Forty-one percent of employers recruit individuals from outside the County at least 25 percent of the time.

Figure 17 Frequency of Recruiting from Outside the County

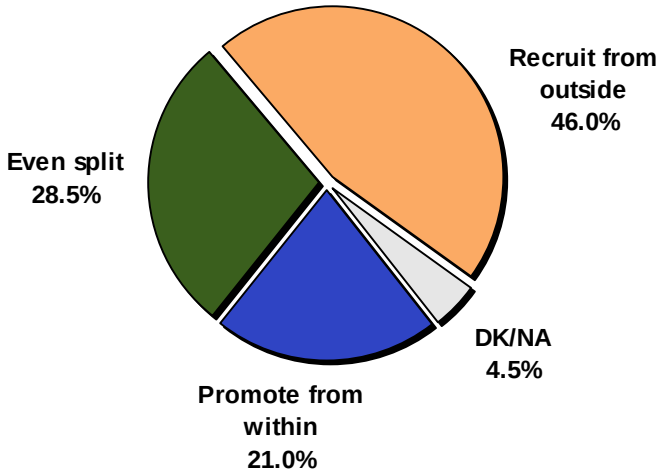


Source: BW Research Computer Cluster Survey, October 2007.

Additionally, when hiring for non-entry level positions, 46.0 percent of employers typically recruit from outside their organization, 21.0 percent promote from within, and 28.5 percent revealed an even split between the two.

> Overall, more employers recruited from outside to fill their non-entry level positions than promoted from within their organization.

Figure 18 Hiring Practices for Non-Entry Positions

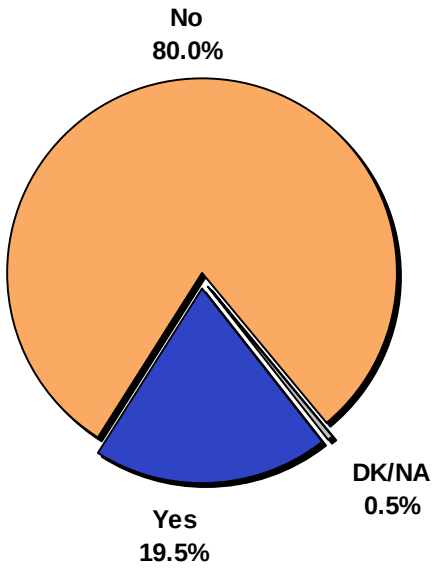


Source: BW Research Computer Cluster Survey, October 2007.

WORKING RELATIONSHIPS OUTSIDE THE UNITED STATES

Nearly one in five employers surveyed indicated that they have an office location outside the United States.

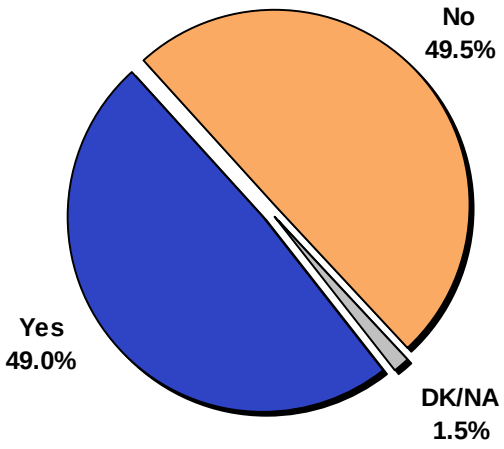
Figure 19 Office Location Outside the United States



Source: BW Research Computer Cluster Survey, October 2007.

Almost one out of every two computer cluster employers has a working relationship with a vendor or consultant outside of the United States.

Figure 20 Working Relationship with Vendors/ Consultants Outside the United States



Source: BW Research Computer Cluster Survey, October 2007.

WORKFORCE OPPORTUNITIES

INTEREST IN POTENTIAL TRAINING AND EDUCATION PROGRAMS

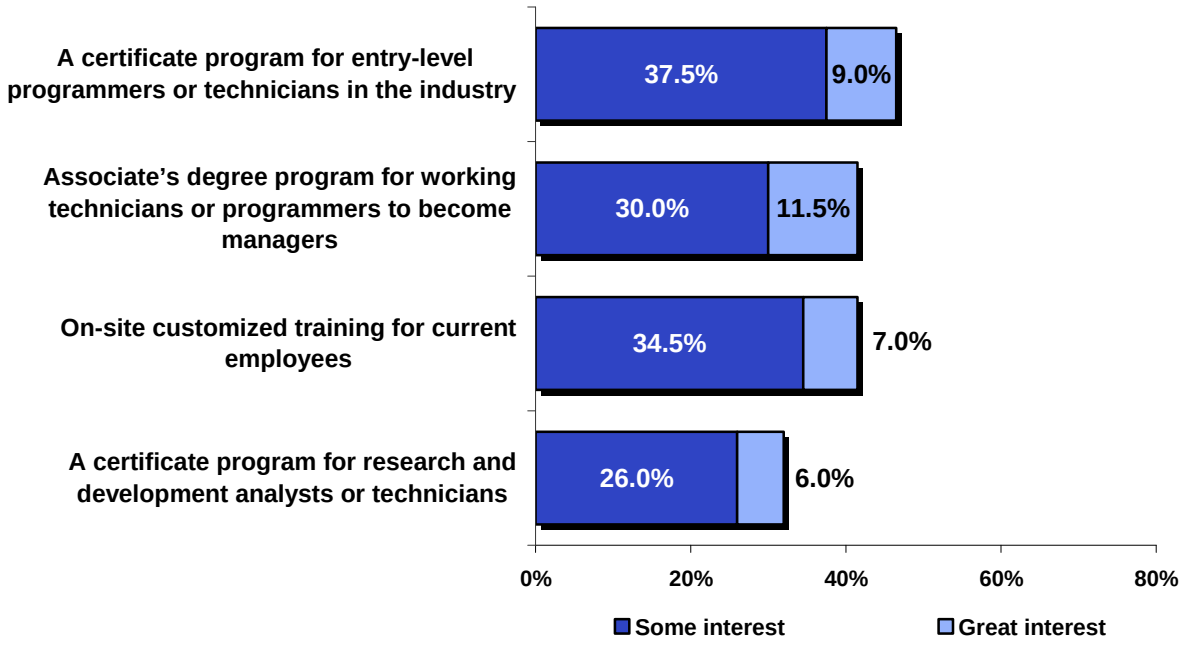
Employers expressed the most overall interest in working with the regional Workforce Investment Board and/ or community colleges to develop a certificate program for entry-level programmers or technicians in the industry (46.5% interest).

Forty-two percent of computer cluster employers also expressed interest in an associate's degree program created to working technicians or programmers to become managers (41.5%) and on-site customized training for current employees (41.5%).

Comparatively, employers were least interested in a certificate program for research and development analysts or technicians, with overall interest at 32.0 percent.

> Forty-seven percent of employers expressed interest in a certificate program for entry-level programmers or technicians.

Figure 21 Employer Interest in Potential Training and Education Programs



Source: BW Research Computer Cluster Survey, October 2007.

OCCUPATIONAL ASSESSMENT

The primary research component of this study focused on eleven computer cluster occupations. To be selected for inclusion, the occupations had to meet at least one of the following criteria: large employment in the region, above average growth, or be an occupation easily served by the Workforce Investment Board's education and training programs.

The occupations chosen as the focus of the primary research were:

- Assemblers and/or electrical and electronic assemblers;
- Computer programmers;
- Computer software engineers;
- Computer support specialists;
- Customer service representatives;
- Database administrators;
- Electrical and electronic engineering technicians;
- Inspectors, testers and graders;
- Research and development technicians;
- Sales managers;
- Sales representatives.

Table 9 shows the percentage of firms employing individuals within each occupational title. The majority of firms surveyed employ customer service representatives (70.5% of firms), sales managers (67.0%), customer support specialists (63.5%), and sales representatives (62.5%).

Table 9 Percentage of Firms Employing Each Occupation

	% of Firms Employing Each Occupation
Customer Service Representatives	**70.5%**
Sales Managers	**67.0%**
Computer Support Specialists	**63.5%**
Sales Representatives	**62.5%**
Database Administrators	46.5%
Computer Programmers	42.0%
Computer Software Engineers	39.0%
Electrical & Electronic Engineering Technicians	36.0%
Inspectors, Testers and Graders	35.0%
Assemblers and/or Electrical & Electronic Assemblers	29.0%
Research & Development Technicians	26.0%

Source: BW Research Computer Cluster Survey, October 2007.

OCCUPATIONAL OUTLOOK

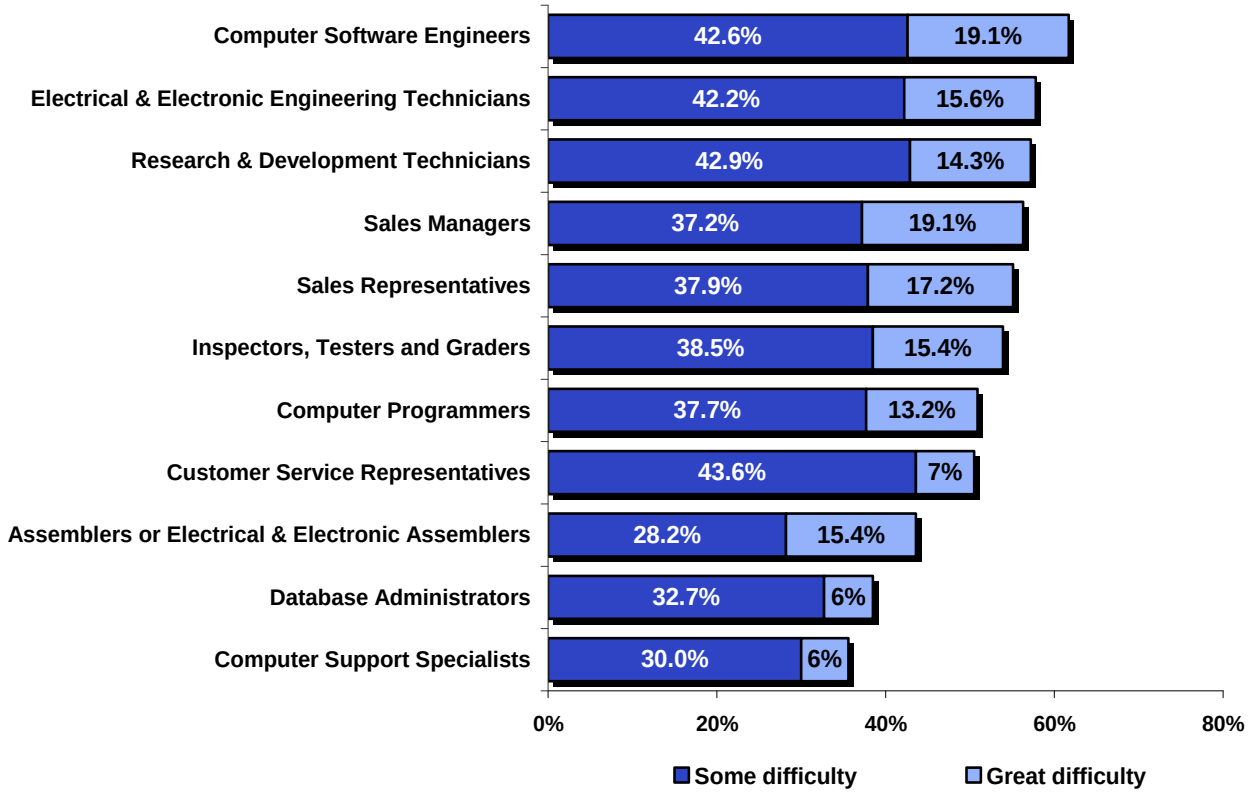
Difficulty Hiring

The majority of employers indicated difficulty finding qualified applicants for all but three of the occupations. Approximately 62 percent of employers expressed difficulty finding qualified computer software engineers, the highest in the survey.

