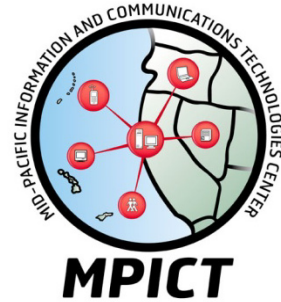




CENTERS OF EXCELLENCE
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2010 ENVIRONMENTAL SCAN

ICT

INFORMATION & COMMUNICATIONS TECHNOLOGIES

in California

Phase Two: Industry Outlook for Educators

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National Science Foundation (DUE 0802284)

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- Phil Jordan of Green LMI provided exemplary research services and project management for this study. Green LMI steered this project through a challenging and complex course with a great deal of skill.
- Josh Williams and Jaime Barraha with BW Research Partnership designed and conducted the primary research study of California businesses. The research provides data from over 600 businesses, representing a broad array of industries that mirror the California economy, on their use of and opinions about ICT and the ICT workforce in their organizations.

The Centers of Excellence and MPICT would also like to thank the more than 600 employers across California who took the time to complete the survey. These results have provided critical information about the ICT workforce needs and requirements of both ICT and non-ICT companies. This information is vital for California's community colleges to use as they develop and strengthen training and education programs for all the businesses in California's economy.

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Information and Communications Technologies (ICT) firms in California anticipate 8.5% employment growth over the next two years — despite flat to negative growth anticipated by non-ICT firms.

— Centers of Excellence Employer Survey

Executive Summary

Organizations and government agencies across the globe have recognized the convergence of computer, software, and communications technologies. By recognizing the synergy among the interrelated technologies, known as Information and Communications Technologies (ICT), these groups are better able to quantify, understand, and recognize the importance of these rapidly changing industries to their regional economies. This information allows for better informed decision making as well as comprehensive and strategic economic and workforce planning.

In contrast, the United States tends to view ICT industries as silos, and it does not typically consider the inter-dependent nature of these fields. Fragmenting ICT data into subsectors has the effect of minimizing the importance of ICT to the U.S. economy. This in turn leads to ICT receiving less attention from policy makers and insufficient development of the workforce.

The importance of a comprehensive framework to categorize and classify these industries is particularly important in these fields because of the pace of change and continuous innovation occurring in ICT. Because the United States does not have its own classification system representing the ICT framework, the California Community Colleges Center of Excellence Initiative and the Mid-Pacific Information Communications Technologies Center partnered on this project to create a framework and develop relevant ICT economic and labor market information for California.

More than 600 employers from across the state were surveyed by the Centers of Excellence to collect primary data about ICT in the workplace. In addition, hundreds of research hours were allocated to the collection and analysis of secondary data for this report. The research indicates that ICT is a significant sector in the California economy. Findings include:

- ICT occupations and firms are expected to outpace the general economy in two-year job growth
- ICT firms employ approximately 6% of all private sector workers in California (the 12th largest by sector)
- ICT firms pay over 10% of all private sector wages (3rd in state)
- ICT firms had sales revenues of \$173 billion (6th largest in state)
- ICT occupations across firms represent approximately 5% of all workers in the state (ranking ICT 8th among all occupational classifications)
- ICT occupations pay a median wage of over \$35 per hour, which is 41% higher than the median for all jobs in the state
- A majority of employers across sectors noted that ICT is strategically important to their organizations and that ICT is growing in importance for their employees.

These findings illustrate that by using the ICT framework to collect economic and labor market data, ICT is larger and more strategically important to California than previously realized. Though people intuitively know that ICT is an important driver of the state's economy, the data indicate that ICT is a top-ten sector for its industries' sales revenue, wages, and employment. ICT is also a top-ten sector for its occupational size and wages paid across sectors in the state. Employers also noted their reliance on ICT and desire for more structure in ICT strategic planning, education, and training.

California Community Colleges should recognize the growth potential and importance of ICT that is illustrated in this report, and policy makers throughout the state should look to organize their strategic planning around the comprehensive ICT framework and crosswalks provided herein.

Introduction

The Centers of Excellence are taking a multi-faceted approach in studying ICT. This report represents Phase Two in a series of research that involves three phases, which are described below:

- Phase One: provided an overview of ICT, its key job functions, and the challenges and opportunities facing the sector.
- Phase Two: provides analysis of the size and scope of the ICT sector in California and its potential for growth.
- Phase Three: will provide a series of regional in-depth labor market occupational studies including detailed wage information, growth forecasts, academic program offerings, and recommendations for community college program development.

Because of the dynamic nature of the ICT workforce, a three-part analysis is required to further examine the industry and its varied occupations. As colleges continue to monitor their programs, the reports will help to ensure that these programs are reflecting employer demand.

The Information and Communications Technologies (ICT) sector encompasses all rapidly emerging, evolving, and converging computer, software, networking, telecommunications, Internet, programming, and information systems technologies. ICT is a flexible framework for organizing these interdependent, inter-related and rapidly changing high-tech fields and their workforce that spans across firms of all sizes and industries.

The ICT framework is widely used outside the U.S., for example, by the United Nations, European Union, World Bank, and International Telecommunications Union. ICT is a strategically important sector that is a major driver of the California economy.

Despite its size and importance, ICT has not received sufficient attention from policy makers. Current frameworks for study, developed by federal and state governments, do not consider the convergence of ICT technologies into one cluster that can be researched effectively. This has resulted in fragmented reporting of ICT related information that does not accurately reflect the true breadth and depth of ICT, because it either includes its companies and workers with other sectors, or it reports on smaller components only (such as computers).

The California Community Colleges System has charged the Economic and Workforce Development (EWD) Network to identify industries and occupations with unmet employee development needs and introduce partnering potential for the college's programs. The Centers of Excellence have partnered with the Mid-Pacific Information and Communications Technologies Center (MPICT) on this Phase Two study that is focused on quantifying the size and scope of ICT in California across industries and firms by collecting primary and secondary data from employers.

Short-Term Employment Growth Trends

The Centers of Excellence randomly surveyed over 600 employers from across the state regarding their ICT workforce needs. The survey sample is representative of the California economy, and includes firms of all sizes and industries throughout the entire state.¹ The findings indicate that ICT employment is growing at a rapid pace while the general economy struggles to add jobs.

ICT Firm Growth

As Figure 1 illustrates, the surveyed firms reported a two-year job growth rate of 3.8% overall, which is similar to existing estimates that suggest approximately 4% job growth for the state over the same period.² However, further analysis of the data reveals that self-identified ICT firms expect to add jobs at a rapid clip of 8.5% over the next two years, but that non-ICT firms in the state expect flat or declining employment growth over the same period.

The data also indicate that San Francisco Bay Area firms expect to add a majority of these jobs, with growth of 11%, in comparison to Southern California’s growth rate of 1.6% and flat growth in the rest of the state.³ In addition, higher-tech firms expect more robust growth than lower-tech firms over the next two years.

ICT Occupational Growth

The surveyed firms were also asked about their specific occupations that require ICT skills, to determine the growth rate of ICT jobs over the next two years. As Figure 2 illustrates, employers expect ICT employment to grow by 7% over the period. As may be expected, ICT firms indicated a higher rate of growth for these occupations, reporting an anticipated 11.2% growth rate for ICT occupations, while non-ICT firms reported an expected 3.7% growth rate.

Perhaps the most significant occupational finding in the research is that non-ICT firms reported an expectation of flat or declining employment overall in the next two years, but expect a 3.7% increase in ICT jobs at their firms over the same period. This finding underscores the importance of ICT to the state’s economy and workforce.

Figure 1: Job Growth in California

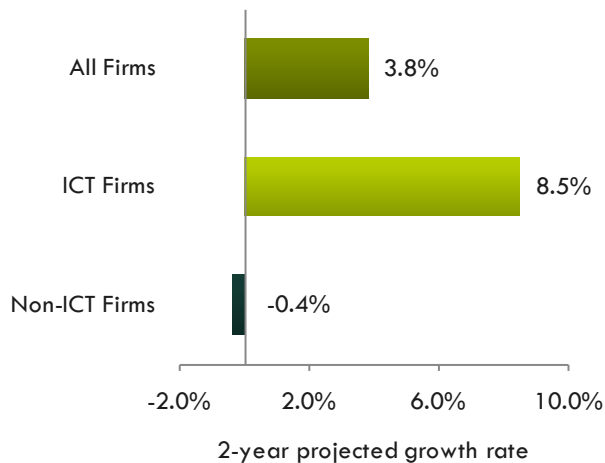
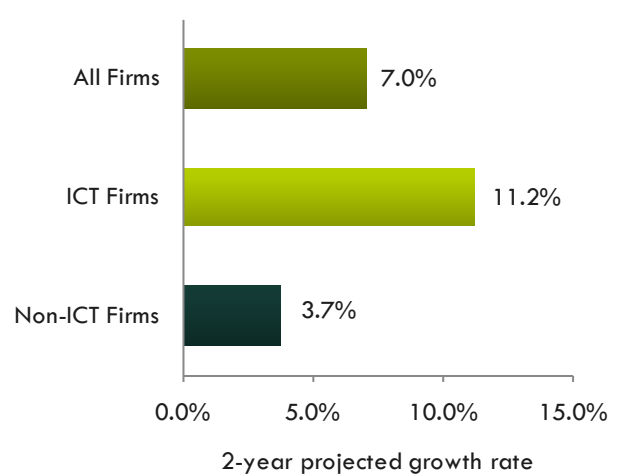


Figure 2: ICT Occupational Growth



¹ See Appendix B for a description of survey methodology.

² EMSI Complete Employment, Spring 2010.

³ Southern California includes Los Angeles County, Orange County and San Diego County.

As Figure 3 illustrates, a majority of ICT firms and more than one in three firms overall expect to need more employees with ICT skills over the next two years. Figure 4 demonstrates the strength of the San Francisco Bay Area employment need for skilled ICT workers.

