Human Capital in the Bay Area

Why an Educated, Flexible Workforce Is Vital to Our Economic Future

February 2008

Bay Area Council Economic Institute


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A Bay Area Council Economic Institute Report

prepared by Jennifer Susskind, MCP and Cynthia Kroll, PhD

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Human Capital in the Bay Area

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Introduction

Human capital, commonly understood as the collective level of education, skill and experience of a region's labor force, is one of the most fundamental building blocks of high-value-added economies. Since the much-publicized loss of manufacturing jobs in the second half of the twentieth century, American workers have found that the key to success lies not only in what goods and services they can produce, but in what they can offer the global economy in terms of innovation, problem-solving, design, marketing, academics, strategy, consulting and management. Robert Reich claims, "Any job that's slightly routine is disappearing from the U.S."[1] This does not necessarily mean a net loss of employment in the U.S., but suggests that new jobs could replace older forms of employment. In order to successfully participate in these "new" jobs, workers will have to retrain, re-skill and become more educated than ever before.

Some economists use the term "knowledge economies" to describe those economies that rely on human capital as a source of competitiveness. The Bay Area has been a leader in science, technology, research and innovation. World-renowned universities, such as Stanford and the University of California (UC) campuses at Berkeley, San Francisco, Santa Cruz and Davis, draw international talent into the region. A culture of tolerance, appreciation of diversity and the arts draws others. Many who benefit from the universities and come for the social and natural amenities in the region remain and return the favor by starting new companies, creating new inventions and increasing productivity.

Bay Area residents in many cases appear ready to meet the challenges of the knowledge economy. The population is, overall, more educated and more capable of participating in the global economy than ever before. Furthermore, while some educated Bay Area residents move to other areas of the country to take advantage of lower home prices and a lower cost of living, a higher number of educated residents move into the Bay Area each year. The Bay Area is also home to many ethnic and immigrant communities. This unique mix of diverse perspectives, skills and intellectual capacity positions the region to perform well now and in the future.

Despite these promising attributes, real human capital challenges remain. The Bay Area's public primary and secondary schools perform unevenly. While there are excellent public schools in the Bay Area, the region is situated in a state that is 29th in the country in spending per pupil.[2] Limited funding hampers some school districts' ability to prepare graduates for entry-level employment opportunities, vocational training programs, colleges and universities. Moreover, due to the high cost of living, many working-class families have left the Bay Area. Some employers of entry-level and mid-level workers have expressed concern over what they perceive to be a shortage of candidates with basic skills.

There is also a real risk that industry will relocate or resist locating in the Bay Area due to the high cost of living, growing commute times, stratospheric housing costs and deficiencies in

[1] Robert B. Reich. "Nice Work If You Can Get It." *The American Prospect Online*. (December 26, 2003). http://www.prospect.org/cs/articles?article=_nice_work_if_you_can_get_it (accessed February 27, 2006).

[2] NEA Research Databank. http://www.nea.org/edstats/images/05rankings-update.pdf

the public school system. Employers of mid-skilled workers with high school and associate's degrees may be particularly at risk.

This report analyzes indicators of human capital in the Bay Area, and identifies what is unique or distinctive about Bay Area workers. Particular attention is given to the supply and demand for workers in the high-tech industries that help steer the vibrant Bay Area economy.

Section I evaluates projected job growth in the Bay Area and considers the region's increasing demand for knowledge workers (and for entry-level unskilled workers).

Section II uses U.S. Census data (in particular, the Public Use Microdata Sample or PUMS) to analyze Bay Area occupations and industries, and to determine the educational attainment levels of Bay Area residents within these industries. Comparing the Bay Area to other regions in the United States that are known for their high-tech industries, our analysis shows that educated workers are more widely distributed throughout Bay Area occupations and within Bay Area industries, and that this phenomenon is due in part to the region's high degree of industrial specialization and in part to a particularly large supply of talent in certain fields. In either case, the high levels of human capital within the Bay Area should continue to be attractive to knowledge-based firms wishing to locate in the region.

Section III looks at population demographics and demonstrates that when compared to other benchmark regions, Bay Area residents are highly educated and are particularly well situated to participate in the global economy due to linguistic and cultural diversity. Section IV addresses the question of whether or not Bay Area educational attainment levels are homegrown or imported, and concludes that many of our most educated residents come from outside the Bay Area, and indeed, outside the United States. Section V considers the role of Bay Area K–12 schools and the role of Bay Area institutions of higher learning, such as universities and national research laboratories.

In order to get a more nuanced illustration of Bay Area human capital, Section VI presents case studies from high-tech firms, executive recruiting firms and an independent research laboratory. The case studies result from interviews conducted in the fall of 2006, and address the role of human capital in company location choice, employee recruitment and retention, and the relationship between institutions of higher learning and regional economic competitiveness. The company representatives were asked to identify what it was about Bay Area employees that distinguished them from workers in other U.S. regions and in other countries, and whether these differences influenced their decision to locate or remain in the Bay Area. The case studies also help illustrate the influential role played by a diverse and extremely talented cluster of business leaders who now call the Bay Area home. The studies consider where business leadership comes from and how this endowment contributes to the unique and innovative Bay Area economy.

Finally, Section VII concludes this report and outlines five public policy considerations aimed at ensuring the ongoing competitiveness of the region by strengthening local knowledge institutions and providing a diverse supply of skilled, educated and experienced workers.

Demand For Knowledge Workers

Economists, educators, and policymakers have considered the effects of globalization on the American workplace, and have broadly concluded that the strength of the economy depends on high-value-added jobs and highly educated workers. According to a study conducted by the nonprofit Educational Testing Service, due to increasing demand, the U.S. could see a shortage of 14 million college-educated workers by the year 2020.[3] A California Council on Science and Technology report, produced in 2002, calls for statewide school reform based on changing labor market conditions. According to the report, high-tech is the second largest economic sector in the state and currently has a shortfall of 14,000 workers with bachelor's degrees in science and engineering. California schools do not produce enough science and education graduates to meet industry's growing demand, and to do so they would need to generate 70 percent more graduates at the bachelor's degree level.[4]

In spite of these worrisome findings, not all regions experience a shortage of skilled workers in the same way. For the Bay Area, the demand for highly educated workers has lured many talented job seekers from across the U.S. and globally. The high level of human capital in the region has become self-reinforcing. Bay Area industry demands educated and experienced workers. This demand has led to an influx of skilled workers who, in turn, increase innovation and productivity and develop new knowledge sectors. Eventually, these new sectors require even more talented workers, thus renewing the cycle. Conversely, regions known for low-cost labor tend to attract industries that depend on cheaply produced goods and services.

The following tables forecast the twenty fastest-growing occupations in the Bay Area, and suggest that the region needs an increasing supply of educated and talented workers. The highlighted occupations are those that require extensive education and/or training. It is also noteworthy that the fastest growing occupations, numerically, indicate an increase in low-paying service jobs as well as high-paying skilled occupations. Mid-range salaried jobs do not appear on the list of fastest growing occupations.

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[3] Anthony P. Carnevale and Donna M. Desrochers. "Standards for What: Economic Roots of K–16 Reform." Prepared for the Educational Testing Service (2003). http://www.ets.org/research/publeadpubs.html (accessed March 5, 2006). [Available from http://www.transitionmathproject.org/resources.asp#reports as of Dec. 2007.]

[4] California Council on Science and Technology. "Critical Path Analysis of California's Science and Technology Education System." (April 2002). http://www.ccst.us/publications/2002/2002CPA.php (accessed March 5, 2006).

Projected 20 Fastest Growing Occupations in the Bay Area[a] Based on Annual Percent Change, 2002–2012

SOC Code[b]	Occupation Title (Occupations that require high levels of educational attainment[c] are bolded)[d]	Total Est. Full Time Workers[e]	Yearly Increase	Annual Percent Change
17-2030	**Biomedical Engineers**	490	22	4.58%
19-1022	**Microbiologists**	690	28	4.10%
19-1021	**Biochemists and Biophysicists**	2,080	81	3.90%
19-2031	**Chemists**	2,920	112	3.83%
31-9092	Medical Assistants	9,070	339	3.73%
21-1093	Social and Human Service Assistants	4,690	175	3.73%
15-1081	**Network Systems and Data Communications Analysts**	6,500	241	3.71%
19-2032	**Materials Scientists**	400	15	3.64%
29-1071	**Physician Assistants**	1,040	37	3.53%
39-9021	Personal and Home Care Aides	6,600	217	3.29%
25-2041	**Special Ed., Preschool, Kindergarten and Elementary School Teachers**	2,360	76	3.23%
29-2054	**Respiratory Therapists**	1,980	64	3.23%
29-2021	Dental Hygienists	4,460	139	3.12%
13-2052	**Personal Financial Advisors**	2,780	84	3.04%
31-9091	Dental Assistants	8,910	269	3.02%
15-1061	**Database Administrators**	4,670	140	3.00%
29-2071	Medical Records and Health Information Technicians	2,820	85	3.00%
31-2021	Physical Therapist Assistants	850	25	2.99%
47-2171	Reinforcing Iron and Rebar Workers	1,410	41	2.92%
21-1023	Mental Health and Substance Abuse Social Workers	1,620	47	2.91%

Projected 20 Fastest Growing Occupations in the Bay Area[a] Based on Total Jobs Created, 2002–2012

SOC Code[b]	Occupation Title (Occupations that require high levels of educational attainment[c] are bolded)[d]	Total Est. Full-time Workers[e]	Yearly Increase	Annual Percent Change
41-2031	Retail Salespersons	96,170	1,316	1.37%
35-3021	Combined Food Preparation and Serving Workers	46,860	1,214	2.59%
29-1111	**Registered Nurses**	46,070	1,085	2.36%
41-2011	Cashiers	76,440	1,070	1.40%
35-3031	Waiters and Waitresses	43,190	800	1.85%
15-1031	**Computer Software Engineers, Applications**	35,430	798	2.25%
43-4051	Customer Service Representatives	43,050	789	1.83%
15-1032	**Computer Software Engineers, Systems Software**	25,190	683	2.71%
11-1021	**General and Operations Managers**	57,970	634	1.09%
33-9032	Security Guards	30,990	614	1.98%
47-2031	**Carpenters**	31,590	606	1.92%
37-2011	Janitors and Cleaners, Except Maids and Housekeeping	50,660	516	1.02%
43-9061	Office Clerks, General	78,470	500	0.64%
47-2061	Construction Laborers	22,650	479	2.11%
25-9041	Teacher Assistants	27,200	450	1.65%
31-1012	Nursing Aides, Orderlies, and Attendants	21,400	447	2.09%
43-4171	Receptionists and Information Clerks	28,810	432	1.50%
15-1041	Computer Support Specialists	17,450	431	2.47%
41-1011	First-Line Supervisors/Managers of Retail Sales Work	27,390	428	1.56%
35-2021	Food Preparation Workers	26,960	419	1.56%

a. Bay Area refers to the following nine counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma. Data for some occupations in Sonoma County collected in 2001 and projected to 2008.

b. Six-digit Standard Occupational Code (SOC) designations only.

c. High levels of educational attainment defined as a bachelor's degree or equivalent training and experience. Standard education levels based on U.S. Department of Labor Occupational Outlook Handbook 2006–07.

d. Excludes occupations with 400 people or less and all occupations identified as "other."

e. 2001 or 2002 estimates.

Source: California Employment Development Department: Labor Market Information

Knowledge Industries and Occupations: A Diverse Group

Knowledge Occupations in the Bay Area

The previous section shows that Bay Area industries are continuing to produce new jobs for highly-educated workers. This section shows that educated workers are also highly dispersed within Bay Area occupations and industries. Jobholders in the Bay Area are more educated than workers in the same occupations and industries in other parts of the country. A job in San Francisco, for example, is more likely to be performed by a worker with a bachelor's degree than the same job in another part of the country.