Employers indicated comparable levels of total difficulty for electrical and electronic engineering technicians (57.8%) and research and development technicians (57.2%), followed closely by sales managers (56.3%), sales representatives (55.1%), and inspectors, testers, and graders (53.9%).

> Employers indicated the most difficulty finding qualified computer software engineers.

Figure 22 Difficulty Finding Applicants who Meet Hiring Standards



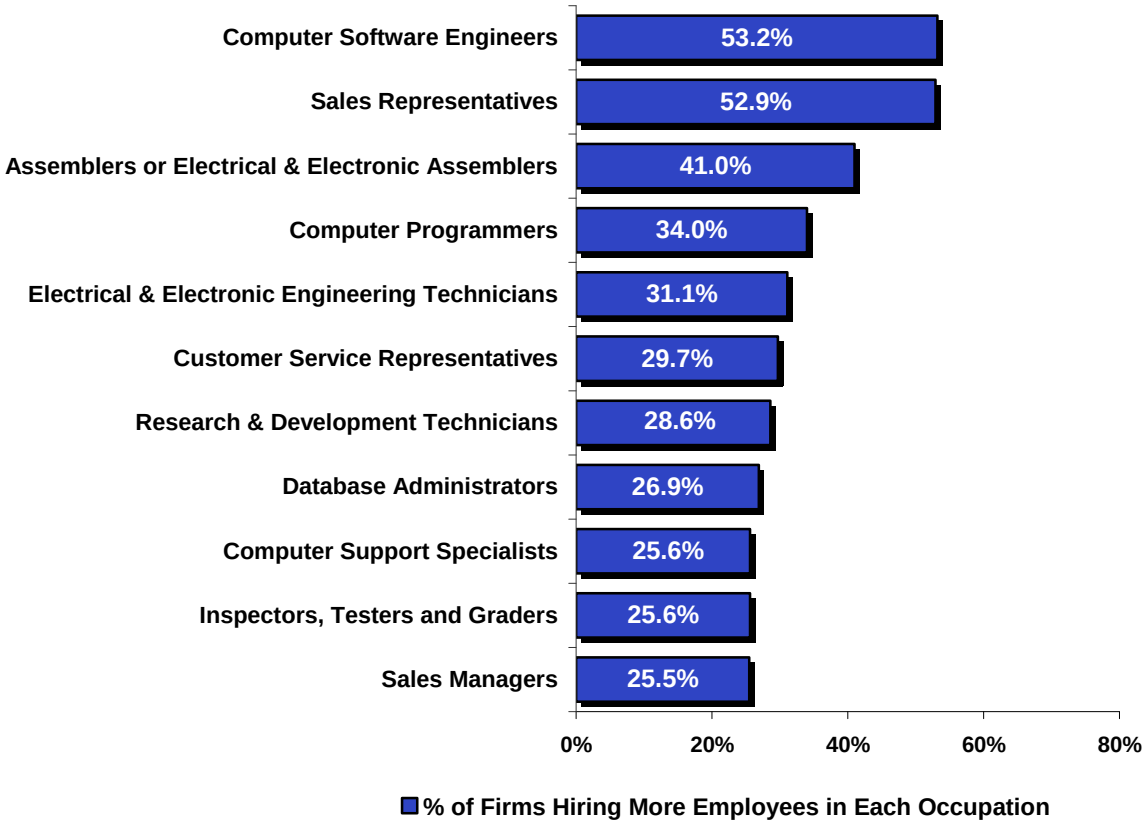
Source: BW Research Computer Cluster Survey, October 2007.

Estimated Growth over the Next 12 Months

Among the firms employing each occupation, at least one in four expect to increase the number of workers in each position over the next 12 months, with over 50 percent expecting to hire more computer software engineers (53.2%) and sales representatives (52.9%).

> At least one in four firms with employees in each occupational title expect to hire more over the next 12 months.

Figure 23 Firms Hiring More Employees in Each Occupation in the Next 12 Months

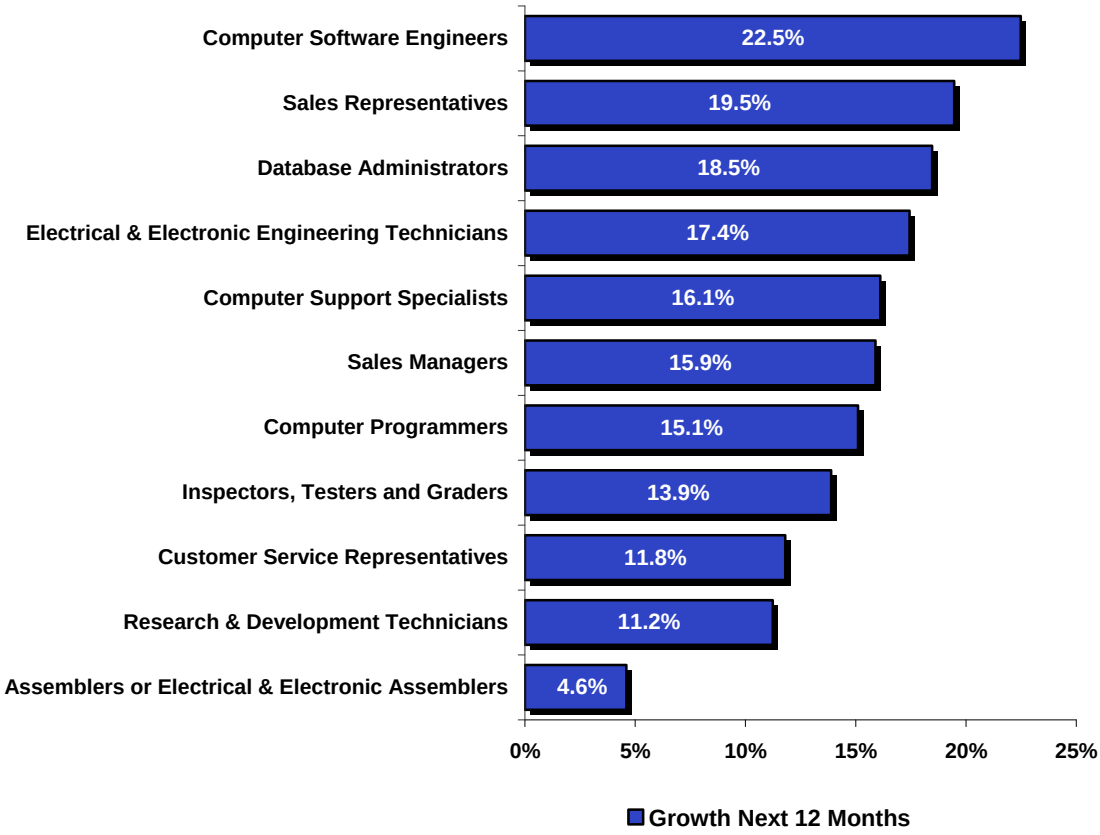


Source: BW Research Computer Cluster Survey, October 2007.

Figure 24 shows growth over the next 12 months for each of the occupations as estimated by the computer cluster employers surveyed. Employers anticipated double-digit growth for all but one of the eleven occupations, with the highest growth percentages expected for computer software engineers (22.5% growth), sales representatives (19.5% growth), and database administrators (18.5% growth).

> Employers anticipate double-digit growth for ten of the eleven occupations examined in this study.

Figure 24 Estimated Growth Needs by Occupation: Next 12 Months[3]



Source: BW Research Computer Cluster Survey, October 2007.

[3] Growth as estimated by the employers surveyed.

The table below shows estimated current employment by occupation within the computer cluster, the number of expected openings from growth (based on employers' growth expectations from the survey), and the median annual wage for each occupation within the computer cluster in Orange County.

Among the occupations examined in this study, computer software engineers have the highest employment (13,870) and the second highest median wage ($86,365). Sales managers have the highest median wage at $118,403 per year.

> The computer cluster in Orange County employs approximately 13,870 computer software engineers.

Table 10 Estimated New Jobs and Median Annual Wages by Occupation[4]

	Estimated 2006 Computer Cluster Employment	Growth Next 12 Months	Openings from Growth	Median Annual Wage
Computer Software Engineers	13,870	22.5%	3,118	$86,365
Computer Support Specialists	3,880	16.1%	625	$47,121
Assemblers or Electrical & Electronic Assemblers	3,790	4.6%	174	$21,033
Computer Programmers	3,140	15.1%	474	$72,454
Inspectors, Testers and Graders	2,150	13.9%	299	$25,769
Sales Representatives	1,820	19.5%	354	$67,173
Customer Service Representatives	1,690	11.8%	199	$35,709
Sales Managers	1,110	15.9%	176	$118,403
Electrical & Electronic Engineering Technicians	820	17.4%	143	$45,036
Database Administrators	650	18.5%	120	$82,150
Research & Development Technicians	645	11.2%	72	$43,124

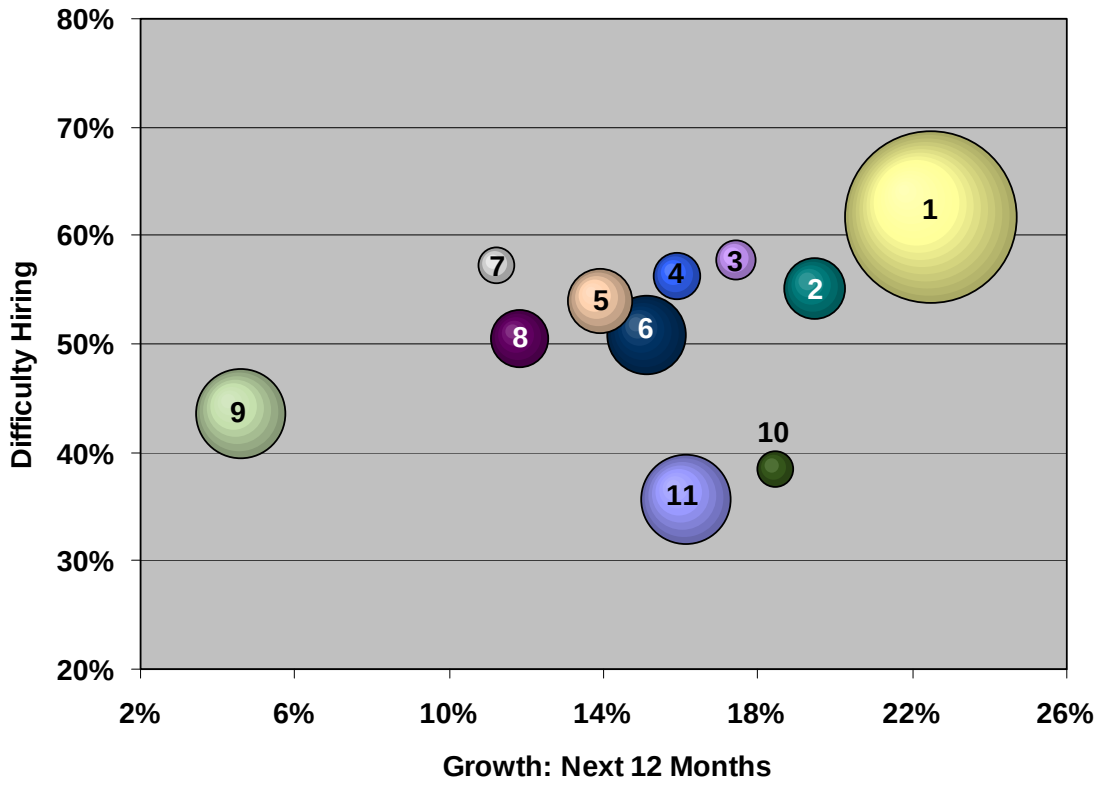
Source: CA EDD Crosswalk File (NAICS to SOC) and BW Research Computer Cluster Survey, October 2007.