Figure 3: Increasing Need for ICT Skills across Industries

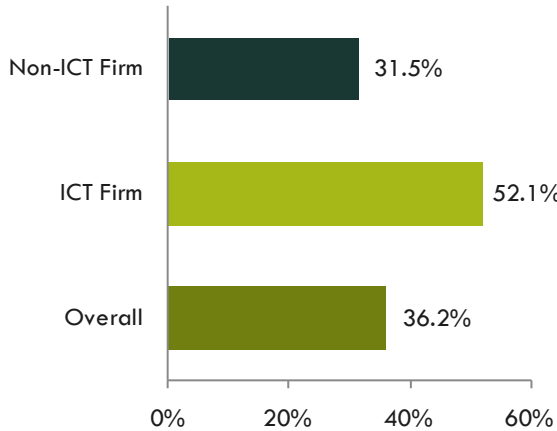
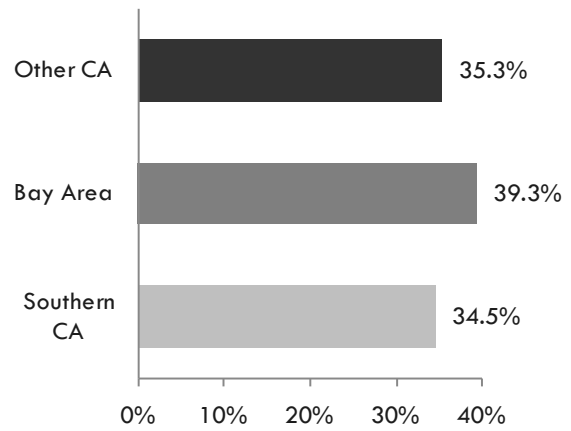


Figure 4: Increasing Need for ICT Skills by Region



Industry and Occupational Crosswalks

Despite the limitations of available industry and occupational data currently collected in the United States, general trends and patterns become evident upon their review. For the purposes of this report, the Centers of Excellence have analyzed secondary data from the California Employment Development Department Labor Market Information Division (EDD), Economic Modeling Specialists, Inc. (EMSI), the Bureau of Labor Statistics (BLS), the U.S. Census Bureau, and InfoUSA.

Classification systems allow for standardization of data, however, as previously noted, neither the United States nor California have organized or aggregated industry or job classification data to an ICT framework. As a result, decision-makers studying this data cannot easily recognize the size or importance of ICT in the U.S. or California economies. This report maps existing U.S. NAICS and SOC codes to ICT, providing an opportunity to scope the size and importance of ICT industries and occupations in the California economy.

The first step in developing a U.S./California definition of ICT was to identify all of the potential industries (using existing NAICS codes) that are related to ICT. The next step was to further delineate the industry list into two categories to differentiate those that are only partially ICT related. The first category, labeled “Primary Industries,” includes those industries where 100% of the firms are directly involved with producing ICT goods or services. The second category, “Secondary Industries,” includes those where some percentage of the companies is ICT related, but because of the classification scheme, it is impossible to determine the percentage directly related to ICT.

This process was then repeated for occupations (using existing SOC codes), again delineating those occupational codes in which every worker therein is engaged in ICT functions (“Primary Occupations”) and those where only some portion of the workers work in ICT (“Secondary Occupations”). These initial crosswalk drafts were then reviewed by an advisory group comprised of experts from industry, academia, nonprofit organizations, and government. This group includes human resource professionals, labor market analysts, college administrators and faculty, and small business owners.⁴

⁴ The industry and occupational crosswalks resulting from the validation process can be found in this study’s companion report “ICT Industry & Employment Outlook” at www.coeccc.net/ict (pages 47-59).

These sets of NAICS and SOC codes were then used to query existing U.S. and California industry and employment databases.⁵ Because it is not possible to know how much of secondary NAICS industries and secondary SOC occupations are attributable to ICT, a conservative estimate of 25% of secondary industries and occupations were added to primary industry and occupation findings to arrive at the total estimates. This conservative estimate was also validated with the industry advisory group.

ICT Industry Overview

The ICT sector in California is significant. ICT represents a large number of businesses, a considerable percentage of private sector wages, substantial sales revenue, and is a vital sector for employment in the state. This Industry Overview Section provides an analysis of secondary data sources on employment across all occupations at ICT-related firms.⁶

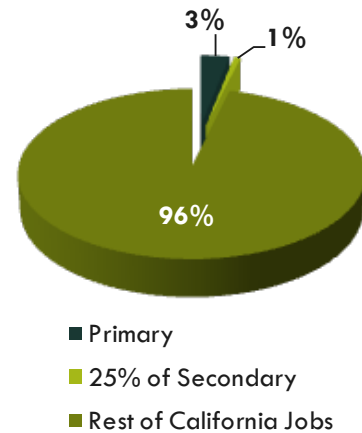
According to California EDD data, Primary ICT firms employed over 596,000 workers in 2008, Secondary ICT firms employed more than 550,000 workers, and combined total employment of California ICT industries is 734,700, or one for every 26 jobs.⁷ Industry employment figures include many occupations and are not limited to those that require ICT skills.

Using the approach outlined in the previous section of this report, the Industry Crosswalk was used to query the 2008 InfoUSA database of California firms for ICT industry employment. Figure 6 on the following page illustrates that, when compared to employment in other industries, ICT ranks 12th in the state.

ICT firms can be found throughout the entire state; however, there are several regions with heavy concentrations of ICT firms and employment. Specifically, Los Angeles and Silicon Valley/San Francisco Bay region, as well as Orange and San Diego Counties, have higher concentrations of ICT firms, employees, and sales than other regions. On the next page, Figures 7 and 8 illustrate the regional distribution of firms and employee concentrations for Primary ICT industries.⁸

ICT industries are clearly a major driver of the California economy, representing a significant percentage of its businesses, revenue, employment, and total wages. However, because literature suggests that approximately 80% of ICT employment occurs outside of ICT industries, data on these firms only show a partial slice of ICT's impacts on California's economy and workforce.⁹ Information on employment trends at non-ICT firms can be found in the next section of this report.

Figure 5: 2008 ICT Industry Employment



Source: Employment Development Department

⁵ The results of the NAICS and SOC queries and additional data comparing ICT to other industry and occupational classifications can be found in this study's companion report "ICT Industry & Employment Outlook" at www.coecc.net/ict (pages 60-75).

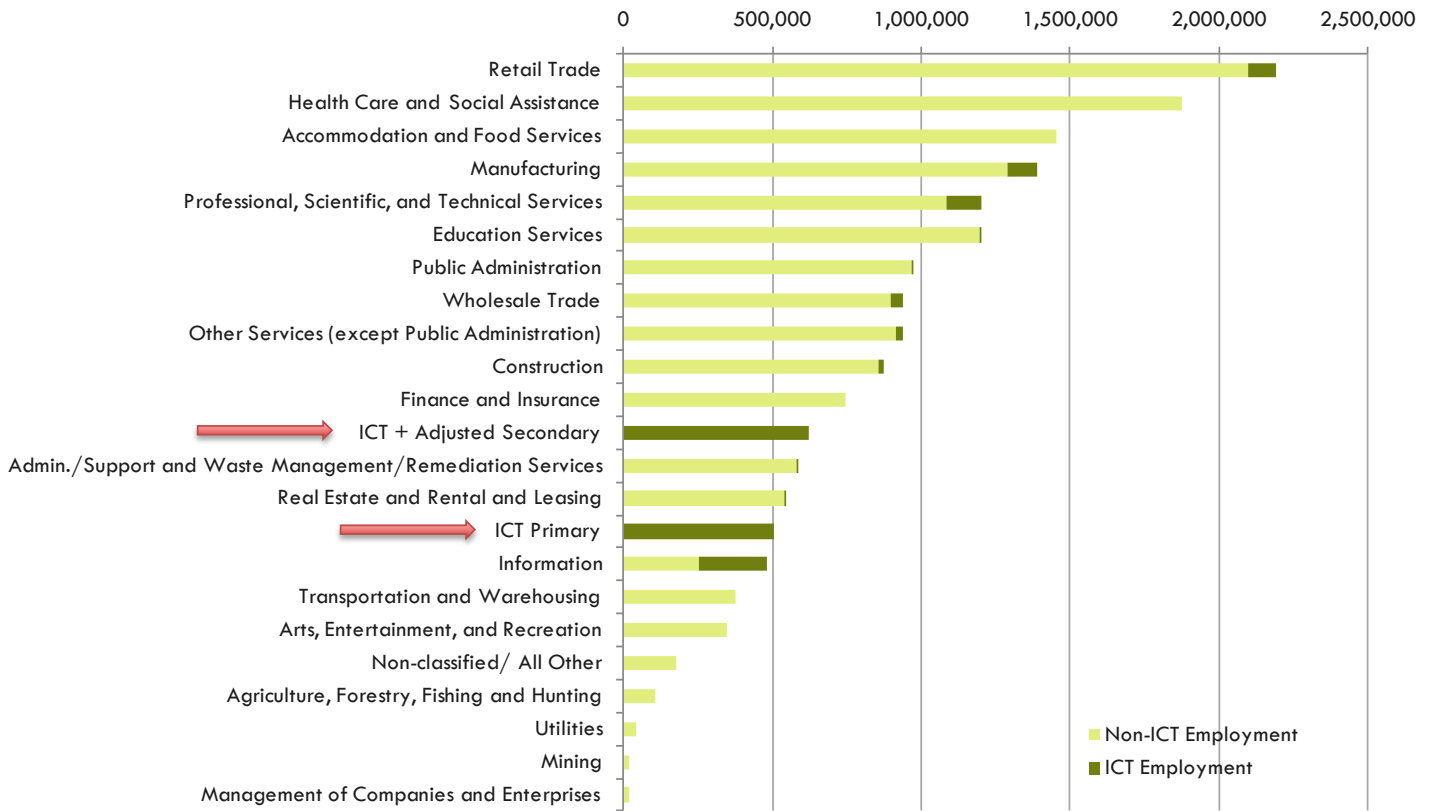
⁶ For a detailed data set of ICT industries, including firm counts, wage data and sales revenue, see Appendix C.

⁷ Total of 734,700 is calculating using Primary ICT employment plus 25% Secondary ICT employment.

⁸ Data source for firm location and employee counts: InfoUSA, 2008.

⁹ "Occupational Overview," *Information and Communications Technologies: Phase One Report*, Centers of Excellence, September 2009 (p. 10); online at www.coecc.net/ict.