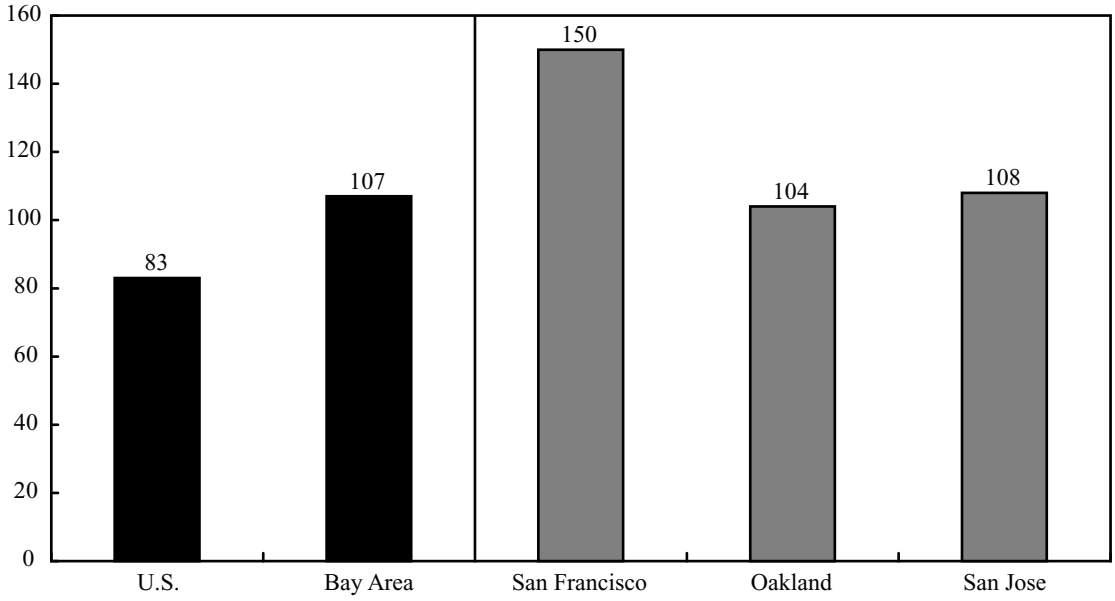
Using Public Use Microdata Sample (PUMS) census data,[5] the following analysis looks at the educational attainment of workers in all reported occupations in the Bay Area,[6] the City of San Francisco, the San Jose Metropolitan Statistical Area (MSA), the Oakland MSA, and the United States. According to this data, there are 107 occupations in the Bay Area (22 percent of all Bay Area occupations) where at least 60 percent of workers have attained at least a bachelor's degree. In San Francisco, for example, workers are employed in 150 occupations where at least 60 percent of the workers hold at least a bachelor's degree (35 percent of all San Francisco occupations). For the nation as a whole, there were only 83 occupations where at least 60 percent of the workers have at least a bachelor's degree (18 percent of all U.S. occupations). For the purposes of this report, we use the term *Knowledge Occupations* for occupations where at least 60 percent of the workers hold a bachelor's degree. *Knowledge Plus Occupations* are those where at least 50 percent of

[5] Unless otherwise specified, this report relies on the 5% sample from the 2000 Census. More recent PUMS data at the MSA level is not available due to low sample size. However, data from 2000 has the unique virtue of measuring levels of human capital during a period of heightened demand for knowledgeable and experienced workers. Thus, conclusions drawn from these data sets may suggest an even greater supply of human capital than under more stable economic conditions. In general as the economy contracts, there is a lag factor where jobs are eliminated well before workers are induced to relocate to areas of greater opportunity.

[6] For all PUMS data analysis, the Bay Area includes the following four MSAs: San Francisco (which includes San Francisco, Marin and San Mateo counties); Oakland (which includes Alameda and Contra Costa counties); Vallejo-Fairfield-Napa (which includes Napa and Solano counties); and San Jose (which includes the County of Santa Clara). Note: The County of Sonoma is not included in the PUMS analyses due to unavailability of data from the 2000 census.

workers have a post-graduate degree. In 2000, there were 29 *Knowledge Plus Occupations* in the Bay Area, compared to only 21 in the United States as a whole.

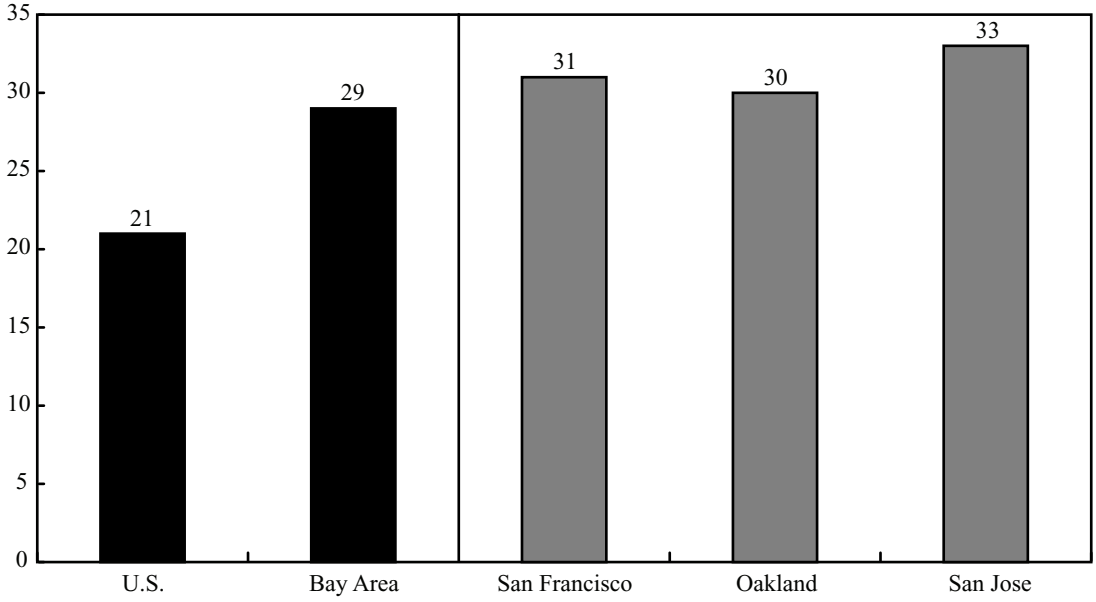
The Bay Area Has More *Knowledge Occupations*, 2000



Note: *Knowledge Occupations* are defined for the purposes of this report as those occupations where at least 60 percent of the workers hold a bachelor's degree.

Source: PUMS, 2000

The Bay Area Has More *Knowledge Plus Occupations*, 2000



Note: *Knowledge Plus Occupations* are defined for the purposes of this report as those occupations where at least 50 percent of the workers have a post-graduate degree.

Source: PUMS, 2000

Knowledge (X) and Knowledge Plus (XX) Occupations in the Bay Area and the U.S., 2000

Occupation Title	Census Occupation Code	Bay Area	U.S.	Occupation Title	Census Occupation Code	Bay Area	U.S.
Chief Executives	1	X		Physical Scientists	176	XX	XX
Legislators	3	X	X	Economists	180	XX	XX
Advertising and Promotions Mgrs	4	X	X	Market and Survey Researchers	181	X	X
Marketing and Sales Mgrs	5	X		Psychologists	182	XX	XX
Public Relations Mgrs	6	X	X	Urban and Regional Planners	184	XX	X
Administrative Services Mgrs	11	X	X	Misc Social Scientists	186	X	X
Financial Mgrs	12	X		Biological Technicians	191	X	
Education Administrators	23	X	XX	Counselors	200	X	X
Engineering Mgrs	30	X	X	Social Workers	201	X	X
Medical and Health Services Mgrs	35	X		Misc Community & Social Svc Specialists	202	X	
Natural Science Mgrs	36	XX	XX	Clergy	204	XX	X
Social and Community Service Mgrs	42	X	X	Lawyers	210	XX	XX
Managers, All Other	43	X		Judges and Other Judicial Workers	211	XX	XX
Agents and Business Mgrs	50	X		Post-Secondary Teachers	220	XX	XX
Compliance Officers	56	X		Elementary & Middle School Teachers	231	X	X
Management Analysts	71	X	X	Secondary School Teachers	232	X	X
Accountants and Auditors	80	X	X	Special Ed Teachers	233	X	X
Budget Analysts	82	X		Archivists, Curators & Museum Techs	240	X	X
Financial Analysts	84	X	X	Librarians	243	XX	XX
Personal Financial Advisors	85	X	X	Other Education	255	X	X
Financial Examiners	90	X	X	Artists	260	X	
Tax Exmnrs, Collectors & Revenue Agents	93	X		Producers and Directors	271	X	X
Tax Preparers	94	X		News Analysts	281	X	X
Financial Specialists	95	X		Public Relation Specialists	282	X	X
Computer Scientists and System Analysts	100	X		Editors	283	X	X
Computer Programmers	101	X	X	Technical Writers	284	X	X
Computer Software Engineers	102	X	X	Writers and Authors	285	X	X
Database Adminstrators	106	X	X	TV, Video and Motion Picture Operators	292	X	
Network Systems and Data Analysts	111	X		Chiropractors	300	XX	XX
Actuaries	120	X	X	Dentists	301	XX	XX
Operations Research Analysts	122	X	X	Dieticians and Nutritionists	303	X	X
Misc Mathematical Science Operations	124	XX	XX	Optometrists	304	XX	XX
Architects	130	X	X	Pharmacists	305	XX	X
Surveyors and Cartographers	131	X	X	Physicians and Surgeons	306	XX	XX
Aerospace Engineers	132	X	X	Podiatrists	312	XX	XX
Chemical Engineers	135	X	X	Registered Nurses	313	X	
Civil Engineers	136	X	X	Audiologists	314	XX	XX
Computer Hardware Engineers	140	X		Occupational Therapists	315	X	X
Electrical Engineers	141	X	X	Physical therapists	316	X	X
Environmental Engineers	142	X	X	Recreational Therapists	321	X	X
Industrial Engineers	143	X		Speech/Language Pathologists	323	XX	XX
Marine Engineers	144	X	X	Therapists	324	XX	X
Materials Engineers	145	X	X	Veterinarians	325	XX	XX
Mechanical Engineers	146	X	X	Hlth Diagnosing & Treating Practitioners	326	XX	XX
Nuclear Engineers	151	XX	X	Clinical Lab Technologists	330	X	
Petroleum, Mining & Geological Engineers	152	X	X	Other Healthcare Practitioners	354	X	
Misc Engineers	153	X	X	Advertising Sales Agents	480	X	
Agricultural and Food Scientists	160	X	X	Securities, Commodities & Financial Svcs	482	X	X
Biological Scientists	161	XX	X	Sales Engineers	493	X	X
Conservation Scientists	164	X	X	Engine & Other Machine Assemblers	773	XX	
Medical Scientists	165	XX	XX	Textile Winding/Twisting/Drawing Out	842	X	
Astronomers and Physicists	170	XX	XX	Aircraft Pilots	903	X	X
Atmospheric and Space Scientists	171	XX	X	Military Officers	980		X
Chemists	172	X	X	**Total *Knowledge Occupations***		107	83
Environmental Scientists & Geoscientists	174	XX	X	**Total *Knowledge Plus Occupations***		29	21

Source: PUMS, 2000

The table above lists the specific occupations that can be classified as *Knowledge* and *Knowledge Plus* in the Bay Area and those that can be classified as such in the nation as a whole. A single "X" indicates *Knowledge Occupations* (where at least 60 percent of the

workers hold a bachelor's degree). A double "XX" indicates *Knowledge Plus Occupations* (where a least 50 percent of the workers hold a post-graduate degree). A blank space indicates those occupations that cannot be classified as *Knowledge* or *Knowledge Plus*.[7] Only occupations that are *Knowledge* or *Knowledge Plus* in either the Bay Area or in the nation as a whole are included in the table.

Note that the pattern that emerges shows a greater number of *Knowledge* and *Knowledge Plus* occupations in the Bay Area than in the nation as a whole.

Knowledge Industries in the Bay Area

By definition, the Bay Area's high-tech industries rely on elevated levels of workforce knowledge and capacity. However, this report finds that the region's high-tech industries do not enjoy a monopoly on talented workers. Highly educated workers are employed in an increasingly diverse range of industries. This section measures human capital levels within industries, rather than occupations, to see how the Bay Area compares to other, nationally recognized knowledge regions.

For the purposes of this report, *Knowledge Industries* are those industries in which at least 50 percent of workers hold at least a bachelor's degree. Aside from the Boston Metropolitan Area, the Bay Area is home to the highest number and highest proportion of *Knowledge Industries*. While *Knowledge Industries* comprise 18 percent of all industries in the Bay Area, they employ 22 percent of all Bay Area workers.