[4] Research and development technicians are not currently captured by the SOC system. As such, employment for this occupation was estimated from the survey data instead of the EDD data. The wage information presented uses the closest SOC code for which wage data was available "Life, Physical, and Social Science Technicians, All Other."

Figure 25 visually displays the number of employees in each occupation (the size of each bubble) by difficulty hiring and expected growth over the next 12 months. The occupational titles corresponding to the numbers in the figure are displayed in Table 11.

Computer software engineers, sales representatives, electrical and electronic engineering technicians, and sales managers (1 through 4 in the figure below) emerge as the occupations with the most potential to be undersupplied in the future.

Figure 25 Occupational Employment, Difficulty Hiring, and Expected Growth



Source: CA EDD Crosswalk File (NAICS to SOC) and BW Research Computer Cluster Survey, October 2007.2

Table 11 Key for Figure 25

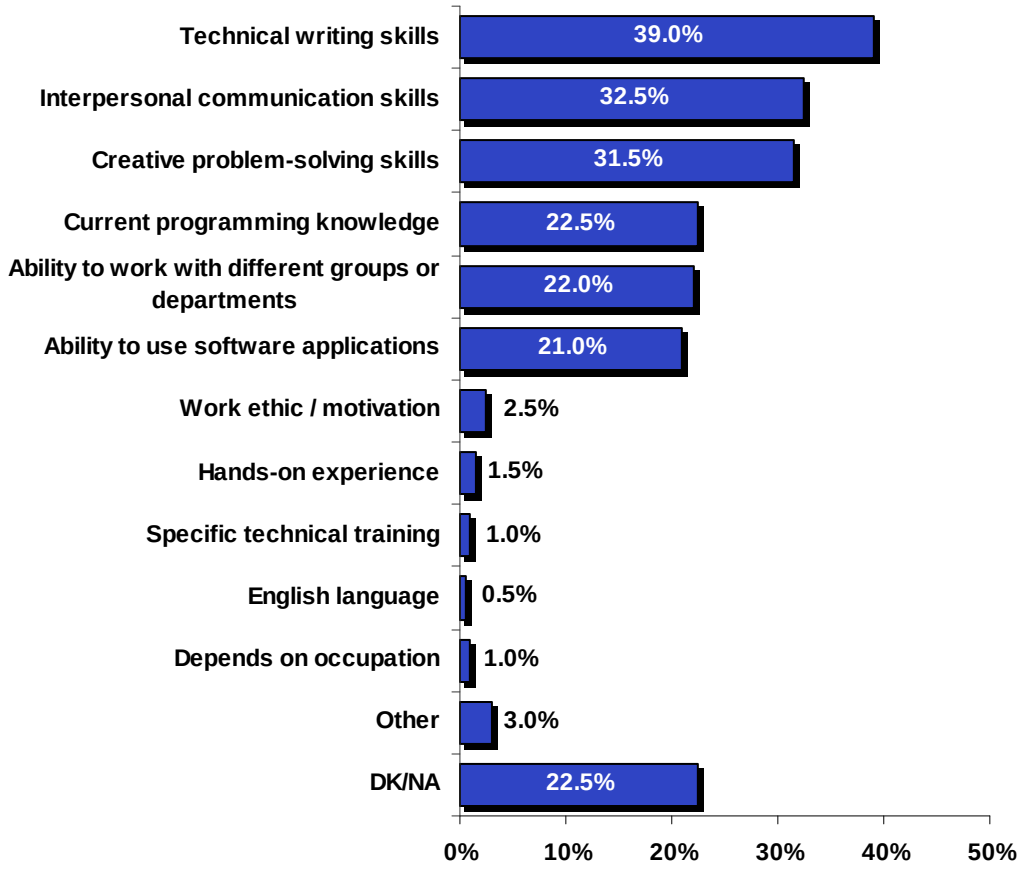
Occupation	Key
Computer Software Engineers	1
Sales Representatives	2
Electrical & Electronic Engineering Technicians	3
Sales Managers	4
Inspectors, Testers and Graders	5
Computer Programmers	6
Research & Development Technicians	7
Customer Service Representatives	8
Assemblers or Electrical & Electronic Assemblers	9
Database Administrators	10
Computer Support Specialists	11

OCCUPATIONAL SKILLS AND EDUCATION REQUIREMENTS

Skill Deficiencies

When asked to reflect on recent hires at their organization, employers indicated that new hires tend to be most deficient in technical writing skills (39.0%), interpersonal communication skills (32.5%), and creative problem-solving skills (31.5%).

Figure 26 General Skill Deficiencies Among Recent Hires



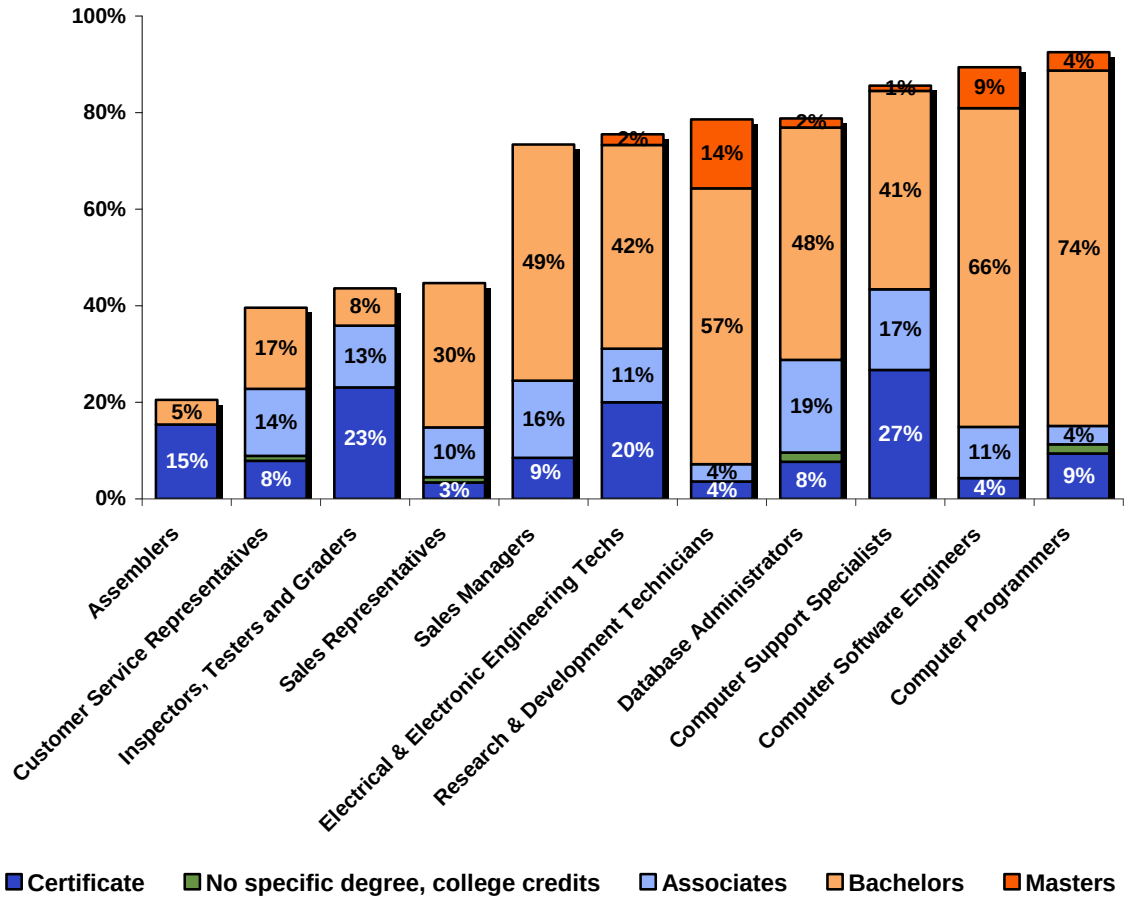
Source: BW Research Computer Cluster Survey, October 2007.

Typical Education Requirements

Within the survey, employers were asked to detail the typical education requirements for successful applicants within each occupation. In the figure below, shades of blue were used to display education at the community college level and shades of orange to show a bachelor's or master's degree. The figure shows that only 20.5 percent of employers expect education beyond a high school diploma for assemblers and electrical and electronic assemblers, whereas 92.5 percent of employers expect at least some college for computer programmers.

Over 70 percent of employers indicated that a bachelor's or master's degree was expected for computer programmers (77.4%), computer software engineers (74.5%), and research and development technicians (71.4%).

Figure 27 Typical Education Requirements: At Least Some College by Occupation



Source: BW Research Computer Cluster Survey, October 2007.

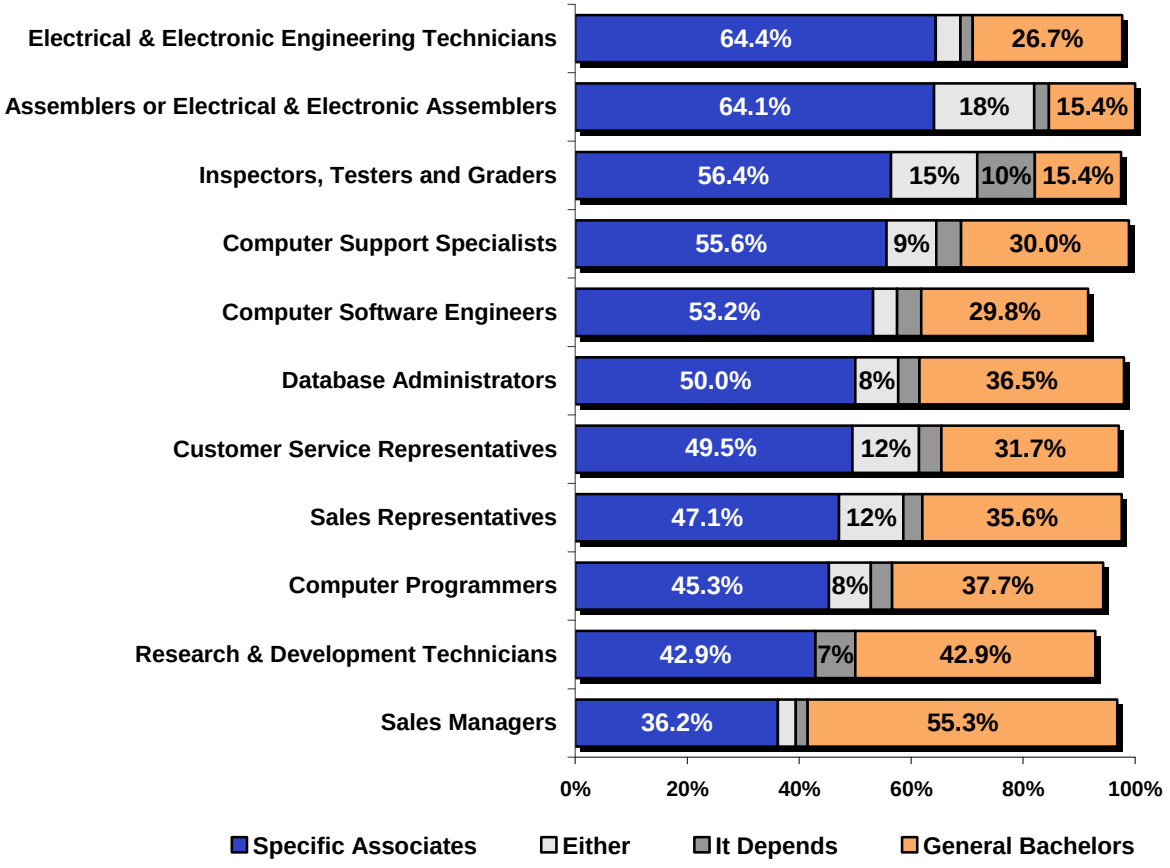
Educational Preferences

Computer cluster employers indicated a preference for an associate's degree specific to the position over a general bachelor's degree for nine of the eleven occupations and were undecided on one other (research and development technicians). Sales manager was the only occupation where a general bachelor's degree was preferred.