Figure 6: Industry Rankings by 2008 Employment Totals



Source: InfoUSA, 2008

Figure 7: Primary ICT Industry Firm Concentrations

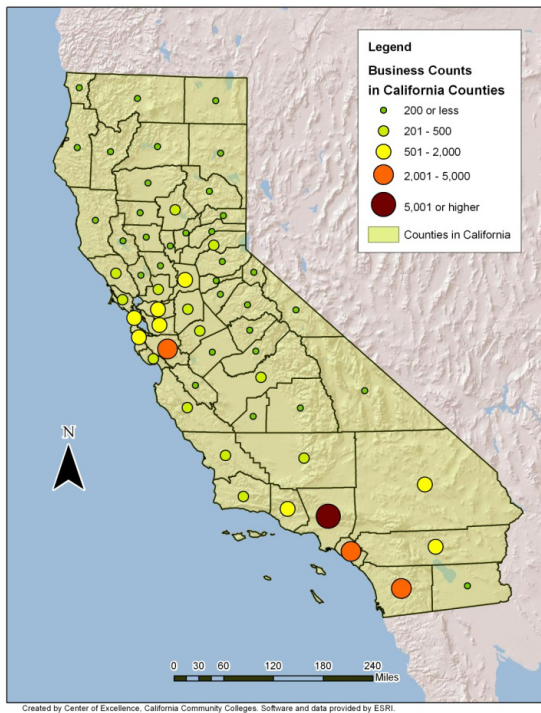
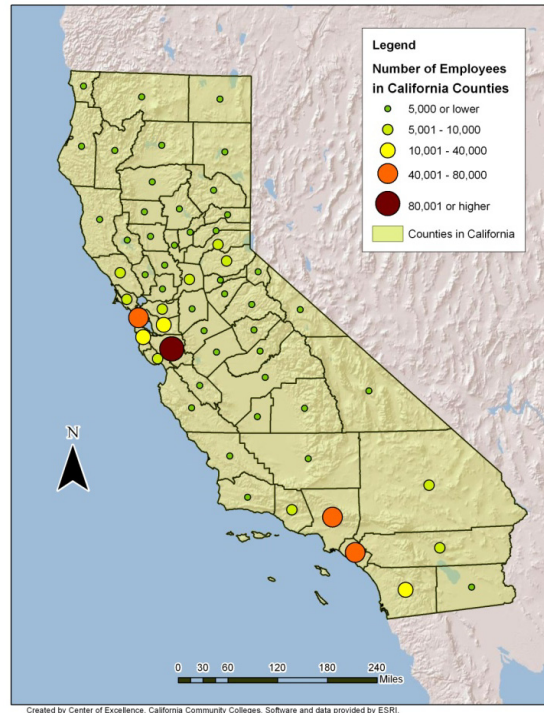


Figure 8: Primary ICT Industry Employee Concentrations



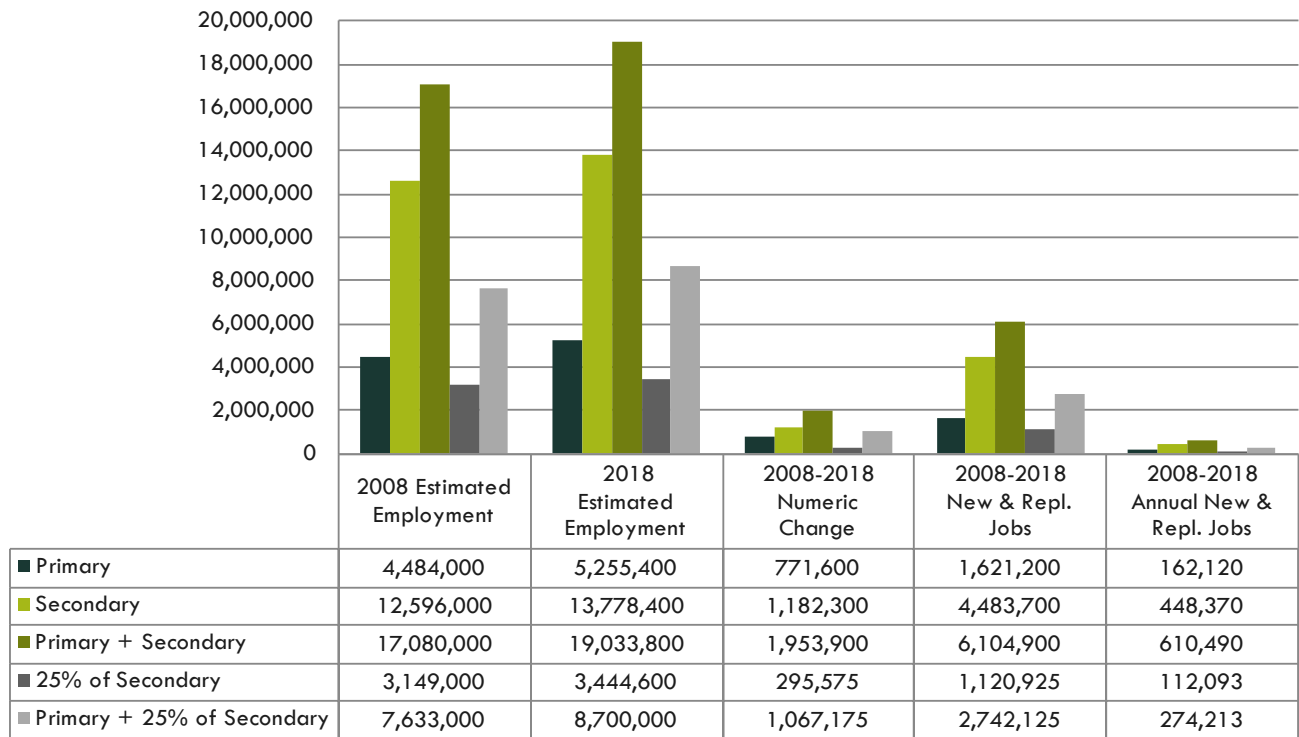
ICT Occupational Overview

In the 21st century, nearly every company relies on ICT for its day-to-day operations. Therefore it is not surprising that the majority of ICT employment occurs in non-ICT firms, nor that ICT workers represent a significant piece of California’s (and the United States’) labor market. Unlike the occupational figures presented in the industry overview, the data presented in this section are not specific to any given industries, but focus only on those workers that work directly with Information and Communications Technologies. Estimates indicate that growth in California over the next six years for these occupations will add 21,789 new jobs annually, and that firms will have the need for an additional 24,820 workers annually to replace existing workers.

National Employment Statistics

The Bureau of Labor Statistics (“BLS”) estimates that there were about 4.5 million workers in Primary ICT occupations (3% of all jobs) and 12.6 million workers in Secondary ICT occupations (8% of all jobs) in the U.S. in 2008. Estimated aggregate U.S. ICT employment—again attributing 25% of Secondary ICT occupations to the total—was 7.6 million ICT workers in 2008 (5% of all jobs). BLS expects ICT occupations to grow by more than one million jobs nationally from 2008-2018, representing nearly 14% growth and close to 275,000 annual new and replacement jobs over the ten-year period. These impressive statistics are especially relevant because California expects to benefit from a disproportional share of this growth.

Figure 9: National ICT Occupational Employment (BLS)



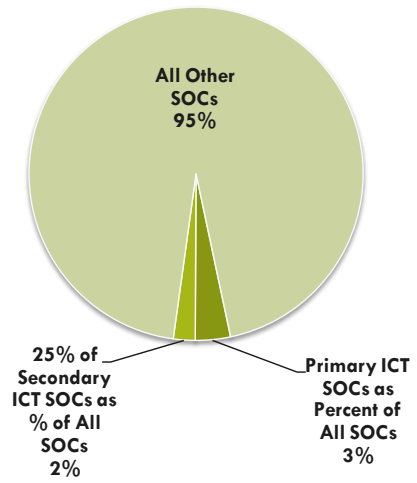
Source: Bureau of Labor Statistics, 2008-2018 estimates.

California Employment Statistics

According to EDD, there were 546,700 Primary ICT workers (3% of all workers) and 1,417,900 Secondary ICT workers (8% of all workers) in 2006, yielding an estimated aggregate of more than 900,000 ICT workers in California (5% of the total workforce). EDD expects this number to exceed one million by 2016. This nearly 21% growth does not include the replacement of existing workers. EDD projects that there is a need for 40,200 new and replacement workers each year in ICT occupations throughout the state.

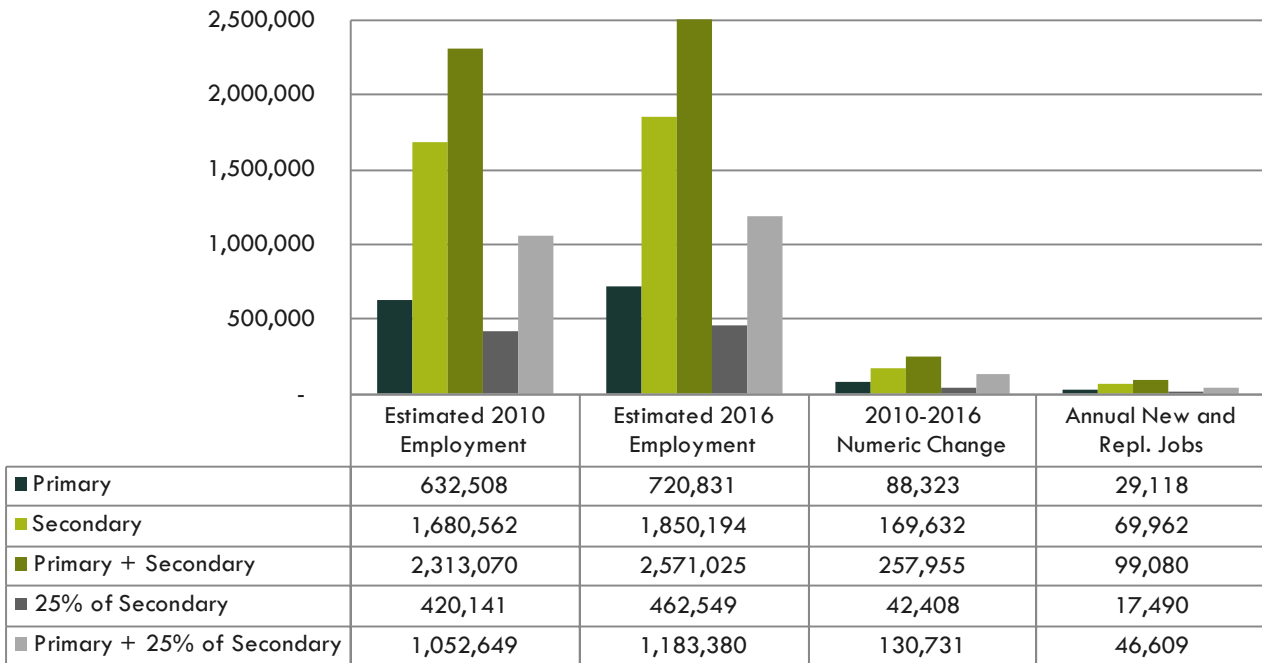
EMSI estimates even more robust employment in ICT fields, reporting 2010 employment in Primary ICT occupations at more than 632,500 (3% of all jobs) and more than 1,680,500 positions in Secondary occupations (8% of all jobs) for an estimated aggregate of about 1,052,625 workers (5% of all jobs). EMSI reports an expected growth to 1,183,380 (720,831 primary occupations), with more than 46,600 new and replacement jobs annually through 2016.