Knowledge Industries: Eight Regions and the U.S., 2000

MSA	Total Number of *Knowledge Industries*	*Knowledge Industries* as Percent of All Industries	Percent of All Workers Employed in *Knowledge Industries*
Boston	59	23%	27%
Bay Area[a]	**47**	**18%**	**22%**
Seattle	43	16%	20%
Austin	42	16%	18%
New York City	36	14%	14%
Chicago	26	10%	12%
San Diego	20	8%	9%
Los Angeles	16	6%	8%
U.S.	15	6%	8%

a. Bay Area Consolidated Metropolitan Statistical Area (CMSA)

Source: PUMS, 2000

The following table lists the 20 U.S. industries with the highest shares of college-educated workers. Bay Area workers in these nationally recognized *Knowledge Industries* are often more highly educated than workers in the same industries in other nationally recognized knowledge regions. The notable exception is the Boston region, where the percentages of

[7] As expected, all *Knowledge Plus Occupations* are also, by definition, *Knowledge Occupations*. In other words, there were no instances where at least 50 percent of workers hold a post-graduate degree but less than 60 percent have earned a bachelor's degree.

college-educated workers in the listed *Knowledge Industries* are greater that the Bay Area's percentages for 13 of the 20 industries.

The Nation's 20 Most Educated Industries: Percent Workers with a Bachelor's Degree, 2000[a]

National Education Rank	Industry	U.S.	Bay Area[b]	Austin MSA	New York City MSA	Boston MSA	San Diego MSA	Seattle MSA	Chicago MSA	Los Angeles MSA
1	Software Publishing	70%	70%	69%	77%	78%	61%	80%	76%	55%
2	Mgmt, Scientific & Tech Consulting	67%	79%	76%	82%	75%	59%	76%	74%	63%
3	Scientific Research & Development	63%	73%	53%	77%	64%	68%	77%	67%	69%
4	Offices of Other Health Professionals	61%	81%	75%	73%	66%	65%	75%	72%	66%
5	Computer System Design	60%	75%	69%	76%	67%	60%	69%	67%	57%
6	Elementary & Secondary Schools	60%	64%	63%	70%	60%	57%	63%	66%	52%
7	Securities, Commodities, Funds, Trusts	60%	72%	63%	71%	64%	57%	67%	61%	58%
8	Other Information Services	57%	73%	58%	76%	72%	52%	71%	65%	57%
9	Legal Services	56%	65%	61%	69%	64%	62%	70%	65%	58%
10	Colleges & Universities	56%	67%	60%	64%	61%	62%	67%	63%	56%
11	Admin of Environmental Quality & Housing	56%	71%	63%	64%	37%	60%	71%	71%	63%
12	Architecture & Engineering	54%	69%	59%	72%	71%	54%	70%	63%	59%
13	Pharmaceuticals & Medicines Mfg	53%	69%	39%	68%	53%	61%	80%	61%	41%
14	Accounting & Tax Preparation	51%	61%	58%	68%	63%	47%	59%	61%	53%
15	Publishing (except Newspapers)	51%	69%	63%	66%	69%	51%	62%	58%	50%
16	Aerospace Products & Parts Mfg	49%	65%	79%	63%	73%	36%	51%	45%	46%
17	Other School & Education Services	49%	60%	51%	61%	52%	44%	58%	54%	45%
18	Admin & Human Resources	48%	54%	54%	64%	43%	46%	55%	47%	38%
19	Business Professional Organizations	48%	51%	58%	68%	52%	33%	58%	58%	46%
20	Mgmt of Companies	48%	59%	**	66%	43%	29%	40%	52%	43%

a. Underlined percentages are for those regional industries where a higher percent of workers have a bachelor's degree than in the Bay Area.

b. Bay Area includes the following 4 MSAs: San Francisco, Oakland, Vallejo-Fairfield-Napa and San Jose

**Data unavailable due to few respondants in this category.

Source: PUMS, 2000

The previous tables indicate that educated workers are widely distributed throughout Bay Area occupations and within Bay Area industries. There are two possible explanations for this phenomenon: from the demand side and from the supply side. Looking first at demand, Bay Area workers may be employed in the most sophisticated, specialized and technical aspects of their professions, thus adding a high degree of value. Similarly, industries could also be demanding a greater supply of human capital in order to maximize the potential for innovation and higher productivity. Start-ups may require a higher level of skill and knowledge than already established companies, and cutting-edge industries may also demand a more educated workforce.

Looking at the abundance of educated workers in the Bay Area from the supply side, educated workers appear willing to live and work in the Bay Area even during periods of relative job scarcity. As a result, educated workers, due to restricted opportunity in traditionally high-skilled occupations during those times, might find themselves performing

a wider range of jobs in a more diverse range of industries. Such workers would be considered overqualified for many of the jobs they are performing and therefore underemployed. Either scenario could be true, depending upon the specific occupation, the industry, and the ebbs and flows of the job market. As Joe Ciola, director of professional services for the San Jose office of Lee Hecht Harrison, a career transition and outplacement firm, commented in an interview, for a period of time following the high-tech bubble, many engineers were being laid off: "People were doing work for which they were overqualified." However, since then, a number of baby boomers have retired, and more and more companies are applying for H-1B visas to meet the demand for engineers.[8]

Regardless of why there is an abundant and diverse supply of talent, employers seeking highly educated workers are not likely to be disappointed with the Bay Area's workforce capacity. In a scenario where educated workers are underemployed, prospective employers will find an able and willing supply of candidates. In the event that educated workers are performing a wide variety of job functions and adding value in a diverse range of industries, the Bay Area will remain a highly competitive and innovative environment for business.

[8] Joe Ciola, Director of Professional Services, and Peg McAllister, Senior Vice President, Lee Hecht Harrison. Interviewed by Jennifer Susskind and Cynthia Kroll. (October 5, 2006).

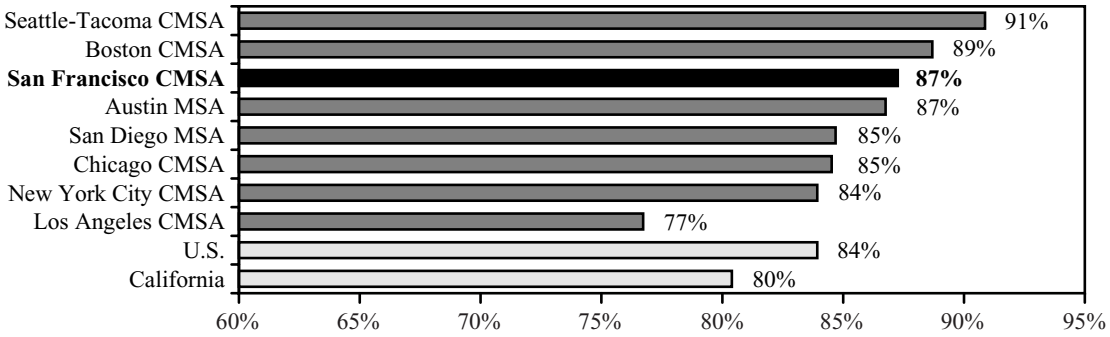
Bay Area Workforce Characteristics

As the name suggests, firms operating within *Knowledge Industries* succeed or fail depending on their capacity to attract the brightest and most talented employees. This is true for top management positions, and it is also true for key science, engineering, human resources and business support professionals. Just as individual companies depend on access to talent, the regional economies that sustain and are sustained by these firms depend on workforce capacity. The following demographic analyses indicate that the Bay Area has a healthy supply of highly educated residents with diverse language capacities and cultural comprehension. Furthermore, a comparison of Bay Area workforce characteristics to regions that are also known for their knowledge-based industries suggests that the San Francisco Bay Area has a highly competitive base of human capital.

Academic Achievement: High School Completion

Bay Area residents are on average more educated than Californians and Americans in general. Eighty-seven percent of Bay Area residents over the age of 25 have achieved at least a high school diploma. Compared to seven other metropolitan regions, the Bay Area[9] ranks third in terms of percentage of the population with at least a high school degree.

Regional High School Graduation Rates, 2004



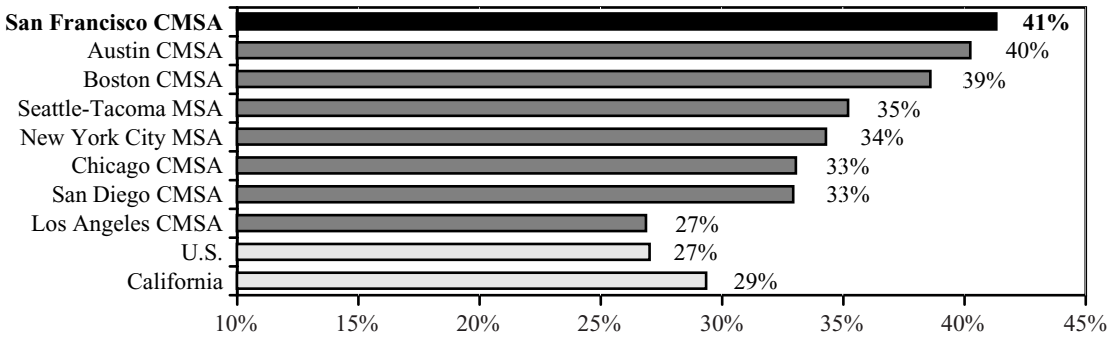
Source: U.S. Census, American Community Survey, 2004

[9] The Bay Area includes the following 9 counties: San Francisco, Santa Clara, San Mateo, Alameda, Marin, Contra Costa, Solano, Napa and Sonoma.

Academic Achievement: College Degree

In spite of the fact that Boston and Seattle area residents are more likely than Bay Area residents to have earned a high school diploma, Bay Area residents are the most likely out of seven peer regions to have earned at least a bachelor's degree. Forty-one percent of residents over the age of 25 hold a bachelor's degree.

Regional Bachelor's Degree Attainment Rates, 2004

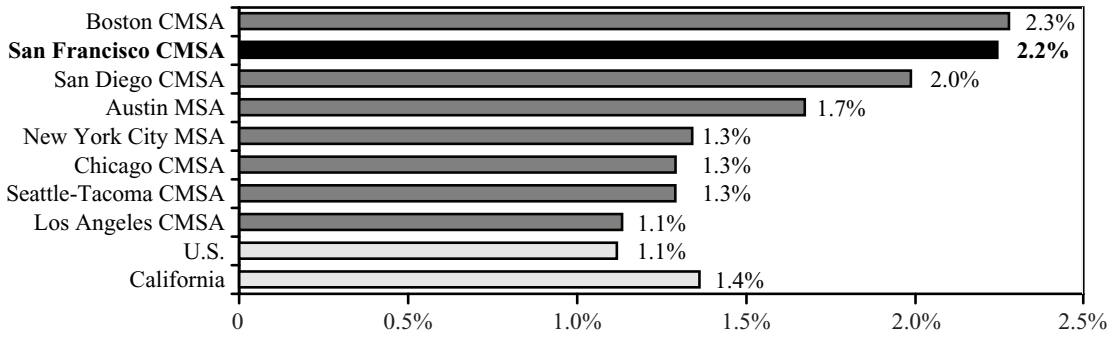


Source: U.S. Census, American Community Survey, 2004

Academic Achievement: Doctorates

Aside from residents of the Boston region, Bay Area residents are the most likely out of eight peer regions to have earned a doctorate degree. In 2004, 2.2 percent of the population over the age of 25 had earned a doctorate degree. This was twice the national average and nearly two times the rate of all California residents.