The preference for a specific associate's degree was most pronounced for:

- Electrical and electronic engineering technicians (64.4% vs. 26.7%);
- Assemblers or electrical & electronic assemblers (64.1% vs. 15.4%);
- Inspectors, testers and graders (56.4% vs. 15.4%);
- Computer support specialists (55.6% vs. 30.0%);
- Computer software engineers (53.2% vs. 29.8%).

Figure 28 Preferences for Specific Associates or General Bachelors



Source: BW Research Computer Cluster Survey, October 2007.

OCCUPATIONAL SUMMARY

This section of the report synthesizes all the secondary research and employer survey data separately for each of the eleven occupations of interest for the study.

Although there is no single equation that can be applied to identify the probability that an occupation will be undersupplied in the future, a combination of the data sources evaluated in this project[5] allows for an estimate of those occupations that have the highest potential to be undersupplied in the future.

Table 12 Occupational Assessment

RED OCCUPATIONS **Occupations that provide the strongest indication that they will be under-supplied in the future**
Computer Software Engineers
Sales Representatives
Electrical & Electronic Engineering Technicians
Sales Managers
YELLOW OCCUPATIONS **Occupations that provide some indication that they will be under-supplied in the future**
Inspectors, Testers and Graders
Computer Programmers
Research & Development Technicians
Customer Service Representatives
Assemblers or Electrical & Electronic Assemblers
Database Administrators
Computer Support Specialists
GREEN OCCUPATIONS **Occupations that provide little to no indication that they will be under-supplied in the future**
Each of the eleven occupations can be classified as either red or yellow.

Information for each occupation in the sections to follow represents a compilation of information from regional and statewide occupational outlook guides, EDD data, and BW Research's Computer Cluster Survey.

[5] A combination of quantitative and qualitative factors from secondary data sources as well as the employer data from both the executive interviews and quantitative survey.

Assemblers and/or Electrical & Electronic Assemblers

Occupational Description

The work of assemblers and/or electrical and electronic assemblers involves assembling or modifying electrical, electronic, or electromechanical equipment or devices as well as performing precision assembling or adjusting.

This is an entry-level position that typically requires short-term on-the-job training (30 days or less). Some employers may also prefer related job experience (al least 6 months) when hiring for this occupation.

Secondary Occupation Title(s)

Technician, Prototype Assembler, Quality Assurance Assembler, and Tester, Electromechanical Technician, Drafter, Cartographer, Photogrammetrist, and Surveying Technician.

Important Skill Sets

- Possession of good hand-eye coordination and good color perception
- Ability to read blueprints and technical drawings
- Possession of soldering skills
- Knowledge of machines and tools, including their designs, uses, repair, and maintenance
- Ability to inspect, test, and adjust completed units to ensure that units meet specifications, tolerances, and customer order requirements
- Ability to assemble parts or units, and position, align, and fasten units to assemblies, subassemblies, or frames, using hand tools and power tools.

Occupations that Lead to this Position

Apprentice, assistant, or helper.

Occupational Opportunities that Come from this Position

Lab technician or senior lab technician.

Across Industries in Orange County

- From 2004 to 2014, the number of assemblers and/or electrical and electronic assemblers in the County is expected to grow by 4.0 percent, which is below the County average of 18.0 percent across occupations. 220 job openings are expected countywide between 2004 and 2014 (22 annually) from growth.
- The median annual wage for assemblers and/or electrical and electronic assemblers across industries in the County is $25,356.

Within the Computer Cluster in Orange County

- There are approximately 3,790 assemblers and/or electrical and electronic assemblers employed within the computer cluster in Orange County.
- Employers expect the number of assemblers and/or electrical and electronic assemblers to grow by 4.6 percent over the next 12 months, resulting in approximately 174 new jobs.
- Forty-four percent of employers indicated at least some difficulty finding qualified applicants.
- Eleven percent of computer cluster employers surveyed do not have any formal education requirements for assemblers and/or electrical and electronic assemblers and 69.2 percent require graduation from high school. Overall, 20.5 percent of employers expect at least some college for this position (the lowest in the survey).
- When given the option, employers overwhelmingly prefer an applicant with an associate's degree specific to the position (64.1%) over a general bachelor's degree (15.4%).
- The wages for computer cluster assemblers and/or electrical and electronic assemblers in Orange County are:
    - Entry-level (25th percentile wage): $17,973 a year;
    - Median (50th percentile wage): $21,033 a year;
    - Experienced (75th percentile wage): $25,446 a year.

Computer Programmers

Occupational Description

The work of computer programmers involves: converting project specifications and procedures into detailed logical flow charts for coding into computer language and developing and writing computer programs to store, locate, and retrieve specific documents, data, and information.

This is a mid-level position that typically requires a bachelor's degree and/or two to four years work experience in the occupation or related field.

Secondary Occupation Title(s)

Network engineer, web designer, or software engineer.

Important Skill Sets

- Ability to think logically
- Ability to test and troubleshoot computer programs and systems
- Ability to write computer software.

Occupations that Lead to this Position

Junior network engineer, junior programmer, or software engineer 1 or 2.

Occupational Opportunities that Come from this Position

Project manager.

Across Industries in Orange County

- From 2004 to 2014, the number of computer programmers in the County is expected to grow by 1.0 percent, which is below the County average of 18.0 percent across occupations.
- 40 job openings are expected countywide between 2004 and 2014 (4 annually) from growth.
- Based on employer expectations within the computer cluster (detailed in the next section), EDD growth estimates likely represent a conservative estimate of growth across industries for this occupation.
- The median annual wage for computer programmers across industries in the County is $71,656.

Within the Computer Cluster in Orange County

- There are approximately 3,140 computer programmers employed within the computer cluster in Orange County.
- Employers expect the number of computer programmers to grow by 15.1 percent over the next 12 months, resulting in approximately 474 new jobs.
- Fifty-one percent of employers indicated at least some difficulty finding qualified applicants.
- Computer cluster employers typically require a bachelor's degree (73.6% - the highest from the survey) or a certificate or associate's degree from a community college (13.2%). Overall, 92.5 percent of employers expect at least some college for computer programmers (the highest from the survey).
- When given the option, employers prefer an applicant with an associate's degree specific to the position (45.3%) over a general bachelor's degree (37.7%).
- The wages for computer programmers in the computer cluster within Orange County are:
    - Entry-level (25th percentile wage): $52,141 a year;
    - Median (50th percentile wage): $72,454 a year;
    - Experienced (75th percentile wage): $90,157 a year.

Computer Software Engineers

Occupational Description

Computer software engineers are typically classified as either systems software or application engineers.

The work of computer software engineers, with a systems software focus typically involves converting project specifications and statements of problems and procedures to detailed logical flow charts for coding into computer language and developing and writing computer programs to store, locate, and retrieve specific documents, data, and information.

The work of computer software engineers, with an application focus typically involves developing, creating, and modifying general computer applications software and analyzing user needs and developing software solutions.

This is a mid to senior-level position that typically requires a bachelor's degree and/or two to four years work experience in the occupation or related field.

Computer software engineers are classified as an in-demand occupation by O*Net.

Secondary Occupation Title(s)

Developer, application integration engineer, computer consultant, software architect, software developer, or programmer.

Important Skill Sets

- Ability to devote attention to detail
- Knowledge of a variety of software systems
- Ability to use object oriented programming
- Ability to solve technical problems
- Ability to analyze users' needs and design, construct, test, and maintain computer applications software or systems
- Ability to coordinate the construction and maintenance of a company's computer systems and plan their future growth.

Occupations that Lead to this Position

Data operator, programmer, junior designer, or technical support technician.

Occupational Opportunities that Come from this Position

Development manager, lead designer, or production manager.

Across Industries in Orange County

- From 2004 to 2014, the number of computer software engineers in the County is expected to grow by 40.6 percent, which is more than double the County average of 18.0 percent across occupations.
- 6,320 job openings are expected countywide between 2004 and 2014 (632 annually) from growth.
- The median annual wage for computer software engineers across industries in the County is $74,811.

Within the Computer Cluster in Orange County

- There are approximately 13,870 computer software engineers employed within the computer cluster in Orange County.
- Employers expect the number of computer software engineers to grow by 22.5 percent over the next 12 months, resulting in approximately 3,118 new jobs.
- Sixty-two percent of employers indicated at least some difficulty finding qualified applicants – the highest in the survey.
- Computer cluster employers typically require at least a bachelor's degree (bachelor's: 66.0%, master's: 8.5% - both the second highest in the survey) or a certificate or associate's degree from a community college (14.9%). Overall, 89.4 percent of employers expect at least some college for computer software engineers (the second highest in the survey).
- When given the option, the majority of employers prefer an applicant with an associate's degree specific to the position (53.2%) over a general bachelor's degree (29.8%).
- The wages for computer software engineers in the computer cluster within Orange County are:
    - Entry-level (25th percentile wage): $64,079 a year;
    - Median (50th percentile wage): $86,365 a year;
    - Experienced (75th percentile wage): $108,998 a year.

Computer Support Specialists

Occupational Description

The work of computer support specialists is focused on providing technical assistance to computer system users and answering questions or resolving computer problems for clients in person, via telephone or from remote location. Computer support specialists may also provide assistance concerning the use of computer hardware and software.

This is an entry to mid-level position that typically requires an associate's degree and/ or 1-2 years work experience in the occupation.

Computer support specialists are classified as an in-demand occupation by O*Net.

Secondary Occupation Title(s)

Information technology specialist, electronic data processing auditor, help desk analyst, computer technician, desktop support technician, or office systems coordinator.

Important Skill Sets

- Possession of good problem solving skills
- Ability to apply interpersonal communication techniques
- Ability to test and troubleshoot computer programs and systems

Occupations that Lead to this Position

This is an entry-level position.

Occupational Opportunities that Come from this Position

Network administrator, information technology infrastructure manager, or information technology supervisor.

Across Industries in Orange County

- From 2004 to 2014, the number of computer support specialists in the County is expected to grow by 21.9 percent, which is above the County average of 18.0 percent across occupations.
- 1,440 job openings are expected countywide between 2004 and 2014 (144 annually) from growth.
- The median annual wage for computer support specialists across industries in the County is $44,845.