Figure 10: California ICT Occupations % of Occupational Employment



Source: EMSI 2010 Complete Employment

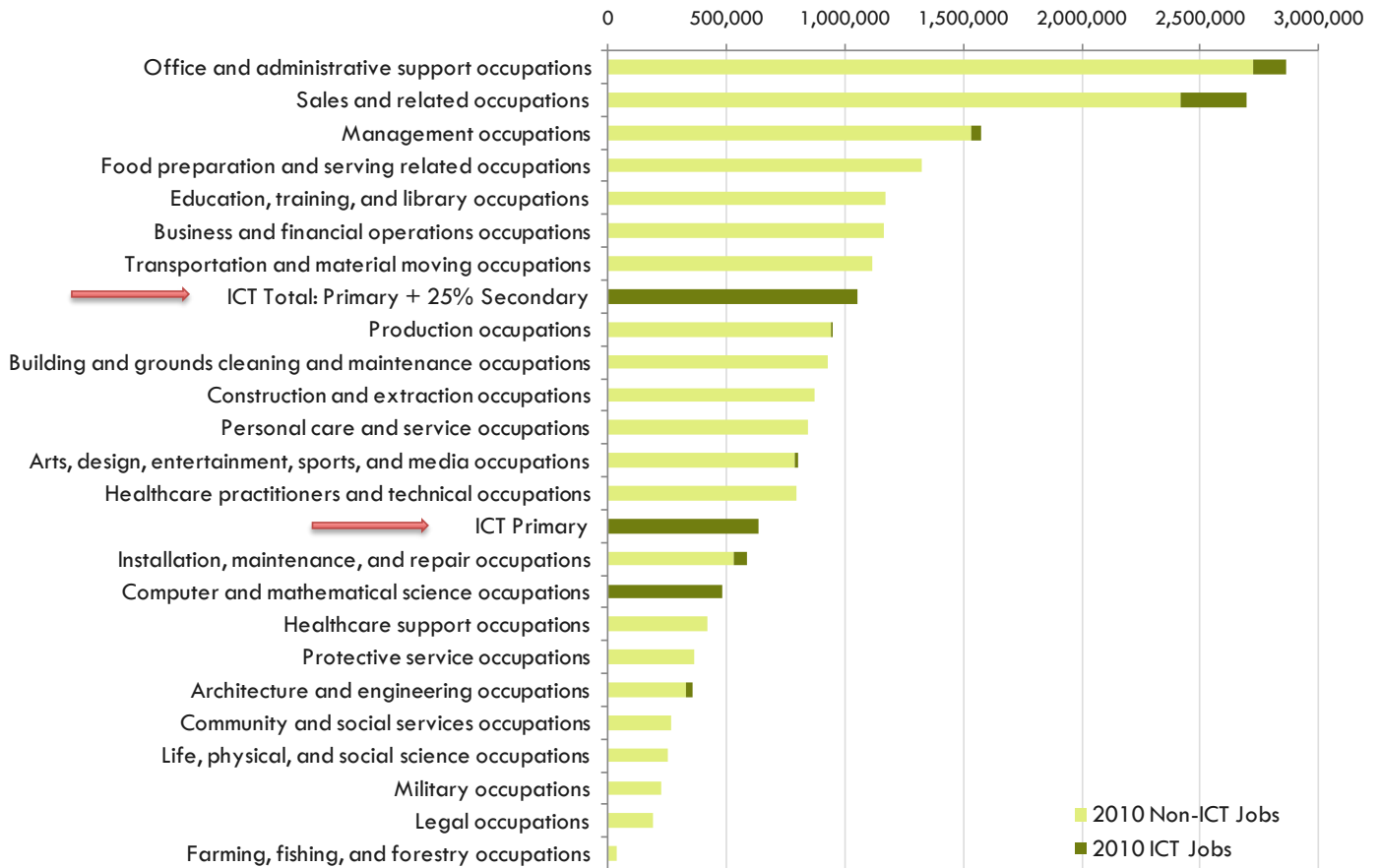
Figure 11: ICT Occupational Projections for California (EMSI)



Source: EMSI 2010 Complete Employment

Traditional U.S. research focuses on “Computer and Mathematical Science Occupations” as a job cluster like ICT, but as Figure 12 illustrates, ICT occupations represent double that employment, meaning that there are more workers in ICT related occupations outside that traditional category than within it. In fact, ICT occupations rank 8th in California by 2010 employment; whereas Computer and Mathematical occupations rank 17th.

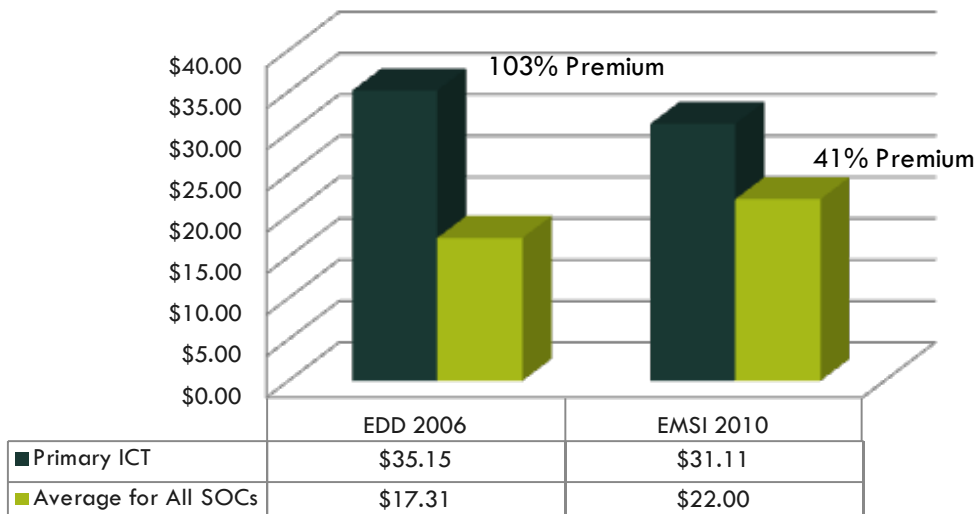
Figure 12: California Occupational Employment Totals, 2010
 Ranking of Occupational Groups by Size



Source: Employment Development Department

Finally, Primary ICT median hourly wages were estimated at \$35.15 by California EDD in 2006, more than twice the overall median of \$17.31 for all occupations in the state. EMSI estimated Primary ICT median hourly wages in 2010 at \$31.11, 41% higher than the \$22 per hour median for all jobs.

Figure 13: Median Wages for ICT Occupations in California



Source: EMSI 2010 Complete Employment and California EDD

Employer Needs and Challenges

The more than 600 employers surveyed by the Centers of Excellence provided detailed feedback regarding their preferences, difficulties, requirements, and attitudes about ICT in the workplace.

ICT Skills in the Workplace

Employers were asked about the ICT skills required by their workers. The questions focused specifically on the types of skills that are most important to employers, whether these skills are growing in importance, and what percentage of their employees require these skills. Regarding the specific skills:

- Across the various classifications of firms, technical competence specific to the position is the most important skill area for new ICT-related hires.
- Approximately two in three employers cited interpersonal communication skills and creative problem-solving skills as the most important for new hires.
- Generally, smaller employers and ICT firms were more likely to cite the importance of technical skills.
- 85% of companies require at least some employees to have at least some of the described ICT skills.
- 74% of firms agree or strongly agree that ICT skills will grow in importance for their employees.
- ICT skills are more important to ICT-related than non-ICT-related firms and to larger than smaller firms.

Skills needed by Individuals in ICT Occupations...

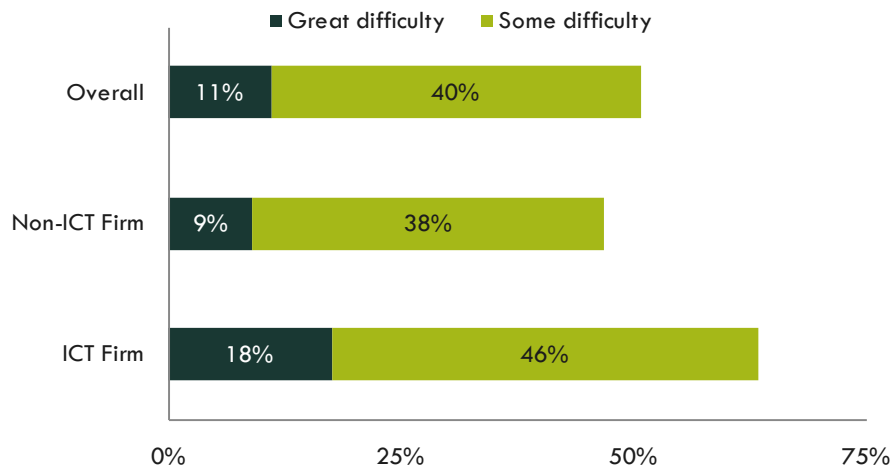
- Technical competence specific to the position
- Interpersonal communication skills
- Creative problem-solving skills
- Ability to work with different groups or departments
- Technical writing skills...

Difficulties in Recruitment and Retention

The surveyed firms reported some difficulty recruiting employees with appropriate ICT skills, as indicated in Figure 14 below. Employers also reported moderate difficulty retaining employees with ICT skills.

- Approximately 50% of firms report difficulty recruiting ICT workers with appropriate skills (11% reported great difficulty).
- ICT firms report difficulty with recruitment at much higher rates than non-ICT firms.
- Approximately 30% of firms report difficulty retaining ICT employees.
- ICT firms and Bay Area firms report greater difficulty retaining ICT employees.
- Across all firms, 47% report difficulty finding competent and reasonably priced ICT consultants, temporary employees, and external services.

Figure 14: Difficulties in Recruitment



Education Preferences

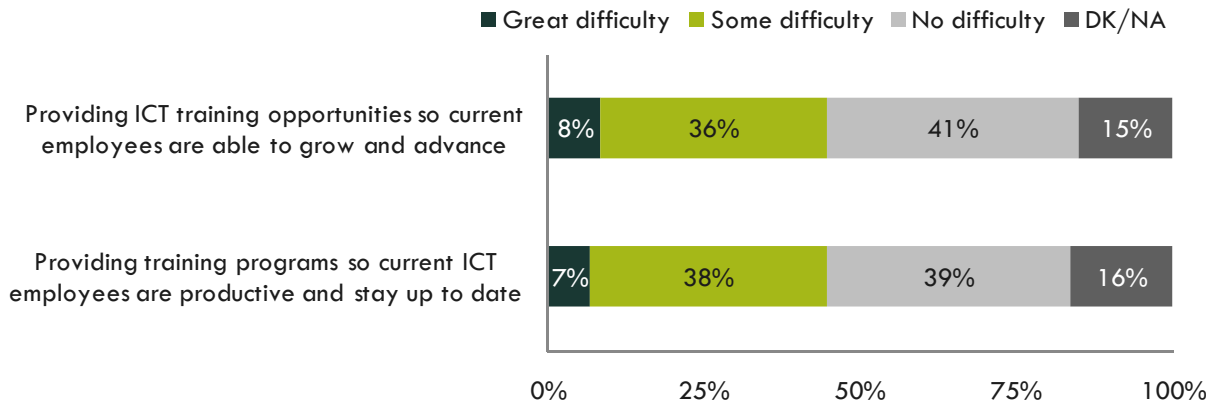
Employers were also asked about the level of education of their ICT employees. Generally:

- Non-ICT firms are much less likely to require a 4-year degree for ICT-related job roles.
- Larger firms are more likely to require a 4-year degree for ICT-related job roles.
- Half of California companies do not require at least a bachelor degree for at least half of their ICT workforce.