Regional Doctorate Attainment Rates, 2004



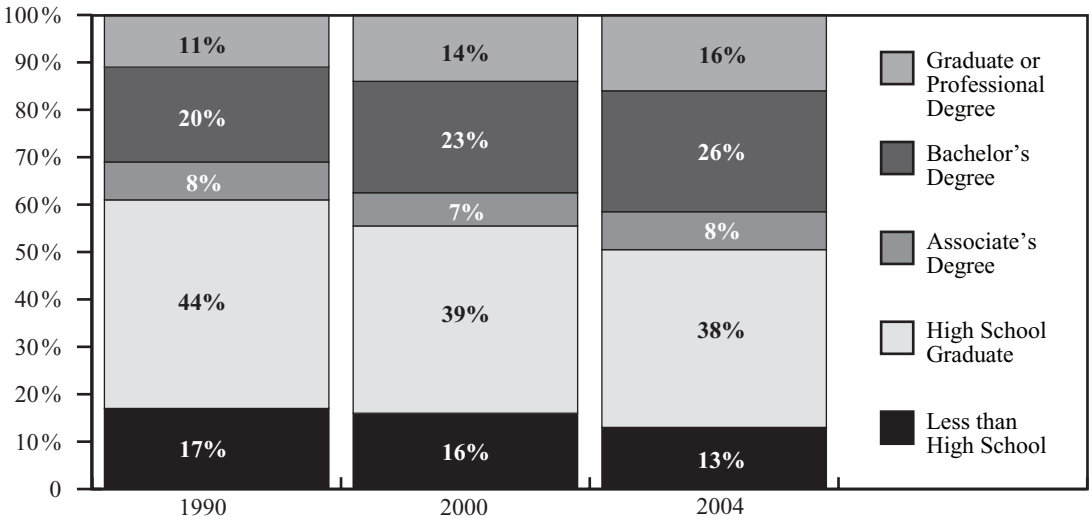
Source: U.S. Census, American Community Survey, 2004

Bay Area Residents are Becoming Increasingly Educated

While Bay Area residents tend to be more highly educated than residents in other nationally recognized knowledge regions, educational attainment levels in the Bay Area have also

increased between 1990 and 2004. The following chart shows a drop in the percentage of residents over the age of 25 who do not have a high school diploma and a drop in the number of residents with only a high school diploma. Simultaneously, there has been an increase in graduate and professional degree attainment and in the percentage of residents with a bachelor's degree.

Bay Area Educational Attainment, 1990, 2000, 2004



Source: U.S. Census, 1990, 2000 and American Community Survey 2004

This trend for the region's workforce to become increasingly educated could slow or even reverse in the next 20 years, as the population mix changes. This will happen simply through natural increase of the population, and it may be complicated by migration patterns. If there were no migration effects, the current labor force aged and began retiring, and the younger population maintained the same education profile (by ethnic category, for example), then the share of the population with college and advanced degrees would drop by about three percentage points. This emphasizes two important factors in maintaining an educated labor force in the Bay Area: (1) maintaining a positive net migration balance of well educated workers (discussed further in the next section); and (2) increasing the educational attainment levels of the younger population entering the labor force. This second strategy must involve improving high school completion rates and expanding college attendance among the region's least educated populations. Looking beyond 2030 without these strategies, the Bay Area labor force advantage could further erode.

Racial, Ethnic and Language Diversity

A diverse workforce is better able to participate in the global marketplace. Employees who speak multiple languages, understand the culture of customers and suppliers in other parts of the world, and bring new ways of problem solving to the workplace offer a unique advantage in an economy where information is instantaneously transmitted across the globe. The Bay Area,

in part due to its geographical location on the Pacific Rim, has a "special relationship with Asia." According to Richard Dasher, professor of electrical engineering at Stanford University and director of the US-Asia Technology Management Center, "Knowledge creation is a two-way street. We are showing Asians what we do over here, as well as learning what they do in Asia."[10] Accordingly, Asian, as well as other immigrants, offer the potential for cross-pollination of ideas and technologies. A leading expert in regional economic development, AnnaLee Saxenian, describes the added value of a diverse workforce:

> *First-generation immigrants like the Chinese and Indian engineers in Silicon Valley, who have the necessary language, cultural, and technical skills to function well in the United States as well as in their home markets, have a commanding professional advantage. Ethnic professional associations and networks extend these advantages by enabling new as well as established ventures to quickly identify and build partnerships with distant suppliers and customers.*[11]

The following table uses the Simpson's Index of Diversity[12] to perform rankings of ethnic/racial diversity on San Francisco, San Jose and other benchmark cities, and on the Bay Area and other metropolitan regions.[13] A ranking of one signifies complete heterogeneity, and a ranking of zero signifies complete homogeneity. According to this analysis, San Francisco and San Jose are relatively diverse cities, and the Bay Area is a highly diverse region. While Seattle, for example, tends to score higher than San Francisco in regard to educational attainment, its diversity ranking is significantly lower.

Ethnic/Racial Diversity, 2000

	Benchmark Cities		Benchmark Regions	
Rank		**S-Index**		**S-Index**
1	New York City	0.73	Los Angeles Area	0.67
2	**San Jose**	**0.71**	**Bay Area**	**0.67**
3	Chicago	0.70	New York Area	0.62
4	**San Francisco**	**0.69**	San Diego Area	0.62
5	Los Angeles	0.67	Chicago Area	0.59
6	Boston	0.67	Washington DC Area	0.57
7	San Diego	0.67	Austin Area	0.56
8	Austin	0.61	Seattle Area	0.40
9	Seattle	0.51	Boston Area	0.31
	U.S.	0.49		

Source: U.S. Census, 2000, SF3

[10] Richard Dasher. Interviewed by Susskind and Kroll. (May 10, 2006).

[11] AnnaLee Saxenian. *The New Argonauts: Regional Advantage in a Global Economy.* Harvard University Press, Cambridge, MA (2006).

[12] See http://www.countrysideinfo.co.uk/simpsons.htm for index methodology.

[13] Benchmark Regions are: Austin-San Marcos, TX MSA; Boston-Worcester-Lawrence, MA-NH-ME-CT CMSA; Chicago-Gary-Kenosha, IL-IN-WI CMSA; Los Angeles-Riverside-Orange County, CA CMSA; New York-Northern New Jersey-Long Island, NY-NJ-CT-PA CMSA; San Diego, CA MSA; San Francisco-Oakland-San Jose, CA CMSA; Seattle-Tacoma-Bremerton, WA CMSA; and Washington-Baltimore, DC-MD-VA-WV CMSA.

The Simpson's Index of Diversity can also be used to measure the relative degree of language diversity among different cities and regions. The following table compares San Francisco and San Jose with eight other benchmark cities, and compares the Bay Area with seven other benchmark regions. The analysis considers 40 language groups that are spoken at home. (For a breakdown of languages spoken by Bay Area residents, see the appendix to this report.)

Language Diversity, 2004

	Benchmark Cities		Benchmark Regions	
Rank		**S-Index**		**S-Index**
1	Los Angeles	0.81	Los Angeles Area	0.71
2	**San Jose**	**0.77**	New York Area	0.67
3	**San Francisco**	**0.70**	**Bay Area**	**0.61**
4	New York City	0.69	San Diego Area	0.56
5	San Diego	0.60	Chicago Area	0.47
6	Boston	0.57	Austin Area	0.44
7	Chicago	0.55	Boston Area	0.37
8	Austin	0.53	Seattle Area	0.35
9	Seattle	0.40		
10	Washington DC	0.24		
	California	0.64	USA	0.34

Source: U.S. Census, American Community Survey, 2004

Language Capacity

While limited English proficiency can be a significant disadvantage for some U.S. workers, the ability to speak English well and at least one additional language other than English can offer workers a growing advantage in the knowledge-driven global economy. According to professional services director Joe Ciola, of the 900 clients served by Lee Hecht Harrison that are experiencing career transitions, those that are bilingual, particularly in English and one of the Chinese or Indian dialects, have the easiest time finding employment. As suggested earlier, "this is due not just to language capacity, but to extensive knowledge of culture."[14]

If an individual's language capacity is an indicator of an individual's competitiveness, the collective language capacity of a region can be seen as an indicator of regional competitive advantage. This section considers language capacity as a regional competitive advantage. For the purposes of this analysis, language capacity is broken down into three exclusive categories based upon primary language spoken in the home:[15] (1) residents who speak only English; (2) residents who speak little or no English; and (3) residents who speak a language other than English in the home, but speak English well or very well.

Based on the premises that the capacity to speak English as well as another language is a desirable indicator of human capital, that the capacity to speak only English is a less desirable

[14] Ciola and McAllister. (2006).

[15] The following analysis is based on U.S. Census Data, 2000, for residents between the ages of 18 and 64. Due to data limitations, we are unable to distinguish between monolingual English speakers and those who speak English in the home but can communicate effectively in another language.

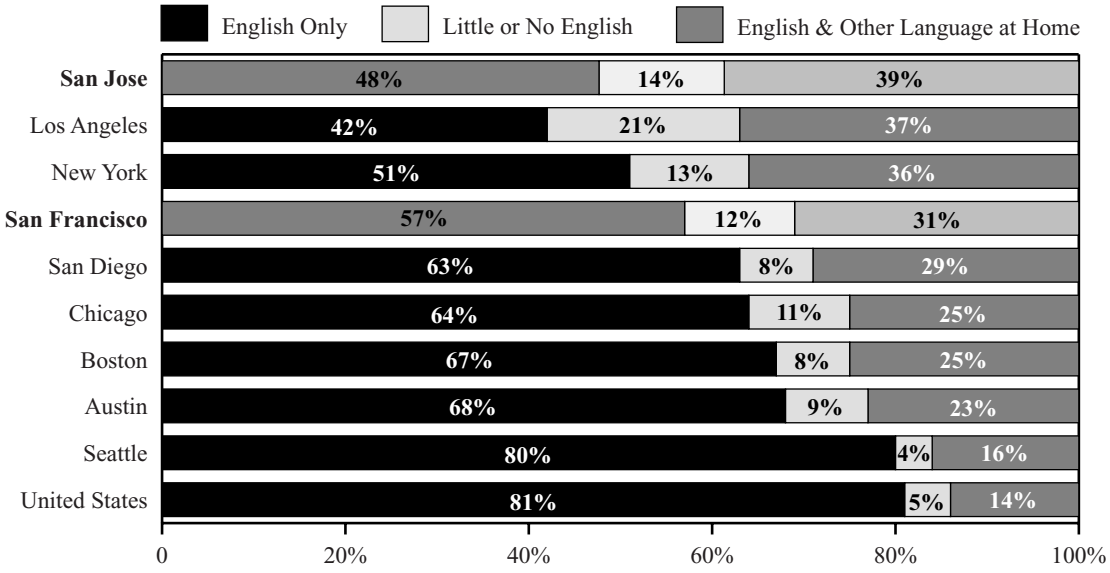
indicator, and that a lack of capacity to speak English severely limits a U.S. resident's capacity to communicate in the workplace and network with other residents, regions with high rates of bilingual English language speakers and low rates of non-English speakers are the most competitive.

Hierarchy of Competitiveness and Language Capacity in the U.S.

1	English plus at least one other language	Highly Competitive
2	English only	Moderately Competitive
3	Limited English	Limited Competitiveness

The following chart compares language capacities among residents in nine U.S. cities, including San Francisco and San Jose, and the language capacity of U.S. residents as a whole. Of the nine cities, San Jose has the highest proportion of residents who speak English and at least one other language—39 percent of the population. In addition, San Jose has a very low proportion of residents who speak English only—48 percent. Thirty-one percent of San Francisco residents speak English and at least one other language. Only Los Angeles and New York have higher rates of this type of bilingual capacity. However, Los Angeles has a very high proportion of residents who speak little or no English—21 percent. Based on this analysis, Bay Area cities are highly competitive in terms of language capacity. San Jose may be the most competitive, and New York, San Francisco and San Diego are closely trailing.

Language Capacity, Nine cities and the U.S.



Source: U.S. Census, 2000

The Role of Global Migration in the Bay Area Economy

Following World War II, Bay Area universities began attracting some of the most talented students from around the world into their graduate programs. Upon graduating, these students, many of them from India and China, remained and ultimately came to account for over a third of the region's high-tech workforce. By the start of the 21st century, many of these immigrants had become the entrepreneurs who now help maintain the Bay Area's role as one of the most technologically advanced and economically wealthy regions in the world. Saxenian elaborates:

> *By 2000, scores of Indian and Chinese engineers, including Jerry Yang, co-founder of Yahoo, Pehong Chen, founder of Broadvision, Vinod Khosla, co-founder of Sun Microsystems, and Sabeer Bhatia, founder of Hotmail, had achieved international recognition together with substantial wealth as a result of entrepreneurial success in Silicon Valley.*[16]

According to a report commissioned by the National Venture Capital Association (NVCA), immigrants have played a significant role in starting and growing American companies and in job creation.[17] Immigrants started 25 percent of public venture-backed companies, and nearly half (47 percent) of private company founders were born outside the U.S. California leads the nation in the number of venture-capital-backed private companies started by immigrants, and based upon the examples provided by Saxenian, the Bay Area is home to many of these successful entrepreneurs. Most of these companies are in high-value-added, knowledge-based sectors such as high-tech manufacturing, IT and life sciences—exactly those industries that have made the Bay Area globally competitive.