Within the Computer Cluster in Orange County

- There are approximately 3,880 computer support specialists employed within the computer cluster in Orange County.
- Employers expect the number of computer support specialists to grow by 16.1 percent over the next 12 months, resulting in approximately 625 new jobs.
- Thirty-six percent of employers indicated at least some difficulty finding qualified applicants.
- Computer cluster employers typically require either a certificate or associate's degree from a community college (43.4%) or a bachelor's degree (41.1%). Overall, 85.6 percent of employers expect at least some college for computer support specialists (the third highest in the survey).
- When given the option, the majority of employers prefer an applicant with an associate's degree specific to the position (55.6%) over a general bachelor's degree (30.0%).
- The wages for computer support specialists in the computer cluster within Orange County are:
    - Entry-level (25th percentile wage): $37,605 a year;
    - Median (50th percentile wage): $47,121 a year;
    - Experienced (75th percentile wage): $58,885 a year.

Customer Service Representatives

Occupational Description

The work of customer service representatives involves interacting with customers to provide information in response to inquiries about products and services as well as handling and resolving complaints.

This is an entry-level position that typically requires moderate term on-the-job training (1 to 12 months), with little to no prior experience expected.

Customer service representatives are classified as an in-demand occupation by O*Net.

Secondary Occupation Title(s)

Client services representative, customer service specialist, member services representative, account manager, hub associate, account service representative, call center representative, claims adjuster, or claims service representative.

Important Skill Sets

- Possession of strong verbal communication and listening skills
- Possession of basic to intermediate computer knowledge
- Possession of good problem-solving skills

Occupations that Lead to this Position

Help desk or customer service assistant, customer service trainee.

Occupational Opportunities that Come from this Position

Supervisor, manager, sales agent, or product development.

Across Industries in Orange County

- From 2004 to 2014, the number of customer service representatives in the County is expected to grow by 27.1 percent, which is above the County average of 18.0 percent across occupations.
- 7,120 job openings are expected countywide between 2004 and 2014 (712 annually) from growth.
- The median annual wage for customer service representatives across industries in the County is $31,325.

Within the Computer Cluster in Orange County

- There are approximately 1,690 customer service representatives employed within the computer cluster in Orange County.
- Employers expect the number of customer service representatives to grow by 11.8 percent over the next 12 months, resulting in approximately 199 new jobs.

- Fifty-one percent of employers indicated at least some difficulty finding qualified applicants.
- Ten percent of employers surveyed do not have any formal education requirements for customer service representatives and 49.5 percent require graduation from high school. Overall, 39.6 percent of employers expect at least some college for this position (the second lowest in the survey).
- When given the option, employers prefer an applicant with an associate's degree specific to the position (49.5%) over a general bachelor's degree (31.7%).
- The wages for computer cluster customer service representatives in the County are:
    - Entry-level (25th percentile wage): $29,507 a year;
    - Median (50th percentile wage): $35,709 a year;
    - Experienced (75th percentile wage): $43,986 a year.

Database Administrators

Occupational Description

The work of database administrators involves coordinating changes to computer databases and testing and implementing the database by applying knowledge of database management systems. Database administrators may also plan, coordinate, and implement security measures to safeguard computer databases.

This is a mid to senior-level position that typically requires a bachelor's degree and two to five years of work experience in the occupation.

Database administrators are classified as an in-demand occupation by O*Net.

Secondary Occupation Title(s)

Management information systems specialist, systems administrator, or systems manager.

Important Skill Sets

- Knowledge of computer hardware/software applications
- Possession of problem-solving and troubleshooting skills
- Ability to write technical reports.

Occupations that Lead to this Position

Computer or database specialist or analyst.

Occupational Opportunities that Come from this Position

Computer and information systems manager, information technology specialist, senior database administrator, programmer analyst, or database network analyst.

Across Industries in Orange County

- From 2004 to 2014, the number of database administrators in the County is expected to grow by 39.8 percent, which is more than double the County average of 18.0 percent across occupations.
- 410 job openings are expected countywide between 2004 and 2014 (41 annually) from growth.
- The median annual wage for database administrators across industries in the County is $71,531.

Within the Computer Cluster in Orange County

- There are approximately 650 database administrators employed within the computer cluster in Orange County.
- Employers expect the number of database administrators to grow by 18.5 percent over the next 12 months, resulting in approximately 120 new jobs.
- Thirty-nine percent of employers indicated at least some difficulty finding qualified applicants.
- Computer cluster employers typically require a bachelor's degree (48.1%) or a certificate or associate's degree from a community college (26.9%). Overall, 78.8 percent of employers expect at least some college for database administrators.
- When given the option, employers prefer an applicant with an associate's degree specific to the position (50.0%) over a general bachelor's degree (36.5%).
- The wages for computer cluster database administrators in the County are:
    - Entry-level (25th percentile wage): $56,857 a year;
    - Median (50th percentile wage): $82,150 a year;
    - Experienced (75th percentile wage): $105,702 a year.

Electrical and Electronic Engineering Technicians

Occupational Description

The work of electrical and electronic engineering technicians involves applying electrical theory and related knowledge to test and modify the developmental or operations of electrical machinery and electrical control equipment and circuitry in plants and laboratories.

This is an entry to mid-level position that typically requires an associate's degree and one to three years of work experience in the occupation.

Electrical and electronic engineering technicians are classified as an in-demand occupation by O*Net.

Secondary Occupation Title(s)

Technician, prototype assembler, quality assurance assembler, or tester.

Important Skill Sets

- Possession of good hand-eye coordination
- Ability to read, evaluate, and analyze technical drawings and schematics
- Ability to install, repair, and test electronic equipment.

Occupations that Lead to this Position

Apprentice or assistant technician.

Occupational Opportunities that Come from this Position

Head engineering technician, production supervisor, senior supervisor, electronics engineer, or materials manager.

Across Industries in Orange County

- From 2004 to 2014, the number of electrical and electronic engineering technicians in the County is expected to grow by 17.5 percent, which is just below the County average of 18.0 percent across occupations.
- 460 job openings are expected countywide between 2004 and 2014 (46 annually) from growth.
- The median annual wage for electrical and electronic engineering technicians across industries in the County is $47,299.

Within the Computer Cluster in Orange County

- There are approximately 820 electrical and electronic engineering technicians employed within the computer cluster in Orange County.
- Employers expect the number of electrical and electronic engineering technicians to grow by 17.4 percent over the next 12 months, resulting in approximately 143 new jobs.
- Fifty-eight percent of employers indicated at least some difficulty finding qualified applicants – the second highest in the survey.
- Computer cluster employers typically require a bachelor's degree (42.2%) or a certificate or associate's degree from a community college (31.1%). Overall, 75.5 percent of employers expect at least some college for electrical and electronic engineering technicians.
- When given the option, employers overwhelmingly prefer an applicant with an associate's degree specific to the position (64.4%) over a general bachelor's degree (26.7%).
- The wages for computer cluster electrical and electronic engineering technicians in Orange County are:
    - Entry-level (25th percentile wage): $37,267 a year;
    - Median (50th percentile wage): $45,036 a year;
    - Experienced (75th percentile wage): $56,410 a year.

Inspectors, Testers and Graders

Occupational Description

The work of inspectors, testers and graders involves inspecting, testing, sorting, sampling, or weighing nonagricultural raw materials or processed, machined, fabricated, or assembled parts or products for defects, wear, and deviations from specifications. Inspectors, testers and graders may also use precision measuring instruments and complex test equipment.

This is an entry-level position that typically requires moderate term on-the-job training (1 to 12 months), with little to no prior experience expected.

Secondary Occupation Title(s)

Inspector, quality inspector, quality technician, quality assurance inspector, quality control inspector, quality auditor, or quality assurance auditor.

Important Skill Sets

- Ability to inspect and evaluate the quality of products
- Possess knowledge of materials, methods, and appropriate tools to construct objects.

Occupations that Lead to this Position

This is an entry-level position.

Occupational Opportunities that Come from this Position

Quality control analyst or supervisor.

Across Industries in Orange County

- From 2004 to 2014, the number of inspectors, testers and graders in the County is expected to grow by 6.2 percent, which is below the County average of 18.0 percent across occupations.
- 430 job openings are expected countywide between 2004 and 2014 (43 annually) from growth.
- The median annual wage for inspectors, testers and graders across industries in the County is $26,894.

Within the Computer Cluster in Orange County

- There are approximately 2,150 inspectors, testers and graders employed within the computer cluster in Orange County.
- Employers expect the number of inspectors, testers and graders to grow by 13.9 percent over the next 12 months, resulting in approximately 299 new jobs.

- Fifty-four percent of employers indicated at least some difficulty finding qualified applicants.
- Eight percent of employers surveyed do not have any formal education requirements for inspectors, testers and graders, 48.7 percent require graduation from high school, and 35.9 percent require a certificate or associate's degree. Overall, 43.6 percent of employers expect at least some college for this position.
- When given the option, employers overwhelmingly prefer an applicant with an associate's degree specific to the position (56.4%) over a general bachelor's degree (15.4%).
- The wages for computer cluster inspectors, testers and graders in Orange County are:
    - Entry-level (25th percentile wage): $20,533 a year;
    - Median (50th percentile wage): $25,769 a year;
    - Experienced (75th percentile wage): $32,053 a year.

Research and Development Technicians

Occupational Description

The work of research and development technicians involves supporting new product development or product revisions by implementing aspects of research, construction, testing, documentation, problem correction, and related tooling.

This is an entry to mid-level position, with most occupations in this category requiring at least an associate's degree.

Secondary Occupation Title(s)

Research associate or science technician.

Important Skill Sets

The critical skill sets include knowledge of production and processing, strong science, mathematics and/ or engineering skills, detail-oriented nature, and troubleshooting and problem solving skills.

Occupations that Lead to this Position

Research assistant or quality control technician.

Occupational Opportunities that Come from this Position

Research and development analyst or manager.

Across Industries in Orange County

- From 2004 to 2014, the number of research and development technicians in the County is expected to grow by 17.9 percent, which is just below the County average of 18.0 percent across occupations.
- 120 job openings are expected countywide between 2004 and 2014 (12 annually) from growth.
- The median annual wage for research and development technicians across industries in the County is $48,912.

Within the Computer Cluster in Orange County

- There are approximately 645 research and development technicians[6] employed within the computer cluster in Orange County.
- Employers expect the number of research and development technicians to grow by 11.2 percent over the next 12 months, resulting in approximately 72 new jobs.

[6] Research and development technicians are not currently captured by the SOC system. As such, employment for this occupation was estimated from the survey data instead of the EDD data. The wage information presented uses the closest SOC code for which wage data was available "Life, Physical, and Social Science Technicians, All Other."

- Fifty-seven percent of employers indicated at least some difficulty finding qualified applicants – the third highest in the survey.
- Employers typically require at least a bachelor's degree (bachelor's: 57.1%, master's: 14.3% - the highest percent for a master's in the survey). Overall, 78.6 percent of employers expect at least some college for this position.
- When given the option, employers were split on their preference for an applicant with an associate's degree specific to the position (42.9%) over a general bachelor's degree (42.9%).
- The wages for computer cluster research and development technicians in Orange County are:
    - Entry-level (25th percentile wage): $35,340 a year;
    - Median (50th percentile wage): $43,124 a year;
    - Experienced (75th percentile wage): $58,042 a year.

Sales Managers

Occupational Description

The work of sales managers involves: directing the distribution or movement of a product or service to the customer; coordinating sales distribution by establishing sales territories, quotas, and goals and establish training programs for sales representatives; and analyzing sales statistics gathered by staff to determine sales potential and inventory requirements and monitor the preferences of customers.

This is a mid to senior-level position that typically requires at least a bachelor's degree and three to five years of work experience in the occupation.

Sales managers are classified as an in-demand occupation by O*Net.

Secondary Occupation Title(s)

Sales manager, director of sales, district sales manager, regional sales manager, or sales supervisor.