Firms also indicated that they did not face significant challenges in keeping their employees up to date with new skills, as illustrated in Figure 15.

- 41% of firms report no difficulty and only 8% of firms report great difficulty finding and providing training programs so current ICT employees are able to grow and advance within the company.
- 39% of firms report no difficulty and only 7% of companies report great difficulty finding and providing training programs so current ICT employees are productive and stay up to date.

Figure 15: Finding and Providing Training Programs for ICT Employees



“Our company is already highly dependent on ICT and is moving toward even greater reliance on computer/ internet-based interaction with our customers.”

— Participant Response,
Centers of Excellence Employer Survey

Employer Preferences for Credentials and Standards

A majority of firms surveyed indicated a preference for industry-wide standards. Figure 16 reveals the differences based on geography, industry, size, and compares ICT versus non-ICT firms. As shown in Figure 17, about half of all firms and 58% of ICT firms indicated desire for a digital literacy or end-user credential.

Figure 16: Development of Statewide ICT Standards

Align Employer Needs with Education and Training Programs – Agree or Disagree?

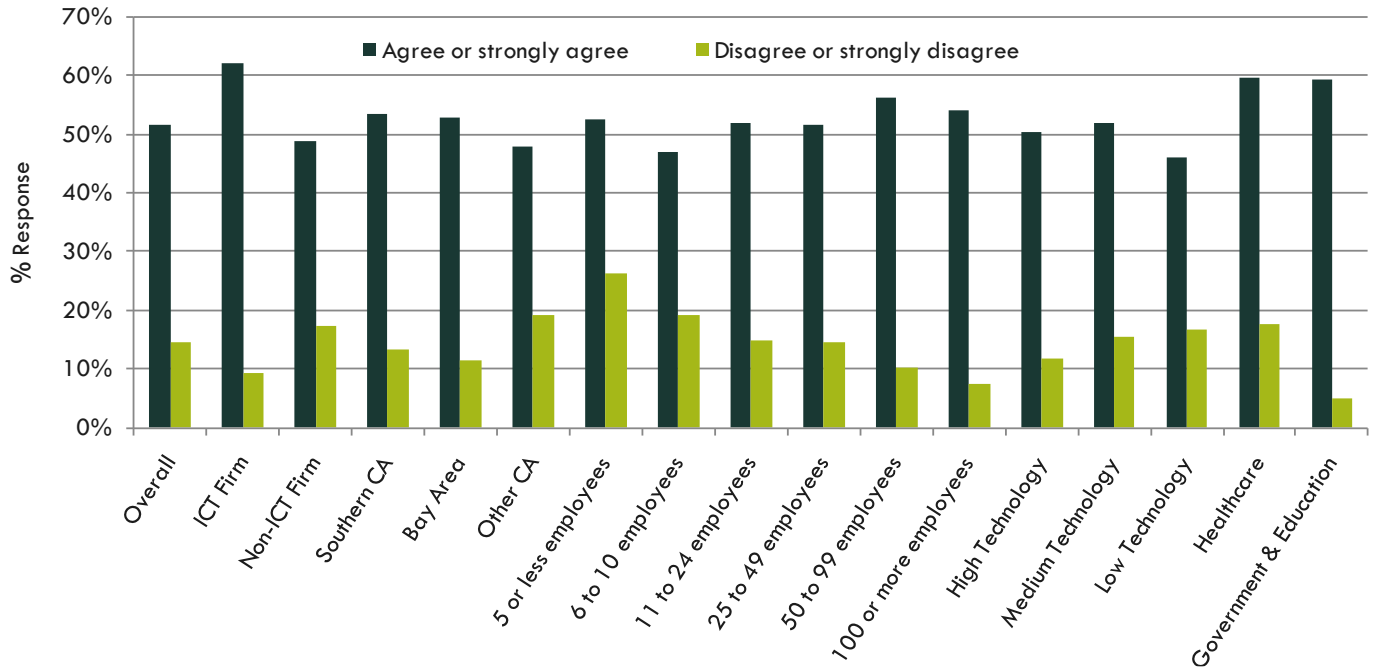
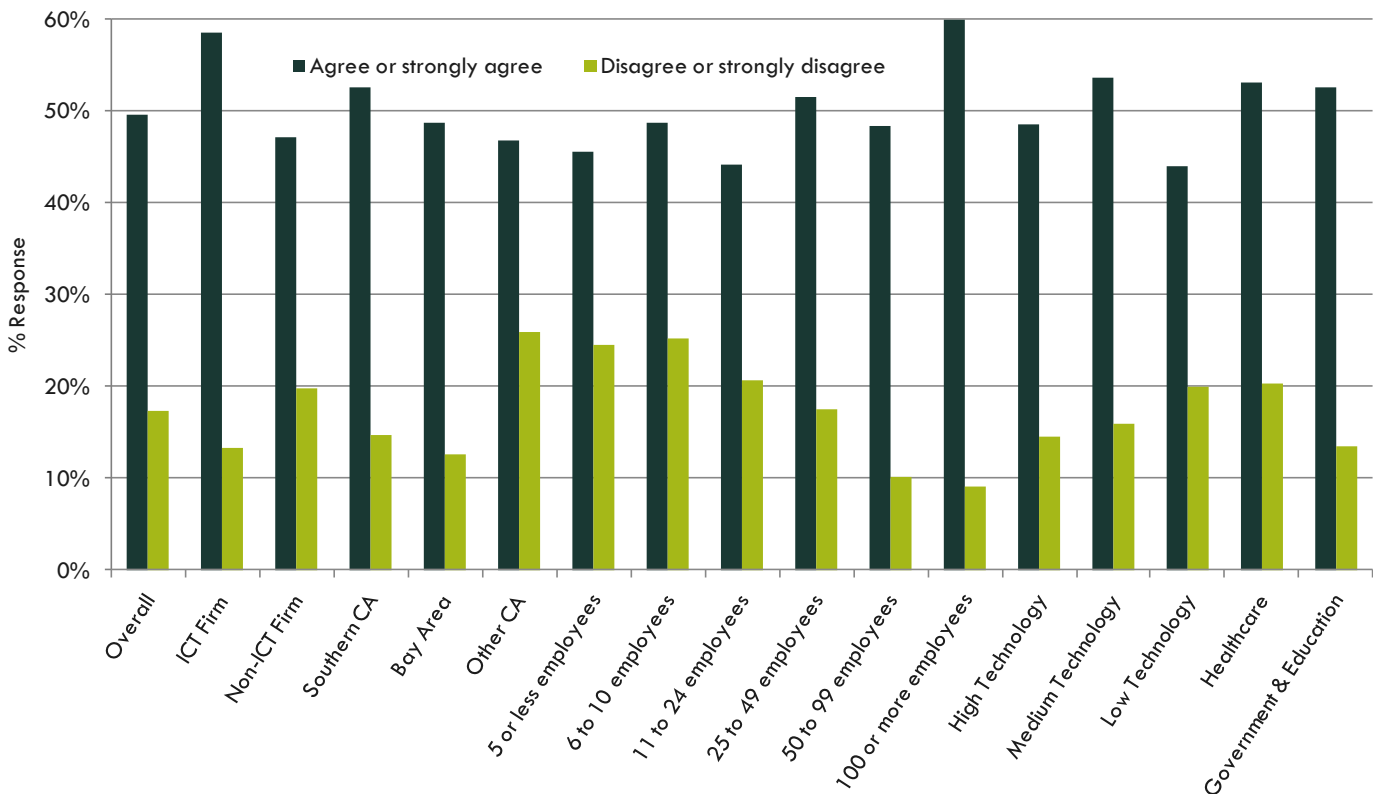


Figure 17: ICT/Digital Literacy Credential

Employers Value a Credential Certifying Basic ICT User Knowledge and Skills – Agree or Disagree?



Conclusions

In the information and knowledge economies of the 21st century, all kinds of organizations and individuals increasingly depend on computer, information and communications technologies for productivity, efficiency, connectivity and growth.

The U.S. still has a mostly fragmented view of the technology, industry and occupational clusters related to these rapidly emerging, evolving and converging fields. Much of the rest of the world collects and analyzes data for one large, umbrella cluster, a superset term capturing all of these inter-related and interdependent fields: Information and Communications Technologies (ICT).

In doing so, other countries better understand ICT technologies, industries, and occupations, and therefore may be more likely to have implemented strategic public and educational plans and policies to advance ICT. The effectiveness of those efforts may be contributing to the ongoing slide of the U.S. in various international ICT rankings. This study of industries, occupations and employers using the ICT framework clearly shows that ICT is strategically important in California.

ICT industries include about 4% of companies, 6% of private sector revenues, 4% of workers and 12% of private sector wages in California, with much higher job growth and compensation expected than for most other industries or the nation as a whole.

A major finding of the primary research conducted for this report is that ICT firms in California anticipate 8.5% employment growth over the next two years – despite flat to negative job growth anticipated for non-ICT firms. However, even though non-ICT firms expect flat job growth, they expect a 3.7% increase in ICT jobs at their firms over the same period.

Community colleges can use the data found in this report to make decisions about ICT program development. This report clearly indicates that there are strong ICT job and career prospects for students with advanced training and degrees and for applied technologists without advanced degrees. In addition, about half of the employers surveyed reported difficulty recruiting ICT workers with the appropriate skills.

Community colleges need to do a better job of raising the visibility of their ICT-related programs with employers. There is support from California companies for a common framework or set of standards mapping ICT workforce needs and jobs to education and training credentials. There is also support for a credential certifying basic ICT User, or digital literacy competency in California.

California's community colleges should use the information in this report to develop and implement strategic plans to align education and training programs to the ICT framework in order to prepare students for employment in these vibrant fields. Colleges should seek assistance from their local employer community and from organizations such as MPICT to assist them in developing appropriate programs to meet the needs of the 21st century ICT workforce.

The Centers of Excellence will contribute additional research for colleges to use in their planning process as Phase Three ICT reports are completed. These upcoming reports will focus on regional labor market occupational studies, including detailed wage information, growth forecasts, academic program offerings, and more specific recommendations for community college program development.

To meet its economic needs and maintain its technology and competitive leadership, California must educate and train a current and future workforce that meets the requirements of all businesses and industries for ICT, not just provide training for the more traditional IT companies. California's community colleges are perfectly positioned to achieve this goal because of their status as the primary provider of workforce education and training to California's businesses and industries.