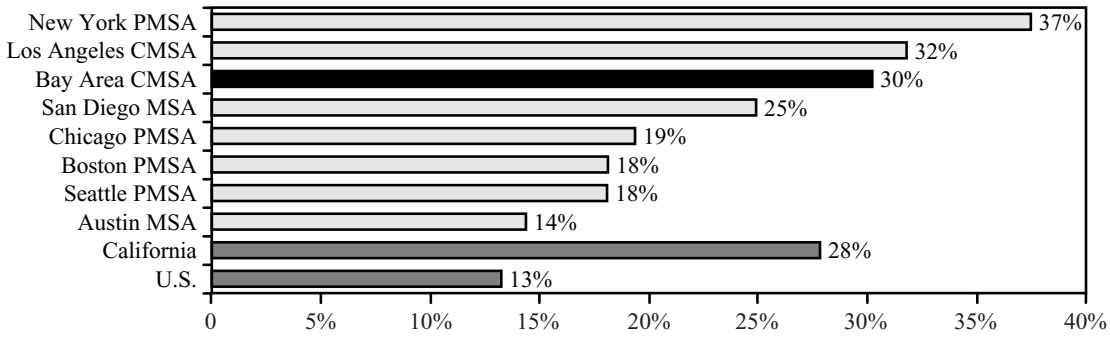
Census data illustrates the powerful demographic role immigrants play in the Bay Area. In the following chart, the proportion of residents born outside the United States is compared for the Bay Area and seven peer regions. In 2004, 30 percent of all Bay Area residents were born outside of the United States. Of the peer regions, only New York has a substantially higher proportion of foreign-born residents (38 percent). Bay Area residents are twice as likely to be

[16] Saxenian. (2006).

[17] Stuart Anderson and Michaela Platzer. "American Made: The Impact of Immigrant Entrepreneurs and Professionals on U.S. Competitiveness." National Venture Capital Association (2006).

foreign born than are U.S. residents as a whole. In this regard, the Bay Area is representative of California in general.

Percentage of Foreign-Born Residents by Region[a], 2004

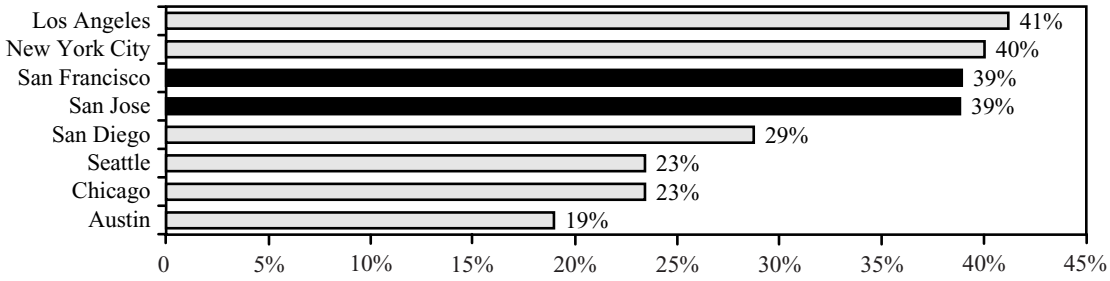


a. Data comparisons are by MSA (Metropolitan Statistical Area), PMSA (Primary MSA), and CMSA (Consolidated MSA).

Source: U.S. Census, American Community Survey, 2004

The following chart shows the percentage of San Francisco and San Jose residents who were born outside the United States. These cities are similar to other urban entry points across the country such as New York and Los Angeles.

Percentage of Foreign-Born Residents by City, 2004



Source: U.S. Census, American Community Survey, 2004

Immigrants Help the Bay Area Remain Competitive

Many Bay Area workers are recent immigrants. Compared to seven peer regions, the Bay Area has the second highest percentage (6 percent) of recent immigrant workers (workers that have lived in the United States for five years or less). However, when considering *Knowledge Occupations* (where 60 percent of workers have at least a bachelor's degree), the Bay Area has the highest percentage of recent immigrant workers (7.3 percent).

Recent Immigrant Workers in All Occupations and in *Knowledge Occupations*, 2000[a]

What percentage of the workers are recent immigrants?	
New York City Region	6.6%
Bay Area	6.0%
Los Angeles	5.2%
Austin Region	4.6%
Boston Region	4.3%
Chicago Region	4.3%
Seattle Region	4.0%
San Diego Region	4.0%

What percentage of *Knowledge Workers* are recent immigrants?	
Bay Area	7.3%
Boston Region	5.3%
New York City Region	5.1%
Seattle Region	4.7%
Austin Region	4.6%
San Diego Region	4.1%
Los Angeles Region	3.9%
Chicago Region	3.7%

a. All regions except Bay Area are MSA; Bay Area includes San Francisco, Oakland-Vallejo, San Jose MSAs.

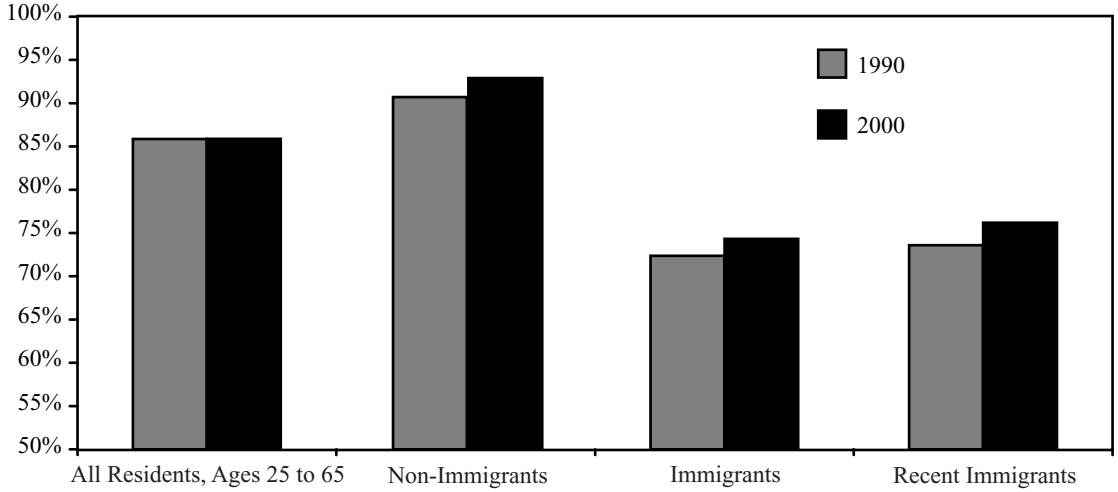
b. Knowledge workers are those workers employed in *Knowledge Occupations*.

Source: PUMS data, 2000, 5% sample

International migration to the Bay Area has had a positive impact on the quality of the Bay Area workforce and particularly on levels of educational attainment. U.S. census data shows two distinct patterns among immigrant and non-immigrant workers. On the one hand, non-immigrants are more likely than immigrants in general to have at least a high school diploma. On the other hand, recent immigrants are more likely than non-immigrants to have received post-graduate degrees.

Between 1990 and 2000, while data on all residents showed an increase in educational attainment levels, immigrants and recent immigrants showed a higher growth rate than the average for all residents.

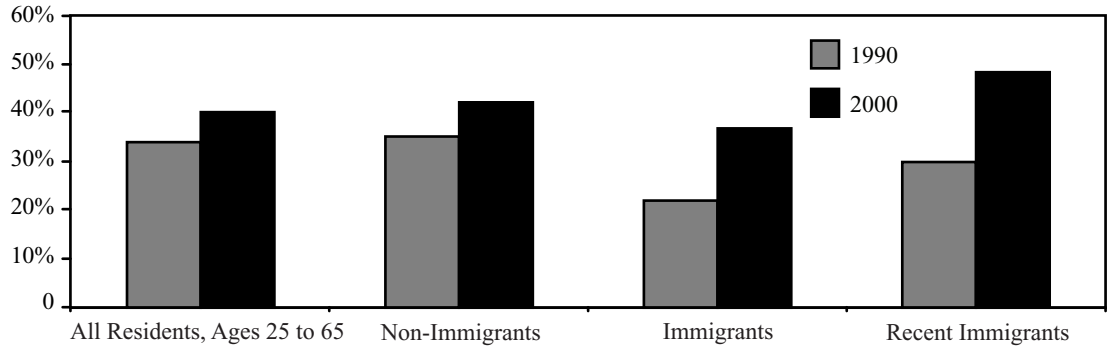
Bay Area High School Graduates, Ages 25 to 65, 1990 & 2000



Source: PUMS, 1990, 2000, 5% sample

Between 1990 and 2000, the percentage of immigrants and recent immigrants with at least a bachelor's degree increased substantially. The increase in educational attainment rates of immigrants occurred concurrently with the demand for educated workers during the high-tech economic boom.

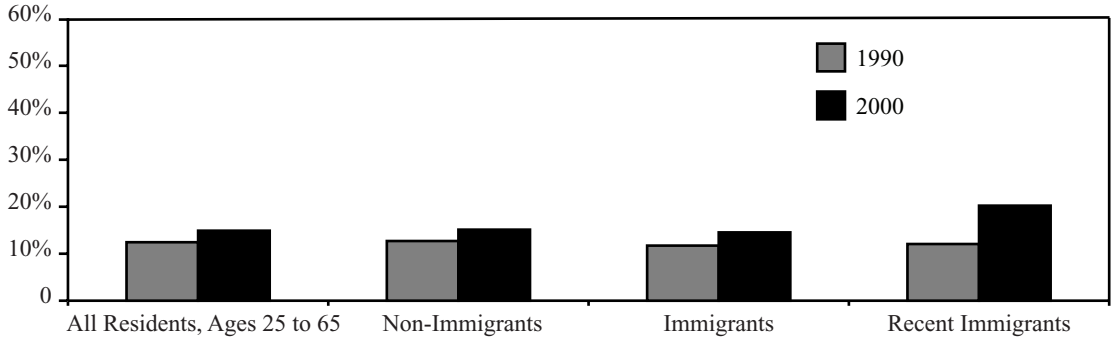
Bay Area Residents, Ages 25 to 65 with Bachelor's Degrees, 1990 & 2000



Source: PUMS, 1990, 2000, 5% sample

This phenomenon was even more pronounced among Bay Area residents with post-graduate degrees. In 1990, there was almost no difference in post-graduate attainment levels between recent immigrants and non-immigrants. By 2000, recent immigrants were much more likely than non-immigrants to have obtained a post-graduate degree.

Bay Area Residents, Ages 25 to 65 with Post Graduate Degrees, 1990 & 2000



Source: PUMS, 1990, 2000, 5% sample

The above-referenced report by the National Venture Capital Association (NVCA) on the role played by immigrant entrepreneurs in the national economy suggests that foreign-born workers contribute significantly to the wealth of our country—the value of public venture-capital-backed companies started by immigrants exceeds $500 billion—and that the U.S. jobs created by these business leaders are also substantial—an estimated 200,000 U.S. workers are employed in venture-backed public companies started by immigrants.[18]

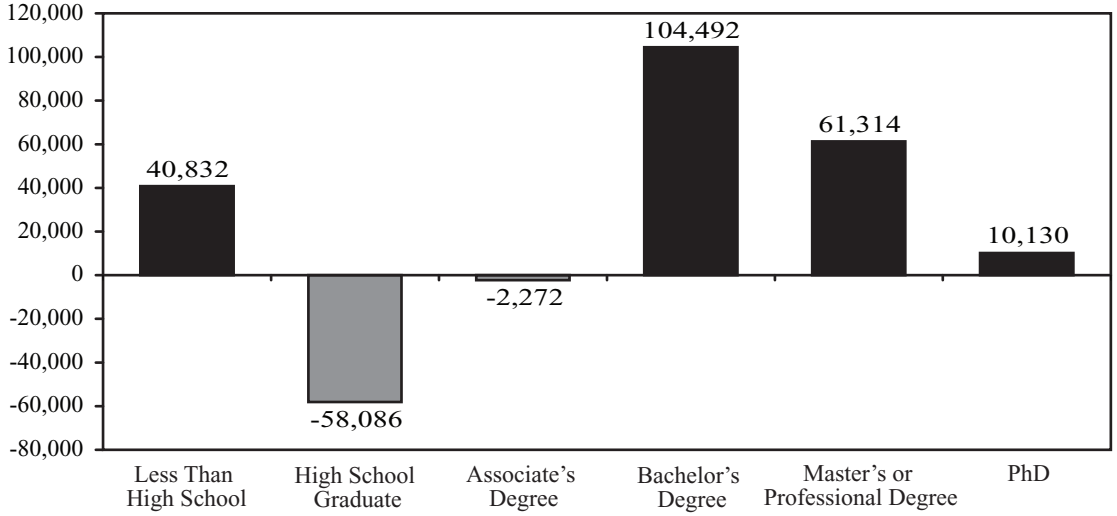
[18] Anderson and Platzer. (2006).