Important Skill Sets

- Possession of strong computer skills and the ability to communicate persuasively, both orally and in writing
- Ability to work long hours, including evenings and weekends, and willingness to travel
- Ability to analyze sales statistics to determine sales potential and inventory requirements and to monitor customers' preferences.

Occupations that Lead to this Position

Sales representative, sales agent, purchasing agent, or buyer.

Occupational Opportunities that Come from this Position

Executive, general manager, sales or marketing vice president.

Across Industries in Orange County

- From 2004 to 2014, the number of sales managers in the County is expected to grow by 25.5 percent, which is above the County average of 18.0 percent across occupations.
- 1,580 job openings are expected countywide between 2004 and 2014 (158 annually) from growth.
- The median annual wage for sales managers across industries in the County is $108,076.

Within the Computer Cluster in Orange County

- There are approximately 1,110 sales managers employed within the computer cluster in Orange County.
- Employers expect the number of sales managers to grow by 15.9 percent over the next 12 months, resulting in approximately 176 new jobs.
- Fifty-six percent of employers indicated at least some difficulty finding qualified applicants.
- Computer cluster employers typically require a bachelor's degree (48.9%) or a certificate or associate's degree from a community college (24.5%). Overall, 73.4 percent of employers expect at least some college for sales managers.
- When given the option, the majority of employers prefer an applicant with a general bachelor's degree (55.3%) over an associate's degree specific to the position (36.2%).
- The wages for computer cluster sales managers in Orange County are:
    - Entry-level (25th percentile wage): $81,739 a year;
    - Median (50th percentile wage): $118,403 a year;
    - Experienced (75th percentile wage): $124,713 a year.

Sales Representatives

Occupational Description

The work of sales representatives involves selling goods for wholesalers or manufacturers to businesses or groups of individuals. The work of sales representatives requires substantial knowledge of the items being sold.

This is an entry to mid-level position that typically requires moderate term on-the-job training (1 to 12 months) and two to four years work experience in the occupation or a related field.

Sales representatives are classified as an in-demand occupation by O*Net.

Secondary Occupation Title(s)

Inside sales representative, account executive, or marketing representative.

Important Skill Sets

- Possession of customer service and interpersonal skills
- Possession of verbal presentation skills
- Knowledge of products and services
- Willingness to travel out of town.

Occupations that Lead to this Position

Sales trainee.

Occupational Opportunities that Come from this Position

Account manager, sales manager, sales director, account development manager, district manager, customer service representative, or regional sales manager.

Across Industries in Orange County

- From 2004 to 2014, the number of sales representatives in the County is expected to grow by 20.8 percent, which is just above the County average of 18.0 percent across occupations.
- 4,820 job openings are expected countywide between 2004 and 2014 (482 annually) from growth.
- The median annual wage for sales representatives across industries in the County is $57,811.

Within the Computer Cluster in Orange County

- There are approximately 1,820 sales representatives employed within the computer cluster in Orange County.
- Employers expect the number of sales representatives to grow by 19.5 percent over the next 12 months, resulting in approximately 354 new jobs.
- Fifty-five percent of employers indicated at least some difficulty finding qualified applicants.
- Nine percent of employers surveyed do not have any formal education requirements for sales representatives, 41.4 percent require graduation from high school, and 13.7 percent require a certificate or associate's degree. Overall, 44.7 percent of employers expect at least some college for this position.
- When given the option, employers prefer an applicant with an associate's degree specific to the position (47.1%) over a general bachelor's degree (35.6%).
- The wages for computer cluster sales representatives in Orange County are:
    - Entry-level (25th percentile wage): $41,900 a year;
    - Median (50th percentile wage): $67,173 a year;
    - Experienced (75th percentile wage): $91,045 a year.

CAREER LADDERS

This section displays two example computer cluster career ladders.

CAREER LADDER – COMPUTER & ELECTRONIC MANUFACTURING

Advanced Level
Bachelor's degree or proven technical skills that can be demonstrated through industry experience.

Design Engineer $20.00 to $30.00/hour	Manager $19.00 to $30.00/hour

Mid Level
Associate's or bachelor's degree and/or equivalent training and experience.

Electric & Electrical Engineering Technicians $15.00 to $23.50/hour	Manufacturing Support Specialist $15.00 to $23.50/hour

Entry Level
High school diploma and appropriate career and technical education classes.

Electrical or Electronic Assemblers $9.00 to $12.70/hour	Inspectors, Testers and Graders $10.25 to $16.00/hour	Machinist Trainee $8.10 to $12.00/hour

CAREER LADDER – SOFTWARE AND COMPUTER SERVICES

Advanced Level
Bachelor's or graduate degree (typically not needed for sales manager) and/or proven technical skills that can be demonstrated through industry experience.

Sales Manager $41.00 to $62.00/hour	Computer & Information Systems Manager $40.00 to $65.00/hour	General & Operations Manager $38.00 to $70.00/hour

Mid Level
Bachelor's degree and/or proven technical skills that can be demonstrated through industry experience.

Sales Representatives $26.00 to $45.00/hour	Computer Software Engineer $32.00 to $51.00/hour	Database Administrator $25.00 to $48.00/hour

Entry Level
Associate's degree or equivalent training and experience.

Computer Support Specialist $16.00 to $28.00/hour	Customer Service Representative $13.00 to $20.00/hour	Computer Operator $9.00 to $15.00/hour

EDUCATION AND TRAINING PROVIDERS

This section provides a list of the Orange County education and training providers that serve the computer cluster. The tables to follow list providers separately by type: Regional Occupational Program – ROP (Table 13), Community College (

Table 14), University (Table 15), and Private Training Provider (Table 16).

Table 13 Education and Training Providers: ROP

Name of Provider	Address	City	Zip
Capistrano-Laguna ROP	31522 El Camino Real	San Juan Capistrano	92675
Chapman Hetting Education Center	11852 Knott St.	Garden Grove	92841
Coastline ROP	1001 Presidio Square	Costa Mesa	92626
Lincoln Education Center	11262 Garden Grove Blvd.	Garden Grove	92843
North Orange County ROP	385 N. Muller Street	Anaheim	92801
Orange Career Education Center	250 S. Yorba St.	Orange	92869
Santa Ana Ritchey Center	1815 S. Ritchey	Santa Ana	92705

Table 14 Education and Training Providers: Community Colleges

Name of Provider	Address	City	Zip
Coast Community College District Office	1370 Adams Avenue	Costa Mesa	92626
Coastline Community College	11460 Warner Avenue	Fountain Valley	92708
Cypress College	9200 Valley View Street	Cypress	90630
Fullerton College	321 East Chapman Avenue	Fullerton	92832
Golden West College	15744 Goldenwest Street	Huntington Beach	92647
Irvine Valley College	5500 Irvine Center Drive	Irvine	92720
North Orange County Community College District Office	1830 W Romneya Drive	Anaheim	92801
Orange Coast College	2701 Fairview Road	Costa Mesa	92628
Rancho Santiago Community College District Office	2323 N. Broadway	Santa Ana	92706
Saddleback College	28000 Marguerite Parkway	Mission Viejo	92692
Santa Ana College	1530 W. 17th Street	Santa Ana	92706
Santiago Canyon College	8045 E. Chapman Avenue	Orange	92869
South Orange County Community College District Office	28000 Marguerite Parkway	Mission Viejo	92692

Table 15 Education and Training Providers: Universities

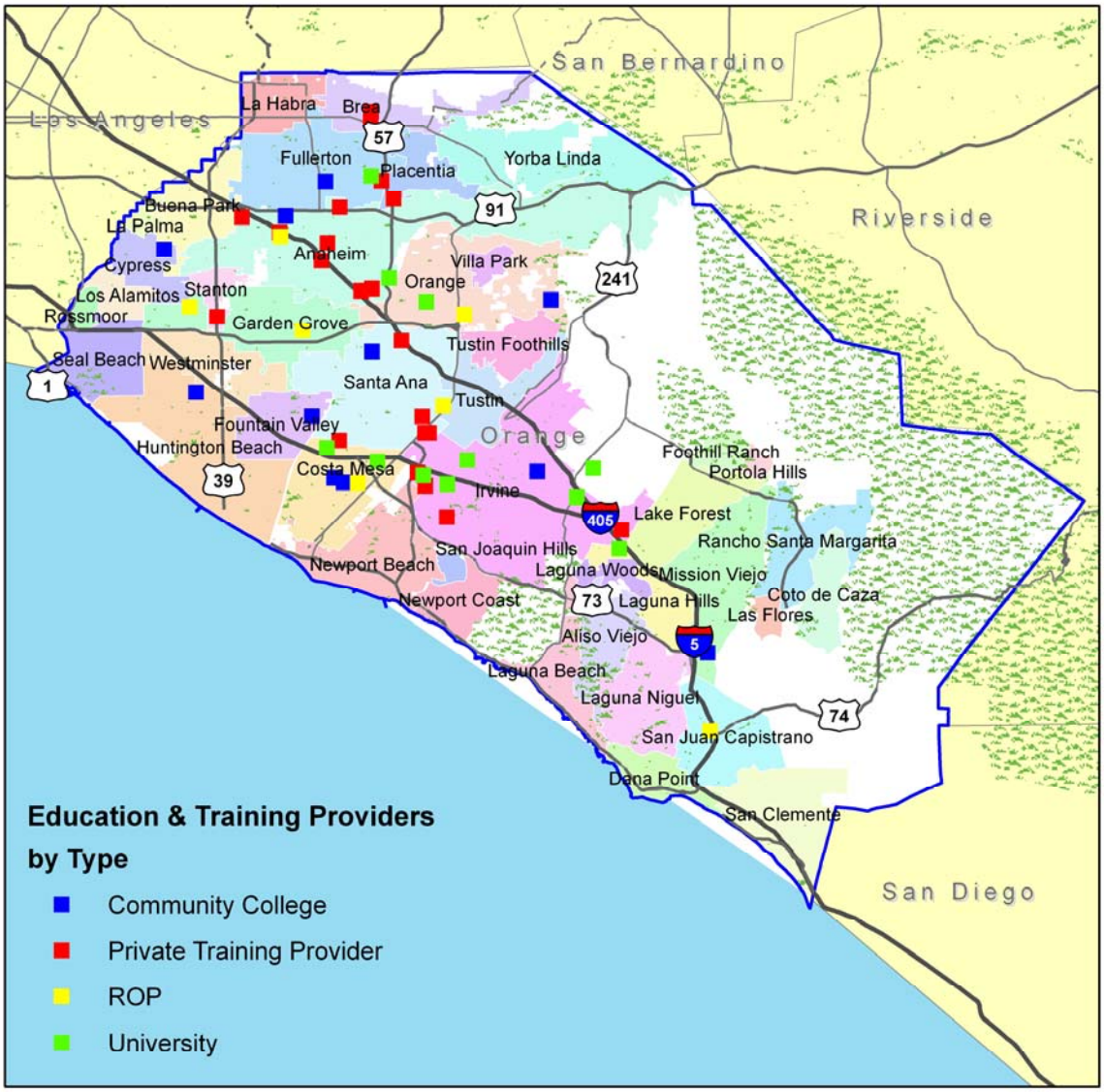
Name of Provider	Address	City	Zip
Chapman University College	One University Drive	Orange	92866
Chapman University College Irvine Campus	7545 Irvine Center Drive	Irvine	92618
De Vry University	3333 Michelson Drive, Ste 420	Irvine	92612
National University Costa Mesa Campus	3390 Harbor Boulevard	Costa Mesa	92626
University of Phoenix Laguna Hills Learning Center	23046 Avenida De La Carlota, Suite 400	Laguna Hills	92653
University of Phoenix South Coast Learning Center	3150 Bristol Street	Costa Mesa	92626
Webster University Irvine Campus	2300 Michelson, Suite 800	Irvine	92612
Westwood College Anaheim Campus	1551 S. Douglass Road	Anaheim	92806
California State University Fullerton	800 N. State College Blvd	Fullerton	92831
California State University Fullerton Irvine Campus	7314 Trabuco Road	Irvine	92618
University of California, Irvine	University of California, Irvine	Irvine	92697