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A: How to Utilize this Report

This report is designed to provide current industry data to:

- Define potential strategic opportunities relative to an industry's emerging trends and workforce needs;
- Influence and inform local college program planning and resource development;
- Promote a future-oriented and market responsive way of thinking among stakeholders; and,
- Assist faculty, Economic Development and CTE administrators, and Community and Contract Education programs in connecting with industry partners.

The information in this report has been validated by employers and also includes a listing of what programs are already being offered by colleges to address those workforce needs. In some instances, the labor market information and industry validation will suggest that colleges might not want to begin or add programs, thereby avoiding needless replication and low enrollments.

About the Centers of Excellence

The Centers of Excellence (COE), in partnership with business and industry, deliver regional workforce research customized for community college decision making and resource development. This information has proven valuable to colleges in beginning, revising, or updating economic development and Career Technical Education (CTE) programs, strengthening grant applications, assisting in the accreditation process, and in supporting strategic planning efforts.

The Centers of Excellence Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The Centers aspire to be the premier source of regional economic and workforce information and insight for California's community colleges.

More information about the Centers of Excellence is available at www.coecc.net.

Important Disclaimer

All representations included in this report have been produced from primary research and/or secondary review of publicly and/or privately available data and/or research reports. Efforts have been made to qualify and validate the accuracy of the data and the reported findings; however, neither the Centers of Excellence, COE host District, MPICT, nor California Community Colleges Chancellor's Office are responsible for applications or decisions made by recipient community colleges or their representatives, or others, based upon components or recommendations contained in this study.

B: Survey Methodology

The table below provides a brief overview of the methodology utilized for the project.

Table 1 Overview of Project Methodology

Method	Telephone and Web Survey of California Employers with 5 or more Employees as defined by InfoUSA
Number of Participants	602 Firms Completed a Survey (312 Online; 290 by Phone)
Field Dates	April 13 – May 28, 2010
Survey Universe	473,521 California Employers with 5+ Employees available in the InfoUSA database as of April 9, 2010
Margin of Error	The maximum margin of error for questions answered by all 602 respondents is +/-3.99% at the 95% level of confidence.

Research Objectives

Prior to beginning the project, BW Research met with the MPICT, the Centers of Excellence, and Green LMI to determine the research objectives for the study. Viewed broadly, the main research objectives of the study were to:

- Evaluate employers current demand for ICT skills and their expectations for these skills from workers in the future;
- Assess interest and perceived importance of different ICT programs and potential solutions for workforce development within California;
- Understand the current workforce needs of California employers particularly as they relate to recruiting and developing employees with the appropriate ICT skill sets; and
- Develop a profile of California Employers, in different industry categories, regions within the state and size as it relates to the demand and expectations for ICT related skill sets.

Questionnaire Design

Through an iterative process, BW Research worked closely with the Centers of Excellence, Green LMI, and MPICT to develop a survey instrument that met all the research objectives of the study. In developing the instrument, BW Research utilized techniques to overcome known biases in survey research and minimize potential sources of measurement error within the survey.

Sampling Method

A mixed-method approach (telephone and web) was utilized to interview a representative sample of businesses from California with at least five employees. A database of all known firms matching the study parameters was provided by the Centers of Excellence and represents the universe for the study of (473,521 firms). The universe of firms was stratified based on size, region, and industry. Below are the classification structures for each of the employer categories.

Employer size:

- Small employers = 5 to 24 employees.
- Medium sized employers = 25 to 99 employees.
- Large employers = 100 or more employees.

Region:

- Southern California includes San Diego, Orange, and Los Angeles counties.
- Bay Area includes Santa Clara, San Mateo, San Francisco, Marin, Napa, Sonoma, Solana, Contra Costa, Alameda, Monterey, and Santa Cruz counties.
- Other includes all other counties in California except those identified in Southern California and the Bay Area.

Industry:

Each employer was categorized into one of five general industry classifications based on their two-digit NAICS code. The five general industry classifications are provided with some examples of what industries were included. Quotas were utilized during data collection to ensure representation of firms by employer size, region, and industry classification.

- High technology (professional and technical services, information, and higher technology manufacturing)
- Medium technology (utilities, transportation and warehousing, all other manufacturing, and management of companies)
- Low technology (retail and accommodations and food services)
- Healthcare
- Government and Education.

Data Collection

The mixed-method data collection was comprised of both an online survey (312 completes) followed by a telephone survey (290 completes) of employers. The mixed-method data collection was implemented to ensure a diverse and representative sampling of different sized employers as well as employers from a broad array of industries.

Prior to beginning telephone data collection, BW Research conducted interviewer training and also pre-tested the survey instrument to ensure that all the words and questions were easily understood by respondents. Telephone interviews were generally conducted from 9:00 am to 4:30 pm Monday through Friday. Callbacks were also scheduled at respondents' convenience.

The web version of the survey was distributed through electronic online panels to a sample of California employers with a general invitation to complete a survey. After the web surveys were completed, the sample was reviewed and those employers that were under-represented became the focus of the phone survey to ensure a representative sample of employers.

The data collection period was April 13 through May 28, 2010.

A Note about Margin of Error and Analysis of Sub-Groups

The overall margin of error for the survey, at the 95 percent level of confidence, is between +/- 2.40 percent and +/- 3.99 percent (depending on the distribution of each question) for questions answered by all 602 respondents.

It is important to note that questions asked of smaller sub-groups (such as questions only asked of firms with ICT employees) or analysis of sub-groups (such as differences by industry) will have a margin of error greater than +/-3.99 percent, with the exact margin of error dependent on the number of respondents within each sub-group as well as the distribution of responses.

Five subgroups were created of companies responding to the survey: 1) High Tech, 2) Medium Tech, 3) Low Tech, 4) Healthcare, and 5) government and education by using the following mapping of 2 digit NAICS codes of respondents to subcategory.

For more information on the employer survey, please contact the COE or MPICT authors.

Industry Description	2 - Digit NAICS	Subcategory
Agriculture	11	3
Mining	21	2
Utilities	22	2
Construction	23	3
Manufacturing	31	2
Manufacturing (Higher technology)	32	1
Manufacturing	33	2
Wholesale trade	42	2
Retail	44	3
Retail	45	3
Transportation & Warehousing	48	2
Transportation & Warehousing	49	2
Information	51	1
Finance & Insurance	52	2
Real Estate, Rental & Leasing	53	3
Professional, Technical Services	54	1
Management of Companies	55	2
Admin, Waster	56	2
Education	61	5
Health Care	62	4
Arts, Entertainment & Rec.	71	3
Accommodation & Food Services	72	3
Other Services	81	3
Public Administration	92	5

C: ICT Industry Data

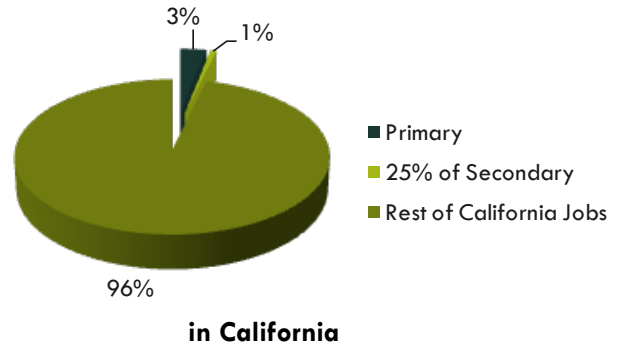
ICT Firms in California

Primary ICT Industries represent approximately 35,000 companies throughout the state, or 3% of all companies in California. Secondary industries represent at least 40,000 additional companies in the state. Because this report conservatively allocates only 25% of secondary firms to ICT, the total estimated aggregate of ICT firms in California is 46,000, or about one in every thirty companies in California.

Comparing the data with other industries in California illustrates the importance of ICT to the state's economic development. Primary ICT companies rank 13th and Primary plus 25% of Secondary ranks 12th among California industries.

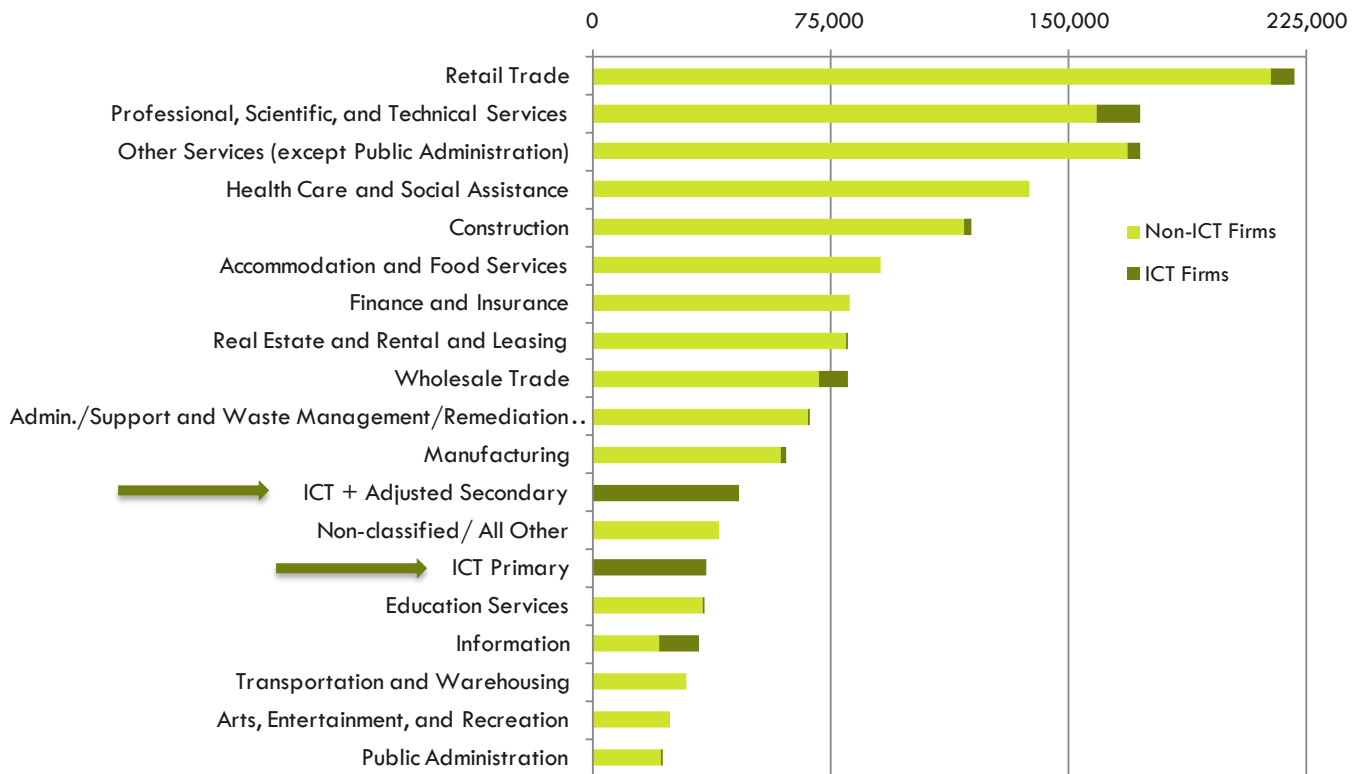
Traditional research efforts limit ICT to a category called "Information," which includes many ICT firms, but also includes print, standard broadcasting, and other non-ICT firms. As illustrated in Figure 19, though ICT makes up a large percentage of "Information" companies, it is much larger and broader when considered as a cluster than Information alone. (Red shading indicates ICT companies included in business counts).