These national and local figures indicate the importance of maintaining an open and flexible immigration system that enables skilled and educated people from abroad to work and study in the United States by expediting student visas, ensuring an adequate supply of H-1B visas and facilitating an expeditious path to permanent residence (green cards). Many of these wealth and job creators came to the United States in their youth or as college students. While the national debate has focused on the issue of illegal immigration, particularly by lower-skilled, less-educated workers, our analysis suggests that U.S. policy should focus on actively promoting the legal immigration of skilled and educated workers. On a final note with particular significance for the Bay Area, the NVCA study found that a significant proportion of venture-backed companies responding to its survey stated that the recent dearth of H-1B visas has influenced their decision to develop personnel and facilities abroad. This trend could have an impact on Bay Area as well as U.S. workers in general.

Domestic Migration

While international migration has had some impact on Bay Area educational attainment levels, domestic in/out migration has had an even more profound effect. The following two charts look at people over the age of 25, who have either moved to the Bay Area from another part of the U.S. between 1995 and 2000, or have moved out of the Bay Area to another part of the U.S. during that same 5 year period. Of these domestic migrants, more people with very low levels and very high levels of education moved to the Bay Area, while a greater number of people with medium levels of educational attainment—a high school diploma or an associate's degree—moved out. The first chart, in conjunction with the previously illustrated effects of recent international migration, suggests that the high levels of education in the Bay Area are not necessarily homegrown.

Domestic In/Out Migration, 1995–2000
New arrivals to the Bay Area are either highly educated or less educated.

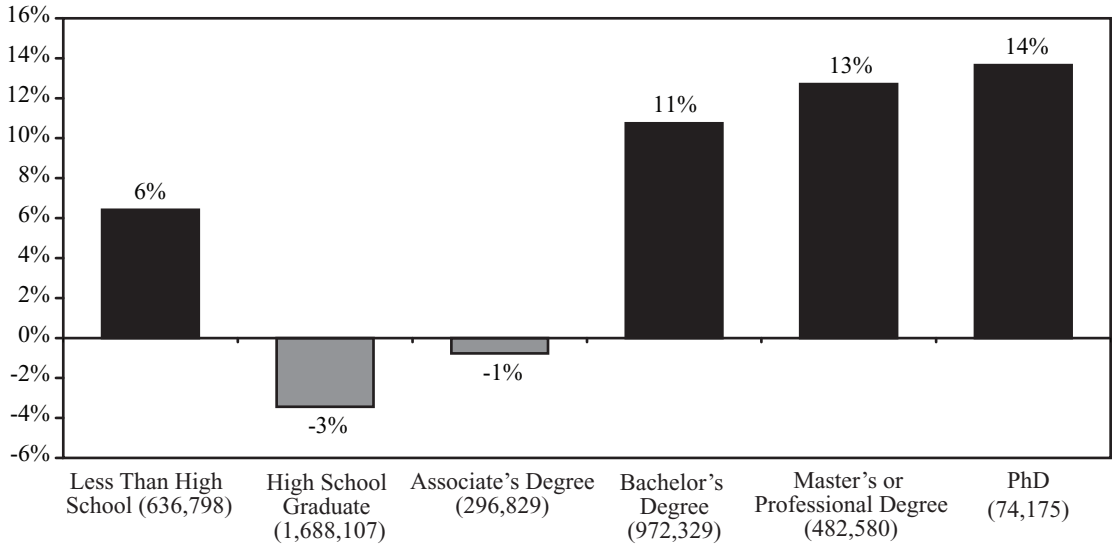


Source: PUMS, 2000

The following chart shows the impact of domestic migration levels on the Bay Area workforce. In 2000, for example, there were over 636,000 Bay Area residents over the age of 25 who had not completed high school. A net increase between 1995 and 2000 of nearly 41,000 residents without a high school diploma contributed over 6 percent to these numbers. Concurrently, a net increase of 10,130 residents with PhDs contributed approximately 14 percent to the 74,175 Bay Area PhDs in 2000.

A study by the Public Policy Institute of California suggests that at least statewide, the demand for skilled workers cannot be met by migration alone. Indeed, their report shows that statewide, since 2000, there has been a net out migration of the most highly educated workers. This data is not available for smaller geographic areas, but it would not be surprising if the balance between in migration and out migration of skilled workers to and from the Bay Area shifted following the dot-com bust. The question in the longer term is whether the region can continue to attract highly educated workers when demand grows. The discussions that follow on higher education institutions and on innovative companies address this question in more depth.

Domestic In/Out Migration, 1995–2000
A significant percent of educated workers in the Bay Area are recent arrivals.



Source: PUMS, 2000

Bay Area Educational Institutions

Training and Education to Meet Industry's Demand

Between 2004 and 2014, U.S. jobs requiring science, engineering or technical training will increase by 24 percent.[19] The shortage of workers in the United States with postsecondary-level skills could grow to 12 million by 2020.[20] Even now, 70 percent of U.S. CEOs cite, as a barrier to growth, the difficulty of finding and retaining talented workers.[21] These national statistics are alarming, and the shortage of skilled workers could have a particularly significant impact on Bay Area workplaces in the future. Research on California finds that the state is not producing enough baccalaureates in science and engineering to meet workforce demand and lags behind the states of Massachusetts and New York in per capita production of such degrees.[22] Bay Area industries and the educational system that supports them are fully integrated into the national economy and are both responsible for and affected by the national and state educational crisis.

Yet, the Bay Area at the moment has an abundant supply of highly educated workers. The preceding analyses suggest this is due, at least in part, to the significant numbers of skilled workers willing and interested in moving to and working in the Bay Area. The continuing allure of the region remains, for the moment, a powerful asset in the global and national competition for skilled workers.

Perhaps the most important asset in the region's competitive quiver is its high concentration of leading universities and research institutions. The Bay Area is home to internationally recognized educational institutions such as Stanford, UC Berkeley and UC San Francisco. These institutions draw gifted students from around the world, many of whom stay in the

[19] United States Department of Education. "Strengthening Education: Meeting the Challenge of a Changing World." February 2006. http://www.ed.gov/about/inits/ed/competitiveness/challenge.html (accessed November 3, 2006).

[20] Anthony P. Carnevale and Donna M. Desrochers. "The Missing Middle: Aligning Education and the Knowledge Economy." Office of Vocational and Adult Education, U.S. Department of Education (2002). http://www.ecs.org/html/Document.asp?chouseid=5013 (accessed November 1, 2006).

[21] Business-Higher Education Forum. "Building a Nation of Learners." (2003). http://www.bhef.com/publications/2003_build_nation.pdf (accessed October 2, 2006).

[22] California Council on Science and Technology. "Critical Path Analysis of California's Science and Technology Education System." (April 2002). http://www.ccst.us/publications/2002/2002CPA.php (accessed March 5, 2006).

Bay Area upon graduation and help build the economy. Bay Area universities and research laboratories attract federal funds for cutting-edge research, which also contributes to the development and growth of local industries. Many smaller colleges, universities and community colleges also help prepare Bay Area residents for ever-changing job requirements in an economy that relies on flexibility and rapid-paced innovation.

While attracting some of the world's most talented managers and scientists, Bay Area companies are also reliant on skilled tech workers, and particularly workers with associate's degrees from community colleges. Most of these mid-level jobs are filled by locally educated workers. A number of Bay Area companies have recognized the critical relationship between industry and academia, and have responded by sponsoring workforce training programs. Genentech, for example, supports a 12-week Biotechnology Manufacturing certificate program and a two-year Associate in Science degree with a biotechnology focus at Skyline College in San Bruno. Bayer HealthCare and the City of Berkeley formed Biotech Partners, a technology curriculum serving between 125–150 typically underrepresented Bay Area students. Ninety-seven percent of Biotech Partners' students are minorities and 54 percent are women. Since 1993, the program has placed nearly 700 youth in industry internships and co-op work programs.[23]

The lists on the following page illustrate the richness and diversity of Bay Area educational and research institutions.

[23] California Health Institute and PricewaterhouseCoopers LLP. "California's Biomedical Industry." (2006).

Bay Area Colleges, Universities and Research Institutions

Public Universities	
University of California, Berkeley	Berkeley
University of California, San Francisco	San Francisco
San Francisco State University	San Francisco
San Jose State University	San Jose
Sonoma State University	Rohnert Park
California State University, East Bay	Hayward
California Maritime Academy	Vallejo
University of California, Hastings College of Law	San Francisco
University of California, Santa Cruz[a]	Santa Cruz
University of California, Davis[a]	Davis
University of California, Office of the President[b]	Oakland

Private Colleges and Universities[c]	
Stanford University	Palo Alto
Santa Clara University	Santa Clara
University of San Francisco	San Francisco
Golden Gate University	San Franicsco
Mills College	Oakland
Saint Mary's College	Moraga
California Institute for Integral Studies	San Francisco
Pacific Union College	Angwin
John F. Kennedy University	Orinda
Dominican University	San Rafael
New College of California	San Francisco
Menlo College	Atherton
California College of Arts	San Francisco
San Francisco Art Institute	San Francisco
Notre Dame de Namur University	Belmont
Patten College	Oakland
Samuel Merritt College	Oakland
Graduate Theological Union	Berkeley
University of Northern California	Petaluma
Pacific Graduate School of Psychology	Palo Alto
Holy Names University	Oakland
Chapman University	Concord
California College of Arts and Crafts	Oakland

a. Nationally ranked universities within the Bay Area commute shed.
b. Provides oversight to programs that ensure academic and industrial cooperation throughout the UC System.
c. Partial list

Community Colleges	
Cañada College	Redwood City
Chabot College	Hayward
City College of San Francisco	San Francisco
College of Alameda	Alameda
College of Marin	Kentfield
College of San Mateo	San Mateo
Contra Costa College	San Pablo
De Anza College	Cupertino
Diablo Valley College	Pleasant Hill
Evergreen Valley College	San Jose
Foothill College	Los Altos Hills
Laney College	Oakland
Las Positas College	Livermore
Los Medanos College	Pittsburg
Merritt College	Oakland
Mission College	Santa Clara
Napa Valley College	Napa
Ohlone College	Fremont
San Jose City College	San Jose
Santa Rosa Jr. College	Santa Rosa
Skyline College	San Bruno
Solano Community College	Suisun City
Vista Community College	Berkeley
West Valley College	Saratoga

Federal, State and Independent Research Institutions	
Stanford Linear Accelerator Center	Menlo Park
NASA Ames Research Center	Moffitt Field
Lawrence Berkeley National Laboratory	Berkeley
Lawrence Livermore National Laboratory	Livermore
Sandia National Laboratories	Livermore
SRI International	Menlo Park
Buck Institute for Age Research	Novato
Children's Hospital Oakland Research Institute	Oakland
Joint Genome Institute	Walnut Creek
California Pacific Medical Center Research Institute	San Francisco
J. David Gladstone Institutes	San Francisco
QB3 (California Institute for Quantitative Biosciences)	San Francisco
CITRIS (Center for Information Technology Research in the Interest of Society)	Berkeley
CIRM (California Institute for Regerative Medicine)	San Francisco

The optimism expressed in the preceding paragraphs should in no way obscure the importance of sustaining and increasing our commitment to the Bay Area young people and entry-level workers who rely on the region's K–12 and other public learning institutions. The Bay Area is home to some of the highest ranking and lowest ranking schools in the state.[24] Even within the highest ranking schools, many students are left out. Failure to address the educational needs of the entire Bay Area community risks the creation of a progressively bifurcated economic system where educated workers earn ever-increasing wage premiums, and fewer and fewer opportunities arise for other residents to work their way up through the educational system.

The risks to the region's existing workforce base are therefore substantial. Uneven public school performance in conjunction with high housing costs may impact the decision of even management-level workers and scientists to remain in the Bay Area or relocate outside of the region. More restrictive immigration policies may also have the effect of depleting the region's human capital pool.

The Role of Universities as Incubators of Industry

Bay Area universities train students for future careers in the increasingly knowledge-driven economy. Less recognized, but equally critical to the health of our economy, is the process by which knowledge is disseminated back and forth between industry and institutions of higher learning. Ikhalq Sidhu, executive director of the Center for Entrepreneurship & Technology at UC Berkeley describes a positive feedback loop in which academics and industry scientists work in tandem on solving technological problems.