Table 16 Education and Training Providers: Private Training Providers

Name of Provider	Address	City	Zip
American Career College	1200 North Magnolia Ave	Anaheim	92801
Apex Infotech Incorporated	15540 Rockfield Boulevard, Suite D	Irvine	92618
California Learning Center	222 S Harbor Blvd	Anaheim	92805
Career College of California	1720 E Garry Ave	Santa Ana	92705
College of Automotive Management	3000 W Macarthur Blvd # 300	Santa Ana	92704
College of Information Technology	2701 E Chapman Ave # 101	Fullerton	92831
ExecuTrain	18818 Teller	Irvine	92612
ITT Technical Institute	525 North Muller Street	Anaheim	92801
Larson Training Centers	2029 W Orangewood Ave	Orange	92868
Monterey Park College	12362 Beach Blvd Ste 100	Stanton	90680
MTI College	2333 N Broadway # 400	Santa Ana	92706
New Horizons Computer Learning Center of Southern California	1900 S. State College Blvd. Suite 108	Anaheim	92806
Newton International College	4255 Campus Dr # A250	Irvine	92612
QPE Technical Institute	1557 N. Gemini Place	Anaheim	92801
Sea College of Business and Technology	265 Randolph Suite 230	Brea	92821
SER / Jobs for Progress	1243 E. Warner Avenue	Santa Ana	92705
Smart Digital Technology, Inc.	187 W. Orangethorpe Ave. Suite 101	Placentia	92870
Soft- Train Inc.	2932 S. Daimler Street	Santa Ana	92705
Software Education of America	265 S Randolph Ave, Ste J230	Brea	92821
Southern California Institute of Technology (SCIT)	1900 W Crescent Ave # A	Anaheim	92801
Stanbridge College Inc.	2041 Business Ctr Dr Ste 107	Irvine	92612
Sutech School of Vocational and Technical Training	1855 S Santa Cruz St	Anaheim	92805
Wolden Multimedia Institute	888 S West St	Anaheim	92802

Figure 29 geographically displays the education and training providers within Orange County that serve the computer cluster.

Figure 29 Education and Training Providers by Location



METHODOLOGY

The table below briefly outlines the methodology for this project. Two phases of primary research were conducted as part of this project - qualitative executive interviews with industry leaders, prominent employers, and human resource directors within the computer cluster and a quantitative telephone and Internet survey of 200 Orange County computer cluster employers with five or more employees.

This project also involved extensive secondary research to compile data from external sources, such as the California's Employment Development Department, the Bureau of Labor Statistics, and the Occupational Information Network.

Table 17 Project Methodology

Method	Secondary Research of the Industry and Its Occupations Telephone and Internet Survey of Computer Cluster Employers Executive Interviews with Industry Leaders, Prominent Employers, and Human Resource Directors
Universe	1,453 Firms with Five or More Employees
Number of Respondents	200 Computer Cluster Employers
Field Dates	August 24 to September 21, 2007

Questionnaire Design

Through an iterative process, BW Research worked closely with the Orange County Workforce Investment Board to develop the questionnaire for the study.

To avoid the problem of systematic position bias - where the order in which a series of questions is asked systematically influences the answers to some of the questions - several of the questions in this survey were randomized such that respondents were not consistently asked the questions in the same order. The series of items relating to industry workforce issues and interest in training and education programs (Question 8 and 15) were randomized to avoid the systematic position bias.

APPENDIX A: TOPLINE RESULTS

[bw] RESEARCH PARTNERSHIP

Orange County Toplines November 2007

Computer Cluster Collaborative (n=200)

Introduction:

Hello, my name is _____. May I please speak to a Human Resources Manager or person responsible for staffing at [organization]?

Hello, my name is _____ and I'm calling on behalf of the **Orange County Workforce Investment Board**, who would value your participation in a brief survey that will help address your future organization needs for trained and educated employees within the computer Industry.

(If needed): The survey should take approximately fifteen minutes of your time. By answering this survey, you can help the Orange County Workforce Investment Board develop the appropriate type of training that will prepare the employees you will be looking for in the future.

(If needed): This survey has been commissioned by the Orange County Workforce Investment Board, which is committed to developing the regional workforce. The survey is being conducted by BW Research, an independent research organization.

(If needed): Your individual responses will **not** be published, only aggregate information will be used in the reporting of the survey results.

Organization-Related Questions

I'd like to begin by asking you a few general questions about your organization,

1. Including all full-time and part-time employees, how many **permanent** employees work at your agency location?

Total # Employees	Mean	Median
6,648	34.1	10.0

Breakdown

1.0%	No permanent employees
54.0%	10 or less employees
18.0%	11 to 24 employees
9.5%	25 to 49 employees
6.0%	50 to 99 employees
7.0%	100 to 249 employees
2.0%	250 or more employees
2.5%	DK/NA

2. If you currently have [TAKE Q1 #] full-time and part-time **permanent** employees at your agency location, how many more or less permanent employees do you expect to have at your location 12 months from now?

52.5%	More
2.0%	Less
42.5%	(DON'T READ) Same number of permanent employees
3.0%	(DON'T READ) DK/NA

[If amount differs by 10% or more in either direction, ask:]
Just to confirm, you currently have ____ permanent employees and you expect to have _____ (more/less) employees, for a total of ____ permanent employees 12 months from now.

Expected Employment: 12 months (Calculated by only examing firms with both current and projected data)

	Current	12 months
n	189	189
Mean	33.9	36.5
Median	10.0	12.0
Total Employees	6,414	6,903
New Employees		489
% Growth		7.6%

3. When a non entry-level position becomes available in your firm, do you more often hire from outside or promote from within the company? (IF NEEDED)

21.0%	Promote from within
28.5%	Even split (50-50 outside & promote)
46.0%	Recruit from outside
4.5%	(DON'T READ) DK/NA

4. How often does your business recruit individuals from outside Orange County?

4.0%	Always (100% to 75% of the time)
14.0%	Frequently (50% to 74% of the time)
22.5%	Sometimes (49% to 25% of the time)
32.5%	Rarely (1% to 24% of the time)
25.5%	Never (0% of the time)
1.5%	(DON'T READ) DK/NA

5. Which of the following categories, best describes the type of work that is done at your business location, and if it is more than one let us know that as well? (IF NEEDED)

[RANDOMIZE ORDER OF 1 – 4, ALLOW UP TO THREE RESPONSES]

49.5%	Produce or manufacture products or services (including software applications)
17.5%	Research and development
51.0%	Sales
63.0%	Consulting and customer services
0.5%	Other (Please Specify_____)

I would like to ask a few questions about the industry or industries that your firm works with.

6. Which industry or industries does your firm provide goods and/or services for? (IF NEEDED) (Multiple Response)

10.0%	Agriculture
19.5%	Utilities
24.0%	Construction
50.5%	Manufacturing
27.5%	Biotechnology or the Life Sciences
41.5%	Retail or Wholesale trade
28.0%	Logistics and/or Transportation
70.0%	Computer or Technology Industry
34.0%	Healthcare
31.0%	Professional Services other than Computers
25.5%	Education
30.0%	Public Sector
8.5%	Defense and Aerospace
1.5%	Entertainment
2.0%	Communications
1.5%	Automotive
1.5%	Other (Please specify_____)
0.5%	(Don't Read) DK/NA

7. Thinking in general about recent hires at your organization, which of the following skills would you say that recent hires tend to be **most deficient** in?

   (IF NEEDED: For this question, I would just like your general perception about skill deficiencies for recent hires across occupations at your organization) (Multiple Response)

22.5%	Current programming knowledge/ability to write code
21.0%	Ability to use software applications
32.5%	Interpersonal communication skills
39.0%	Technical writing skills
31.5%	Creative problem-solving skills
22.0%	Ability to work with different groups or departments
2.5%	Work ethic/motivation
1.5%	Hands-on experience
1.0%	Specific technical training
0.5%	English language
3.0%	Other (Please specify_____)
1.0%	(Don't Read) Depends on occupation
22.5%	(Don't Read) DK/NA

8. Now, I'm going to read a list of issues facing the region's technology and computer workforce in the coming years. Please tell me how much difficulty your organization faces in addressing each workforce need.

   Here's the (first/next) one _____ (READ ITEM): Please tell me whether your organization has no difficulty, some difficulty, or great difficulty in dealing with this issue.

RANDOMIZE

	No difficulty	Some difficulty	Great difficulty	(DON'T READ DK/NA
A. Developing training programs so current employees are productive and stay up-to date on changing technology and industry requirements	52.0%	41.5%	3.0%	3.5%
B. Providing training opportunities so current employees are able to advance within the organization	61.0%	31.0%	5.5%	2.5%
C. ***Recruiting*** entry-level employees with appropriate training and education	44.5%	31.0%	17.0%	7.5%
D. ***Recruiting*** non-entry level employees with adequate experience and understanding of the industry	29.5%	47.5%	19.5%	3.5%
E. ***Retaining*** valuable employees who could move up within the organization	56.0%	34.0%	8.0%	2.0%
F. ***Retaining*** valuable employees who could be recruited and employed by industry competitors	54.5%	35.5%	10.0%	0.0%
G. ***Recruiting*** employees with reasonable salary requirements	35.5%	44.5%	17.5%	2.5%

Occupation-Related Questions

[NOTE PLEASE COMMUNICATE TO RESPONDENT THAT WE WILL BE USING GENERAL OCCUPATIONAL TITLES RATHER THAN SPECIFIC JOB TITLES THAT MAY BE USED WITHIN EACH ORGANIZATION]

9. Now, I'm going to ask you about specific occupations within your organization. The occupational titles we are using may differ from the specific position titles used in your organization. For these questions, I would like you to try to equate your organization's specific position titles with the more general ones we will use here. Please tell me if your organization employs, at your location, individuals in positions matching the following general occupational titles:

   Here's the (first/next) one: _____ (READ ITEM, THEN ASK): Do you have employees who fit this occupational description at your agency location?
   (1 = Yes, 2 = No, 3 =DK/NA)

   Occupational List (Read brief definition of occupation only if needed by respondent)

Computer Cluster Occupations

	Yes	No	DK/NA
A. Assemblers and/or Electrical & Electronic Assemblers	29.0%	70.0%	1.0%
B. Electrical & Electronic Engineering Technicians	36.0%	63.5%	0.5%
C. Research & Development Technicians	26.0%	74.0%	0.0%
D. Computer Support Specialists	63.5%	36.5%	0.0%
E. Computer Software Engineers	39.0%	61.0%	0.0%
F. Inspectors, Testers and Graders	35.0%	64.5%	0.5%
G. Sales Managers	67.0%	32.5%	0.5%
H. Sales Representatives	62.5%	37.5%	0.0%
I. Customer Service Representatives	70.5%	29.0%	0.5%
J. Computer Programmers	42.0%	58.0%	0.0%
K. Database Administrators	46.5%	52.5%	1.0%

(SELECT UP TO 4 OF THE OCCUPATIONS THAT THE RESPONDENT INDICATED ARE REPRESENTED AT THEIR AGENCY'S LOCATION IN Q9 – TO BE ASKED THE FOLLOWING OCCUPATIONAL QUESTIONS)

[NOTE: FOR DATA COLLECTION, EACH OCCUPATION SHOULD HAVE ITS OWN NUMBER AND THAT NEEDS TO BE USED FOR ENTIRE DATA COLLECTION – FOR EXAMPLE, OCCUPATION 6 SHOULD ALWAYS BE OCCUPATION 6 – RESPONSES TO Q10 FOR OCCUPATION 6 SHOULD BE FOUND UNDER Q10.6]

(READ THE OCCUPATIONS IN THE SAME ORDER FOR EACH OF THE OCCUPATION-SPECIFIC QUESTIONS: Q11 – Q16)

Next I'm going to ask you a few questions about some of the occupations you mentioned, including _____ (READ LIST OF OCCUPATIONS TO BE USED)

10. As I read each of the following occupations, please tell me how many individuals you have at your agency location that are currently employed either full-time or part-time in this occupation.