Figure 18: ICT Industry Employment



Source: InfoUSA, 2008

Figure 19: Industry Ranking by Number of Firms



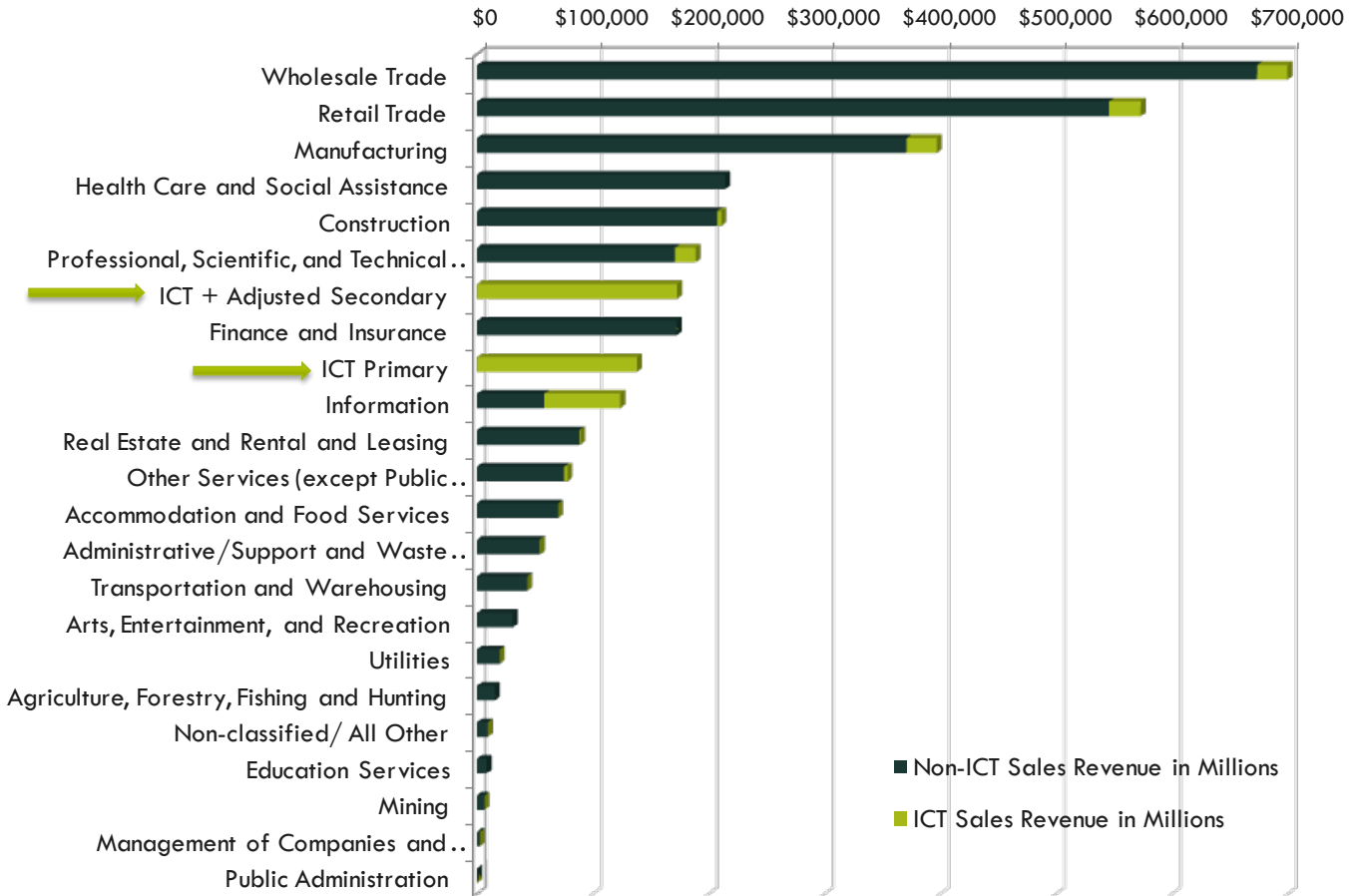
*not including industries with less than 10,000 firms

Source: InfoUSA, 2008.

ICT Industry Sales Revenue

According to InfoUSA, Primary ICT industries reported nearly \$138 billion in Sales Revenue in 2008, or about 5% of roughly \$3 trillion total California revenue. Secondary ICT firms added \$139 billion, another 5%. Again employing a 25% factor for Secondary firms, the aggregate estimated sales revenue for ICT in California is nearly \$173 Billion, about 6% of revenue for the state. Adopting a conservative approach, ICT roughly ties as the sixth largest industry sector in the state by sales revenue (with Professional, Scientific, and Technical Services).

Figure 20: Industry Ranking by Sales Revenue



Source: InfoUSA, 2008.

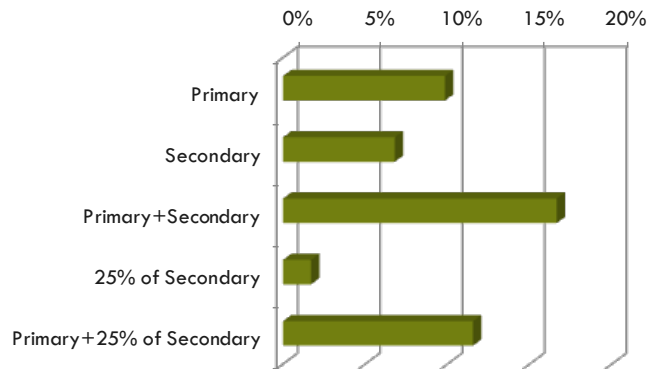
Figure 20 shows that ICT is considerably larger than the Information industry (the traditional ICT point of reference) by sales revenue as well. In fact, ICT is approximately 28% larger than the Information sector. When ICT firms are stripped from Information, ICT is approximately three times larger.

Wage Data

According to the California EDD, Primary ICT firms employed over 596,532 workers and paid over \$65 billion in wages in 2008. EDD estimates that Secondary ICT firms employ over 550,000 workers and nearly \$45 billion in wages. Again using the 25% estimates, the estimated aggregate total employment of ICT industries is 734,700.

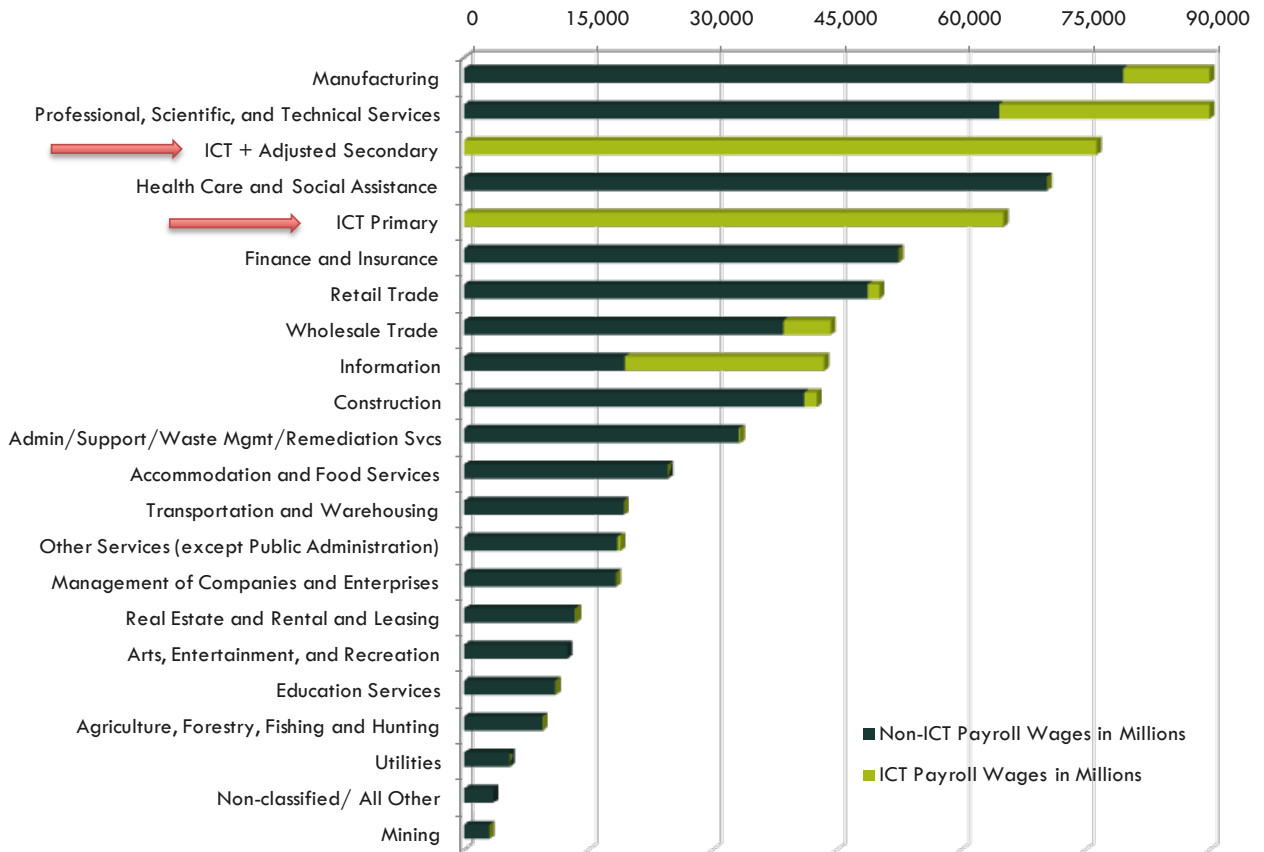
ICT wages paid are the third largest cluster in the state according to California Employment Development Department wage information, just behind Manufacturing and Professional, Scientific, and Technical Services. When the ICT data is removed from those categories, however, ICT jumps to the second position in the state.

Figure 21: ICT Industry % of California Wages



Source: California EDD, 2008 Estimates.