> *Academics like to tackle problems. Industry can take academic research and build things. When industry does this, usually it finds that there are five [more] problems that no one in academia has ever thought of…These problems come back to the university for more research…Industry can't do it by itself…And universities can't do it by themselves because they don't know what the problems are.*[25]

Bay Area universities are particularly successful in this process of moving technology to the marketplace. Inc. Magazine describes the process of technology transfer as the following: "…academic researchers patent their work, then license it, often under a royalty agreement, to companies that ultimately bring the innovation to the market. Many of the great breakthroughs of the past 30 years—in fields such as computing, telecom, the Internet and fiber optics—were first conceived in a university lab." And according to Inc. Magazine,

[24] In 2004, Cupertino's Faria Elementary School was the highest-ranking school, based on the Academic Performance Index, and San Francisco's Newcomer High, a school for immigrants with limited English capacity ranked last. http://www.cde.ca.gov/

[25] Ikhalq Sidhu, Executive Director, Center for Entrepreneurship and Technology, UC Berkeley. Interviewed by Jennifer Susskind and Cynthia Kroll. (May 8, 2006).

which universities are most successful at technology transfer? "Just five schools, in fact, constitute the elite of the technology transfer world. They are Berkeley, Caltech, Stanford, MIT and Wisconsin." Each of these universities produces approximately 100 new patents per year. [26]

The history of Silicon Valley is in many ways a narrative of this feedback relationship. Much of the initial funding for Silicon Valley enterprises came from federal research grants. For example, F. E. Terman, the Dean of Engineering at Stanford after World War II, was largely responsible for the emergence of Hewlett-Packard. He attracted federal money for research and understood the need to spin off companies. UC Berkeley, too, started as a land grant college, with significant federal funds for research. Michael Borrus of Mohr Davidow Ventures, a venture capital firm in Silicon Valley, explains that the history of Silicon Valley was not just about social capital and the willingness of venture capitalists to take risks, but it was also about the flow of federal monies into Bay Area universities.[27] The Bay Area's—and indeed California's—role as a global leader in biotechnology is based to a large degree on funding from the National Institutes of Health.[28]

The interrelationship between Bay Area biotech industries and academic research illustrates particularly well the economic value of university-industry partnership and technology transfer. In the 1970s, scientists from UC San Francisco, UC Berkeley and Stanford defined new genetic engineering methods through their work on recombinant DNA. With help from the federal government, researchers founded the first biotechnology company, Genentech Inc.[29] In 2006, Milken Institute researchers analyzed the relationship between academic research and the development of spin-offs, startups, and collaborations between universities, biotech firms and venture capital. The resulting report, "Mind to Market," ranks 683 international universities on the quality of their biotech research, number of biotech patents, and the ability of these universities to transfer patents to commercial uses.[30] The following table shows the ranking of Bay Area research universities in these three categories.

Bay Area Research Universities' Milken Rankings for Biotechnology Transfer, 2006

	UC Berkeley	Stanford	UC San Francisco	UC Davis
Biotech Publication Ranking	25	12	4	74
Biotech Patent Ranking	7	4	2	52
Technology Transfer and Commercialization Ranking	29	4	19	75

Source: Milken Institute

Between 2001 and 2006, 202 new biomedical companies were established in California. Five California schools, including Stanford, UC Berkeley and UC San Francisco, were responsible

[26] Carl Schramm. "Five Universities You Can Do Business With." *Inc. Magazine*. (February 2006).

[27] Michael Borrus, Executive in Residence, Mohr Davidow Ventures. Interviewed by Jennifer Susskind and Cynthia Kroll. (May 17, 2007).

[28] California Health Institute. (2006).

[29] Biotechnology Industry Organization. "San Francisco: The Birthplace of Biotechnology." http://www.bio.org/events/2004/media/sfbirth.asp (accessed December 14, 2006).

[30] Ross Devol et. al. "Mind to Market." Milken Institute. (September 20, 2006).

for spinning off two-thirds of these companies. Since 2001, UC Berkeley alone has produced 48 established biomedical spin-off companies. Two-thirds of these companies are still located within 35 miles of the university where their technology was developed.[31]

Leading Bay Area Research Universities' Rankings for Total Research Funding, 2003[a]

	Total Funding (in thousands)	Total Funding Rank	Life Science Rank	Physical Science Rank	Engineering Rank	Computer Science Rank	Math Rank
UC San Francisco	$671,443	6	1	29	N/A	N/A	N/A
Stanford	$603,227	8	14	7	8	17	21
UC Berkeley	$507,186	12	46	5	6	93	15
UC Davis	$482,145	16	12	49	67	67	53

Ranking of Stanford, UC Berkeley and UC Davis for Number of PhDs Granted[b]

	2004		1998	
	Number	Rank	Number	Rank
UC Berkeley	775	1	756	5
Stanford	625	8	606	10
UC Davis	375	31	337	36

a. Ranking based on all American universities reporting federal research in 2003.

b. UC San Francisco is not shown since medical schools produce relatively few PhDs.

Source: University of Florida, The Center, "Top American Research Universities"

[31] Carol Mimura, Assistant Chancellor, Intellectual Property and Industry Research Alliances, and Veronica Lanier, Acting Director, Office of Technology Licensing, UC Berkeley. Interviewed by Jennifer Susskind and Cynthia Kroll. (May 1, 2006).

Living Studies

The following eight perspective studies are derived from interviews conducted by the research team during the fall of 2006. The interviewees represent five knowledge-based companies, a research laboratory and recruitment firms that position high-level management and corporate board members. Each addressed the supply of and demand for highly educated workers in the Bay Area, the types of knowledge and skills that industry will demand in the future, and the role of human capital in regional competitiveness. The interviewees were asked to identify any unique features of Bay Area employees that distinguish them from workers in other U.S. regions and other countries, whether these differences influenced their decision to locate or remain in the Bay Area, and any difficulties they faced in recruiting highly educated workers and board members.

A Bioscience Startup Perspective: Interview with Corey S. Goodman, PhD., Founder and former CEO, Renovis, Inc.

Renovis, Inc., a biopharmaceutical company incorporated in January 2000, focuses on the discovery, development and commercialization of drugs to treat neurological disorders and diseases. All four of the company cofounders previously held positions in Bay Area universities. When asked why Renovis chose to locate in the Bay Area, founder Corey Goodman explains:

> *While some start-up companies think it is important to locate close to venture capital, it is actually more important for us to be close to the science. There was never a question that this company would locate in the Bay Area. What drives companies to be here are the three great universities [UC Berkeley, Stanford and UC San Francisco]. Our venture capital partners never questioned this location choice.*

Nonetheless, academia alone cannot explain the high levels of innovation and entrepreneurship achieved by many Bay Area scientists. It is the private sector, according to Goodman, that most readily generates innovative solutions to medical problems. “Campuses are like molasses. The academic senate has way too many layers of bureaucracy. It would

take decades [within the university] to do what I'm doing now. I'm not sure society understands that it is easier to build things in the private sector than in the university." Goodman considers the private sector to be more "collegiate" than the university: "We in the bioscience industry are less competitive. There are more resources than in the university. I'm working in neurology; someone else is in a totally different discipline. I can talk to other CEOs and retired CEOs. They offer an enormous source of mentoring for me." Ultimately it is the synergistic relationship between the private sector and the university that helps drive the Bay Area's technology engine.

Aside from academia, Renovis depends upon the Bay Area's business networks, which include lawyers, support services and high-tech infrastructure. These auxiliary institutions help to shape the knowledge economy. Renovis also depends upon what location economists call "agglomeration economies" and specifically the region's large pool of talented and educated workers. Goodman explains: "Take our employees: If, somehow, we have to lay employees off, they won't have to move. Within one or two months, all of them would have jobs. It's all I can do not to have recruiters pick my employees off." While there is rarely an abundance of qualified PhDs, start-ups like Renovis have an even tougher time retaining technical staff such as research assistants and animal technicians. Established companies like Genentech can offer better benefits, including, for example, a cafeteria with a sushi chef. In contrast, small start-ups often rely on stock options to draw skilled workers. Lower-level employees frequently work for a number of years and return to school for additional degrees. For these employees, the stock options are not the biggest draw.

The Renovis workforce is highly educated. Of the firm's 114 employees, 104 have at least a bachelor's degree and 35 have a PhD. Many of the company's employees were educated in the Bay Area; others were recruited internationally. Of the 104 bachelor's degrees, 38 (more than one-third) came from Bay Area universities, 12 came from other California universities, 21 from other American universities, and 33 (slightly less than one-third) came from universities outside the United States.

Looking at future growth prospects, Goodman considers multiple aspects:

> *I don't want people to think they are part of a huge organization. There is a way you can grow if you outsource, and still remain a village, a family, here at home. This is part of our long-term game plan. And we are typical [of many start-up companies]. This is how we maintain the entrepreneurial, creative edge.*

A Biomedical Perspective: Interview with Victor Assad, Director of Human Resources, Medtronic Vascular

Medtronic Vascular, a billion-dollar medical technology firm headquartered in Santa Rosa, designs, engineers and manufactures stents, balloon angioplasty catheters and other interventional medical devices to treat vascular disease. While its parent company, Medtronic, is headquartered in Minneapolis, Medtronic Vascular has remained in the North Bay since acquisition. According to Victor Assad, director of human resources, Medtronic Vascular is the fastest growing division of 11 billion dollar Medtronic, Inc.

In 1991, a Santa Rosa surgeon and three South Bay engineers launched Arterial Vascular Engineering. According to legend, while trying to address the problems associated with angioplasty over a game of golf, someone got the idea of applying scaffolding to the artery. "This became the genesis of arterial engineering" explains Assad. The three engineers moved to Santa Rosa, and in 1998 Medtronic acquired the firm. Would Medtronic have chosen to locate a vascular therapy medical firm in Santa Rosa? Probably not, according to Assad, but Medtronic has shown no interest in relocating. In fact, Medtronic merged a vascular unit in San Diego with the Santa Rosa facility because the Santa Rosa unit showed stronger performance. Now Medtronic Vascular has eight facilities, including one in Galway, Ireland, with 2,000 employees that manufacture stents, and another in Massachusetts that designs and manufactures catheters.

While medical device companies more often establish operations in centrally located Bay Area cities or the South Bay, Santa Rosa has proved to be a good location for this knowledge-based company. According to Assad:

> *The Bay Area is still going though a gold rush. Many Californians are looking for the one-in-ten start-up that will make them rich. We often hire people who have gone from one start-up to another. But because we are bigger than a start-up, we can offer an opportunity for financial and career growth with more economic stability. Now that we've adjusted our pay rate to equal that of other Bay Area companies, we've been able to attract people who have gotten tired of working in start-ups.*

Also, like many more suburban and rural regions of the country, Medtronic Vascular reports no trouble recruiting support staff. Ultimately, because of location and the difficulty of finding an equivalent employer nearby, the facility has fewer turnovers among employees. Still, in spite of the beautiful scenery and the cheaper home prices, Medtronic Vascular has had a hard time encouraging Bay Area scientists and managers to relocate northward. Santa Rosa is still an hour away from San Francisco and far from other employers in the medical device industry.

Thus, according to Assad, Medtronic Vascular attracts talent from as far away as Chicago, Cleveland and Boston—all pharmaceutical manufacturing regions. This can be a challenge, since there is a big cost disadvantage for workers recruited from the Midwest. To mitigate the financial concerns that recruits express, "We have adjusted pay and we help with mortgage loans. For upper management, we often provide a second loan on the house." The company also recruits engineers directly from numerous universities in the Bay Area (including Stanford and more recently Berkeley) and from other universities both inside and outside of California.

As far as local talent is concerned, Medtronic Vascular has not historically had a close relationship with Sonoma State or the local community colleges. One of the cited reasons is that the vocational and technical curriculum at these local schools has focused primarily on training for the telecommunications industry, as there are few other medical device facilities in the area. Nor has the Santa Rosa facility traditionally relied on many foreign-born workers. Bay Area start-ups, Assad explains, tend to hire straight out of the science programs at local universities, where there are many foreign born candidates, but Medtronic Vascular generally hires people with significant employment experience.