Current Employment:

	Assemblers/ Electrical & Electronic Assemblers	Electrical & Electronic Engineering Technicians	Research & Development Technicians	Computer Support Specialists
n	35	42	27	84
Mean	17.4	2.3	3.3	2.5
Median	5.0	2.0	1.0	1.0
Total Employed	609	97	89	213

	Computer Software Engineers	Inspectors, Testers & Graders	Sales Managers	Sales Representatives
n	44	37	90	82
Mean	3.2	2.9	1.7	3.2
Median	3.0	2.0	1.0	2.0
Total Employed	142	109	151	263

	Customer Service Representatives	Computer Programmers	Database Administrators
n	95	48	48
Mean	3.4	2.9	1.4
Median	2.0	2.0	1.0
Total Employed	322	139	66

11. As I read each of the occupations again, please tell me how many more or less employees you estimate will be employed in each of the occupations 12 months from now.

[Use the following format for each one:]

If you currently have [TAKE Q9 #] [INSERT OCCUPATION TITLE] _____ at your agency location, how many more or less [INSERT OCCUPATION TITLE] do you expect to have at your location 12 months from now?

	More	Less	Same	(DON'T READ DK/NA
A. Assemblers and/or Electrical & Electronic Assemblers (n=39)	41.0%	5.1%	48.7%	5.1%
B. Electrical & Electronic Engineering Technicians (n=45)	31.1%	0.0%	62.2%	6.7%
C. Research & Development Technicians (n=28)	28.6%	0.0%	71.4%	0.0%
D. Computer Support Specialists (n=90)	25.6%	1.1%	70.0%	3.3%
E. Computer Software Engineers (n=47)	53.2%	2.1%	38.3%	6.4%
F. Inspectors, Testers and Graders (n=39)	25.6%	2.6%	66.7%	5.1%
G. Sales Managers (n=94)	25.5%	0.0%	73.4%	1.1%
H. Sales Representatives (n=87)	52.9%	0.0%	43.7%	3.4%
I. Customer Service Representatives (n=101)	29.7%	0.0%	69.3%	1.0%
J. Computer Programmers (n=53)	34.0%	0.0%	60.4%	5.7%
K. Database Administrators (n=52)	26.9%	0.0%	69.2%	3.8%

[If amount differs by 10% or more in either direction, ask:]
Just to confirm, you currently have ____ (insert occupation title) and you expect to have _____ (more/less), for a total of ____ (insert occupation title) 12 months from now.

Expected Employment: 12 months (Calculated by only examing firms with both current and projected data)

	Assemblers/ Electrical & Electronic Assemblers		Electrical & Electronic Engineering Technicians		Research & Development Technicians		Computer Support Specialists	
	Current	12 months	Current	12 months	Current	12 months	Current	12 months
n	35	35	40	40	27	27	83	83
Mean	17.4	18.2	2.2	2.5	3.3	3.7	2.5	3.0
Median	5.0	5.0	2.0	2.0	1.0	2.0	1.0	2.0
Total Employees	609	637	86	101	89	99	211	245
New Employees		28		15		10		34
% Growth		4.6%		17.4%		11.2%		16.1%

	Computer Software Engineers		Inspectors, Testers & Graders		Sales Managers		Sales Representatives	
	Current	12 months	Current	12 months	Current	12 months	Current	12 months
n	42	42	36	36	90	90	81	81
Mean	3.1	3.8	3.0	3.4	1.7	1.9	3.2	3.9
Median	2.5	3.0	2.5	3.0	1.0	1.0	2.0	3.0
Total Employees	129	158	108	123	151	175	262	313
New Employees		29		15		24		51
% Growth		22.5%		13.9%		15.9%		19.5%

	Customer Service Representatives		Computer Programmers		Database Administrators	
	Current	12 months	Current	12 months	Current	12 months
n	95	95	48	48	47	47
Mean	3.4	3.8	2.9	3.3	1.4	1.6
Median	2.0	2.0	2.0	2.0	1.0	1.0
Total Employees	322	360	139	160	65	77
New Employees		38		21		12
% Growth		11.8%		15.1%		18.5%

12. For the same list of occupations, I'm interested in the level of difficulty your organization has in finding applicants who meet the organization's hiring standards. As I read each occupation, please tell me whether your organization has no difficulty, some difficulty or great difficulty finding applicants. (PRESENT IN ORDER THEY WERE PREVIOUSLY PRESENTED)

	No difficulty	Some difficulty	Great difficulty	(DON'T READ DK/NA
A. Assemblers and/or Electrical & Electronic Assemblers	53.8%	28.2%	15.4%	2.6%
B. Electrical & Electronic Engineering Technicians	40.0%	42.2%	15.6%	2.2%
C. Research & Development Technicians	35.7%	42.9%	14.3%	7.1%
D. Computer Support Specialists	64.4%	30.0%	5.6%	0.0%
E. Computer Software Engineers	38.3%	42.6%	19.1%	0.0%
F. Inspectors, Testers and Graders	46.2%	38.5%	15.4%	0.0%
G. Sales Managers	42.6%	37.2%	19.1%	1.1%
H. Sales Representatives	42.5%	37.9%	17.2%	2.3%
I. Customer Service Representatives	49.5%	43.6%	6.9%	0.0%
J. Computer Programmers	45.3%	37.7%	13.2%	3.8%
K. Database Administrators	61.5%	32.7%	5.8%	0.0%

13. Now, for the same list of occupations, I'd like to know the ***typical*** education requirements for successful applicants within each occupation. The categories are (READ OPTIONS). As I read each occupation, please indicate the typical education requirement for that occupation.

1 Completion of high school or equivalent
2 Certificate, from a college or trade school in a specialized area
3 Associate's degree from a Community College
4 Bachelor's degree (B.A., B.S.)
5 Master's or other graduate degree (M.A., M.S., MPA, MBA, Ph.D., J.D.)
6 (DON'T READ) No specific requirements
7 (DON'T READ) No specific degree, but college credits
8 (DON'T READ) DK/NA

	HS	Cert.	AA	BA	MA	None	Credit	DK
A. Assemblers and/or Electrical & Electronic Assemblers	69.2%	15.4%	0%	5.1%	0%	10.3%	0%	0%
B. Electrical & Electronic Engineering Technicians	20.0%	20.0%	11.1%	42.2%	2.2%	0%	0%	4.4%
C. Research & Development Technicians	17.9%	3.6%	3.6%	57.1%	14.3%	0%	0%	3.6%
D. Computer Support Specialists	11.1%	26.7%	16.7%	41.1%	1.1%	2.2%	0%	1.1%
E. Computer Software Engineers	4.3%	4.3%	10.6%	66.0%	8.5%	4.3%	0%	2.1%
F. Inspectors, Testers and Graders	48.7%	23.1%	12.8%	7.7%	0%	7.7%	0%	0%
G. Sales Managers	19.1%	8.5%	16.0%	48.9%	0%	3.2%	0%	4.3%
H. Sales Representatives	41.4%	3.4%	10.3%	29.9%	0%	9.2%	1.1%	4.6%
I. Customer Service Representatives	49.5%	7.9%	13.9%	16.8%	0%	9.9%	1.0%	1.0%
J. Computer Programmers	5.7%	9.4%	3.8%	73.6%	3.8%	0%	1.9%	1.9%
K. Database Administrators	13.5%	7.7%	19.2%	48.1%	1.9%	3.8%	1.9%	3.8%

14. For my next occupation-specific question, I'm going to present you with two applicants with different educational backgrounds.

    For _____ (INSERT OCCUPATION), would you prefer:

    (Rotate order of the two applicant types)

    - An applicant with a bachelor's degree in a related field, but not specific to the occupation

    or

    - An applicant with a two-year associate's degree or a certificate program specific to the position?

	General Bachelors	(DON'T READ) Either	Specific Associates	(DON'T READ) It Depends	(DON'T READ) DK/NA
A. Assemblers and/or Electrical & Electronic Assemblers	15.4%	17.9%	64.1%	2.6%	0.0%
B. Electrical & Electronic Engineering Technicians	26.7%	4.4%	64.4%	2.2%	2.2%
C. Research & Development Technicians	42.9%	0.0%	42.9%	7.1%	7.1%
D. Computer Support Specialists	30.0%	8.9%	55.6%	4.4%	1.1%
E. Computer Software Engineers	29.8%	4.3%	53.2%	4.3%	8.5%
F. Inspectors, Testers and Graders	15.4%	15.4%	56.4%	10.3%	2.6%
G. Sales Managers	55.3%	3.2%	36.2%	2.1%	3.2%
H. Sales Representatives	35.6%	11.5%	47.1%	3.4%	2.3%
I. Customer Service Representatives	31.7%	11.9%	49.5%	4.0%	3.0%
J. Computer Programmers	37.7%	7.5%	45.3%	3.8%	5.7%
K. Database Administrators	36.5%	7.7%	50.0%	3.8%	1.9%

We have completed all of the questions about specific occupations. Before we finish, I'd like to ask you some general questions and verify your contact information.

15. What is your organization's level of interest in the following training and education programs that could be developed by a regional Workforce Investment Board and/or the community colleges for the regional workforce?

    As I read each possible program, please tell me whether your organization would have no interest, some interest, or great interest in the following workforce development programs.

RANDOMIZE

	No Interest	Some Interest	Great Interest	(DON'T READ) DK/NA
A. A certificate program for entry-level programmers or technicians in the computer industry	52.5%	37.5%	9.0%	1.0%
B. On-site customized training for your current employees	58.0%	34.5%	7.0%	0.5%
C. An associate's degree program In the computer industry, created for working technicians or programmers to become managers	58.0%	30.0%	11.5%	0.5%
D. A certificate program for research and development analysts or technicians	66.5%	26.0%	6.0%	1.5%

16. Does your firm have an office location outside of the United States? (IF NEEDED)

19.5%	Yes
80.0%	No
0.5%	(Don't Read) DK/NA

17. Do you have a working relationship with vendors or consultants outside of the United States? (IF NEEDED)

49.0%	Yes
49.5%	No
1.5%	(Don't Read) DK/NA

Since it sometimes becomes necessary for the project manager to call back and confirm responses to certain questions, I would like to verify your contact information.

A. First and Last Name of Respondent_____

B. Position of Respondent_____

C. Phone of Respondent_____

D. Email of Respondent_____

Those are all the questions I have.
Thank you very much for your time.

E. Name of Organization_____

F. Address of Organization_____

G. Date of Interview _____

H. Time of Interview_____

I. Name of Interviewer_____

J. Employer Type _____

K. County _____

L. Primary SIC_____

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