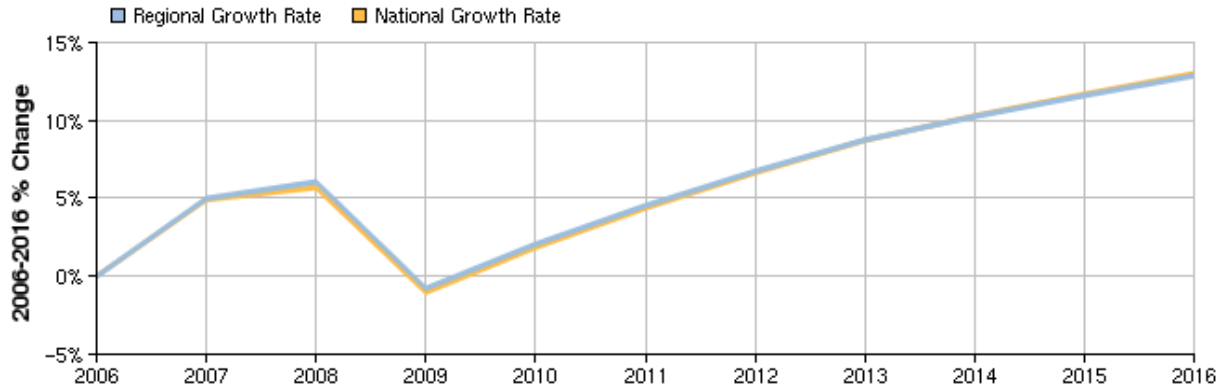
Figure 22: Industry Ranking of California Wages



Source: California EDD, 2008 Estimates

2006 – 2016 Industry Snapshots

Figure 23: Primary ICT Industry Job Growth

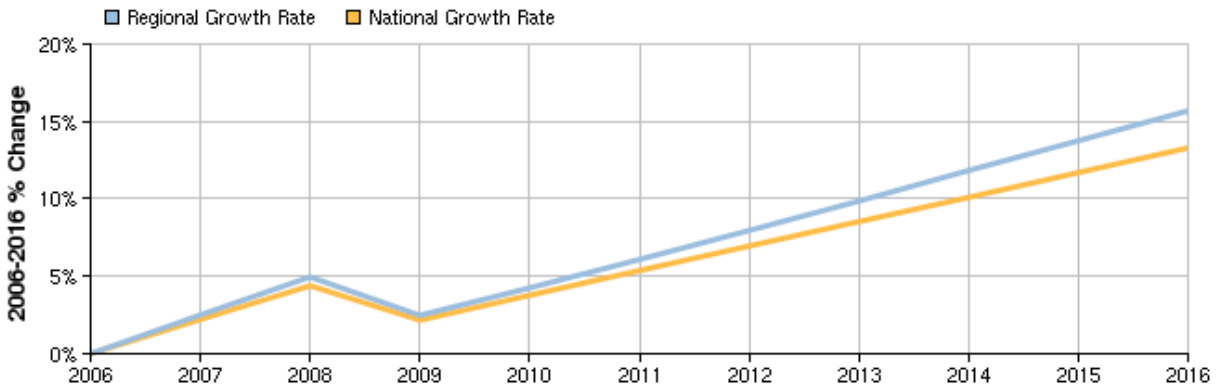


Primary ICT Industries Job Change Summary

Primary ICT	2006 Jobs	2016 Jobs	Change	% Change	Current EPW	2008 Establishments
Regional Total	649,223	774,510	125,287	19%	\$116,090	36,831
National Total	4,400,647	5,068,545	667,898	15%	\$91,344	324,061

Source: EMSI Complete Employment - 1st Quarter 2010; EPW – Earnings per Worker

Figure 24: Secondary ICT Industry Job Growth



Secondary ICT Industries Job Change Summary

Secondary ICT	2006 Jobs	2016 Jobs	Change	% Change	Current EPW	2008 Establishments
Regional Total	718,573	869,374	150,801	21%	\$86,224	50,619
National Total	4,661,373	5,434,900	773,527	17%	\$73,631	344,938

Source: EMSI Complete Employment - 1st Quarter 2010

Combined ICT Industry Job Growth

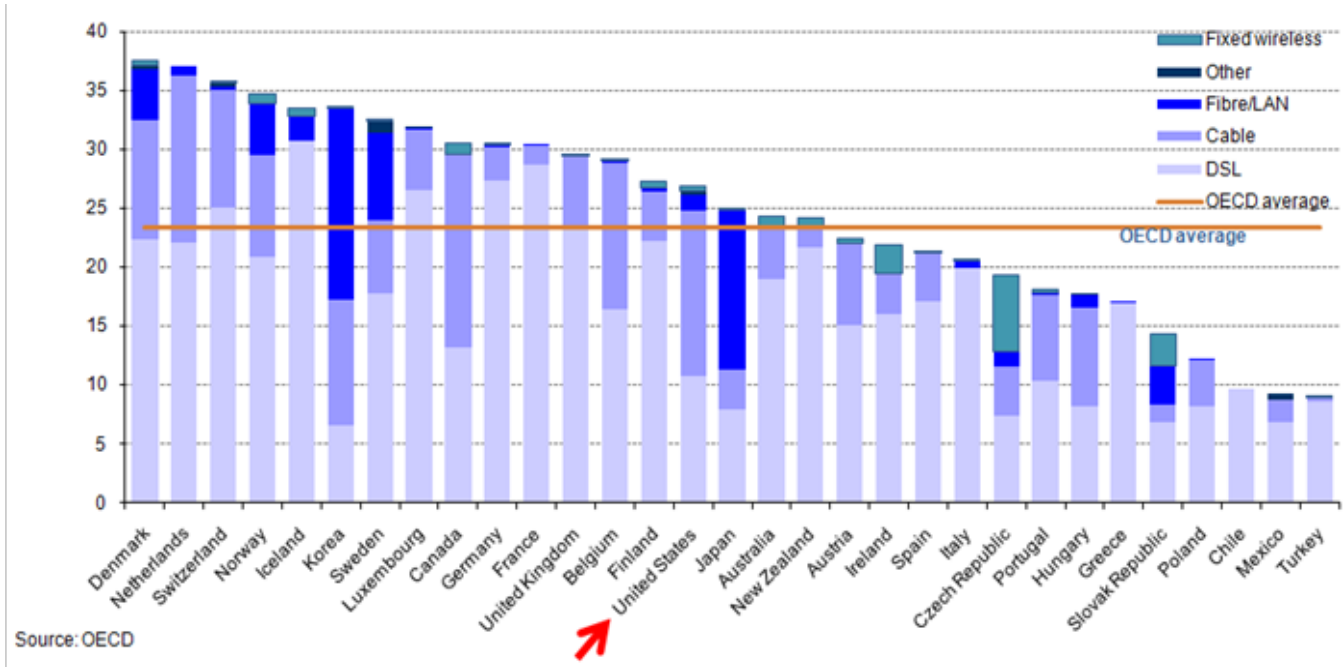
Combined ICT	2006 Jobs	2016 Jobs	Change	% Change	Current EPW	2008 Establishments
Regional Total	828,866	991,854	162,987	20%	\$109,617	49,486
National Total	5,565,990	6,427,270	861,280	15%	\$87,635	410,296

Source: EMSI Complete Employment - 1st Quarter 2010

D: Global ICT Trends

The United States is rapidly losing ground to many international competitors in regards to ICT infrastructure development and user adoption. According to the Organisation of Economic Co-Operation and Development (OECD), the United States has fallen to 15th in the world in per-capita broadband subscriptions.¹⁰

Figure 25: Broadband Subscribers Per 100 Inhabitants
December 2009



In a 2010 study by the International Telecommunications Union, the United States was reported to have dropped to 19th in ICT Development (from 17th in 2007 and 12th in 2002), behind many European nations, Korea, Japan, Singapore, and New Zealand.¹¹

Figure 26: ITU Ranking of Broadband Development

Economy	Rank 2008	IDI	Rank 2007	IDI 2007
Sweden	1	7.85	1	7.27
Luxembourg	2	7.71	6	6.98
Korea (Rep.)	3	7.68	2	7.23
Denmark	4	7.53	3	7.18
Netherlands	5	7.37	5	7.06
Iceland	6	7.23	4	7.06
Switzerland	7	7.19	8	6.83
Japan	8	7.12	7	6.89
Norway	9	7.11	9	6.78
United Kingdom	10	7.07	12	6.70

¹⁰ The Organisation for Economic Co-Operation and Development Broadband Portal, online at: www.oecd.org/dataoecd/22/43/39574979.xls and www.oecd.org/dataoecd/10/53/39/575086.xls

¹¹ The International Telecommunications Union, “Measuring the Information Society – The ICT Development Index,” 2010 Edition.

Economy	Rank 2008	IDI	Rank 2007	IDI 2007
Hong Kong, China	11	7.04	10	6.78
Finland	12	7.02	11	6.70
Germany	13	6.95	13	6.60
Singapore	14	6.95	15	6.47
Australia	15	6.90	14	6.51
New Zealand	16	6.81	16	6.38
Austria	17	6.72	19	6.25
France	18	6.55	22	6.09
United States	19	6.54	17	6.33
Ireland	20	6.52	20	6.14

Source: The International Telecommunications Union, 2010.

Recent data show ICT venture capital in the U.S. has held up moderately well, and the share of ICT in total venture capital remains stable at around 50% (down from more than 75% at its peak in the dot-com bubble). However, according to the Organisation of Economic Co-Operation and Development (OECD), “US ICT venture capital declined substantially in current terms to around USD 1.5 billion in the first quarter of 2009 from close to USD 3 billion in the last quarter 2008. The current level of venture capital investments in ICT is almost as low as it was in 1996.”¹² Figure 27 on the following page shows this investment pattern in more detail.

According to OECD, these venture capital investments indicate the continuing importance of ICT as a promising source of innovation and growth despite the downturn, and this importance is expected to continue — although with some shifts, particularly towards ICT-intensive clean technologies.¹³

The global community has also surpassed the United States in its ability to understand and respond to the changes in the ICT workforce. For example, Australia and New Zealand have been collaborating for several years to classify ICT occupations in each country appropriately. This approach, led by the Australian Bureau of Labor Statistics, has created new standard occupational classifications for ANZSCO, the official workforce reporting mechanism of Australia and New Zealand and the equivalent to our Bureau of Labor Statistics.¹⁴ Armed with these classifications, other nations and their investment communities are able to quantify their ICT industries and workforce to a degree of accuracy not available in the United States. Recognizing their size and strategic importance, these nations focus policy-making attention and educational system efforts to improve ICT infrastructure, industry performance, and workforce knowledge and skills.

¹² The Organisation for Economic Co-Operation and Development, “The Impact of the Crisis on ICTs and their Role in the Recovery,” August 2009.

¹³ *Id.*

¹⁴ Hunter, David, “The Classification of ICT Occupations: The Approach Proposed for the Australian and New Zealand Standard Classification of Occupations (ANZSCO),” Australian Bureau of Labor Statistics, 2004.

Figure 27: Venture Capital Investments (ITU)