The company relies on interdisciplinary skill sets, putting mechanical engineers, chemists, biomedical engineers and pharmacologists on teams:

> *We need people who know pharmaceuticals and who know how to design biomedical devices. Mechanical engineers would know how to stent an artery and know what kind of metal to use. And a pharmacologist would know how to use the correct medicine. You can't get that all from one person. Also, in the future, we will need people who can apply gene therapy. For example, we need people who understand how to apply cellular research to healing a heart. We will use gene therapy on a stent. And we will use a catheter that has a needle, load that needle with a drug and insert it in an artery to help the artery heal. That technology doesn't exist yet. There is now a confluence of disciplines that used to be considered unique: biology, chemistry, and engineering.*

A Management Recruiter's Perspective: Interview with Terry Chuah, Partner, Heidrick & Struggles

With over 60 international offices and 400 consultants, Heidrick & Struggles is the largest executive search firm in the world. Its San Francisco office places senior level management, including chief executives, financial and marketing officers, scientists and board members, in high-tech companies, academic institutions and nonprofit organizations. Terry Chuah, a partner in the San Francisco office, is familiar with industry's demand for high-level management and issues involved in meeting the regional demand.

Important in analyzing human capital, Chuah points out, is an understanding that each industry cluster has its own needs that are distinct from other clusters in the area. For example, he focuses on recruitment and relocation of high-tech workers for companies such as Cisco and Hewlett-Packard. These companies are likely to face labor supply and demand issues that differ from other knowledge-based companies, such as those in the biotech industry. Secondly, the issues involved in recruiting a CFO or board member differ dramatically from those involved in hiring an engineer, scientist or other highly educated worker. In Chuah's experience, the Bay Area offers a deep pool of skills and expertise:

> *The Bay Area is so rich with talent, it is hard to imagine that you simply could not find a person with the right skill set who is already here. But if there were a demand for a specific skill that resided in the mind of only one person, you might have to do a global search.*

It is still possible to recruit people to move to the Bay Area from almost anywhere in the world; the process, however, can be very challenging. Only 5 to 7 percent of Chuah's recruits involve an out-of-state move. One factor is the high cost of housing. "If it weren't for the price of housing, there would be a far greater inflow of knowledge workers into the Bay Area than we see today." As a result, many executives live in Sacramento or even Reno, and commute as far as San Jose. Often they pay, or the company pays, for an apartment during the week. Chuah explains, "People just don't want to move. It has to do with lifestyle, kids, schooling, and the cost of housing."

It can also be difficult to get someone to move to the Bay Area due to the perception of risk. "A lot of potential recruits from the East Coast or Midwest are worried about how unstable the companies in the Bay Area are. They would rather be with a Whirlpool than a Cisco." The view from outside the area is that there is particular risk in start-ups. On the other hand, for some—or for a person from the Bay Area—the potential for greater economic gain may offset the risk. The Bay Area also benefits from a perception that if you do lose your job, there are ample additional opportunities.

Ultimately, senior-level workers are willing to move to the Bay Area if the opportunity is compelling enough, if there is significant opportunity for wealth creation and if they are the right person for the job. According to Chuah, the qualities that Bay Area high tech companies

look for in an executive are in part defined by the specific industry, but also are defined by the general nature of Bay Area business activities:

> *The speed you need to operate with here in the Bay Area is different than in an industrial company in the Midwest. You need a higher degree of tolerance for ambiguity, you need to make fast decisions, deal with risk, and multitask a lot more. Therefore the folks that are more conservative don't come here. Whereas, those with an attraction to high growth, fast moving, changing situations do come here.*

When asked what type of recruitment Heidrick and Struggles is likely to be performing in the near future, Chuah reiterates that every industry is different and has distinct labor needs:

> *Right now, clean energy technology is very fashionable. Ethanol processing is also very popular. There is a lot of venture capital going into ethanol, which will generate an increasing need for related engineering, chemistry and biological processing skills. These have typically not been skills that are abundant in the Bay Area.*

The petroleum and food-processing sectors are potential sources of processing engineers, but these industries have been shrinking in the Bay Area, so the pool of talent is not large. While Chevron employees may have some of these skills, Chuah notes that he will be looking for people with the flexibility to work in start-ups and smaller companies. Generally, this will require a new inflow of knowledge workers in that area. On the other hand, bio-fuel or photovoltaic technologies will continue to drive demand for people who are skilled in semiconductor processing. Due to the number of firms in this area that have been working with this technology, there probably won't be a specific need to recruit for those skills from outside the region.

A Global Fortune 1000 Company Perspective: Interview with Amy McKee, Senior Manager, Global Staffing, Autodesk, Inc.

In 1982, after leaving another Marin-based company, computer programmer John Walker founded Autodesk. The software company that revolutionized drafting with its AutoCAD software has since outgrown its original Sausalito location and has branched out into over 37 countries worldwide. Nonetheless the company remains headquartered in Marin, and nearly one in five of Autodesk's 5,500 global employees works in its San Rafael offices. Aside from serving as the company's corporate office, the Marin office hosts a range of product development, engineering, human resources, marketing, legal, sales and finance functions.

Many of the same activities performed in the Marin headquarters are also performed in other Autodesk locations. According to Amy McKee, senior manager of global staffing,"Most of the same functions that are here are everywhere. We are a global company. It's important to have a local presence in those areas where we have customers." As a result, the company has a highly integrated management system. McKee manages employees from Marin to Singapore to London to New Hampshire. "We have a global hiring process. The managers in San Rafael can expect the same consistency of process as managers in other areas."

Nonetheless, the cost of living differential in places like New York City and the Bay Area requires the company to develop salary structures tailored to local markets. The Oregon and Michigan offices might have one pay scale and the offices in China and India will have another. According to McKee, the cost of living differential between the Bay Area and Asia or between the Bay Area and Portland, for example, does not deter candidates from seeking employment in the Bay Area, since the Bay Area has a lot to offer. McKee explains:

> *The region attracts highly educated people. Many candidates are enticed to come to the Bay Area because of the arts, the outdoor activities and the academic community. But being in Marin can be a challenge. When the market is strong and there are a lot of available jobs in Silicon Valley, people are less willing to commute to Marin. We had many outstanding candidates during the economic bust because there were fewer options in the Valley and candidates were more willing to travel to Marin.*

McKee cites the Bay Area's cost of living, and especially housing costs, as one of the more difficult factors in recruiting quality employees from outside the area. The company has tried to mitigate some of the difficulties associated with long commute times and a less central location with telecommuting options and relocation benefits.

In general, McKee finds that it is fairly easy to attract and retain qualified employees and management in the region:

> *In the Bay Area, it is easier to find people who have worked in tech companies. There is such a high concentration of tech companies here. People in the Bay Area are bright. They have been encouraged to innovate, and come up with new ideas and products. They have received patenting bonuses. Our products are a testament to the type of thinking that goes on in the region.*

Autodesk's global presence permits a great deal of skill and knowledge sharing between employees. Sometimes managers from the Marin office work in other regions for a while. Other times employees from elsewhere in the world come to the United States to learn about the U.S. business climate. The exchange goes both ways.

An Independent Research Institute Perspective: Interview with James Kovach, MD, JD, President and Chief Operating Officer, and Kay McMahon, Director of Human Resources, Buck Institute

The Buck Institute for Age Research, located in Marin County, is the only national research institute dedicated solely to aging and age-related illness. Researchers at the Institute investigate the processes of aging and how they impact diseases such as Huntington's, Parkinson's, strokes, cancer and Alzheimer's. With over eleven thousand American baby boomers turning 60 every day, age research has become an increasingly significant scientific pursuit.

The successful establishment of the Buck Institute and its projected employment growth have a great deal to do with its Bay Area location. While 63 percent of its funding comes from the National Institutes of Health and other federal sources, local philanthropic grants, particularly a large endowment from the locally headquartered Buck Trust, have enabled the Institute to thrive. Proximity to top universities and an environment of innovation and entrepreneurship further contribute to the prospects of this young organization. In many respects, the Buck Institute functions like a successful start-up company. As a nonprofit institution, however, the Buck Institute is conscious of the need to employ scientists who also possess business acumen.

Currently, the Institute employs 125 scientists out of a total of 175 employees. There are 15 principal investigators who comprise the faculty and the remaining scientists are lab members, staff scientists and post-doctoral researchers. At build-out, the Institute will employ 550 full time equivalents. Similar to most biotech companies and other independent research institutes, the Buck Institute plans to retain an approximate 3 to 1 ratio of scientists to administrators.

As a relatively new institution, the Buck Institute has used an array of recruitment strategies, ranging from those designed for technicians and lab workers, to those for post-doctoral fellows, faculty and executive management. According to president and CEO Dr. James Kovach:

> *In the beginning, it was particularly difficult to fill specialized management positions such as the director of compliance and manager of purchasing. As the Institute gained name recognition and as the general public became more excited about the science of aging, it has become easier to attract talented scientists as well as financial and administrative managers. Now we have people lined up who want to work at the Buck Institute and faculty and upper management are recruited via search committees.*

For these positions, the Institute casts a "wide net." The committees recruit from a global talent pool in order to attract those with specific skills, knowledge and experience. Being close to world-class universities has helped it recruit talent and engage in the cross-pollination of ideas and disciplines. Several faculty members hold adjunct professorial positions at UC San Francisco and other universities. In the long-term, the Institute is faced with the same challenges facing other knowledge-based institutions. One is how to maintain its position as an employer of choice. Kay McMahon, director of human resources, explains:

> *We are competing with salaries and benefits offered at universities. We need to focus on staying competitive within our industry and with an eye to the West Coast's high cost of living. We take that into consideration with salary and housing packages for key faculty positions.*

The recruitment of post-doctoral fellows is frequently from an international pool. The goal is to find the best match between the candidate's research interest, expertise and training to date, and the faculty mentor's laboratory research focus. Kovach notes that for post-docs, the decision to relocate to the Bay Area is rarely about cost of living:

> *They typically stay for 3 to 5 years. They live close to the Institute because they have experiments going 24 hours a day. Occasionally, we get people who pull out because they want to be more centrally located, closer to a university. But ultimately our attrition rate has been very low.*

The highest turnover at the Institute is with laboratory research associates, who are frequently hired as graduates with 4-year degrees and who then spend from one to three years in a laboratory. The labs benefit from the enthusiasm and recent training of new graduates, and the research associates have the time to explore their career options. Most leave the Institute

to pursue further education in their field. This turnover is considered healthy by the Institute, as the employees are moving on with their training.

The Buck Institute is an active member of the North Bay Leadership Council, which is made up of major employers in Marin County. According to Kovach, one of the biggest issues for the Institute and other leading employers is housing affordability: "You go into the sciences with the idea that you will be able to afford a home with a white picket fence. Even when you are a married couple with two advanced degrees, many times you don't have the savings to buy a house here." While this has not yet prevented the Institute from bringing on faculty members, it is a general concern for the area.

Another issue critical to recruitment efforts at the Buck Institute is the availability (or lack thereof) of public transportation. Located in Northern Marin, the Institute is relatively isolated. Many of the post-docs bicycle to work because they don't have cars.

Finally, Kovach brings up an issue that can affect those who recruit highly educated international job candidates: namely, the fact that many of these workers have spouses who do not have work visas. Kovach suggests that policies that enable the spouses of workers to obtain legal work would reduce some of their candidates' cost of living concerns.

An Executive Recruiter's Perspective: Interview with Abby Adlerman, Area Manager for the San Francisco Office, Russell Reynolds Associates

In the late 1960s, Russell Reynolds founded one of the first professional recruitment firms in New York City's financial sector. Since its inception, the company has helped define the industry, establishing rules of conduct and industry guidelines, growing to 37 global offices, and employing more than 275 consultants worldwide. In addition to financial services, the firm recruits executive management for the technology, consumer, industrial/natural resources, not-for-profit and healthcare sectors, and provides executive search and assessment services to such companies as Google, Hewlett-Packard, Yahoo, the Bill & Melinda Gates Foundation, Gilead, the California Academy of Sciences and The Carlyle Group.

From the San Francisco-based office of Russell Reynolds Associates, Abby Adlerman has an informed perspective on the Bay Area's demand for top talent and the capacity of organizations to attract and retain such professionals. She attributes the continuing demand for knowledge workers to local and statewide historic events, referring to the development of Silicon Valley in the 1970s and its role in the formation of the Bay Area's knowledge and innovation economy. She also looks deeper into mid-19th century California history:

> *The Bay Area is infused with a general culture of innovation and research stemming from the Gold Rush. Look at Levi Strauss; all those miners needed something to wear.*

> *San Francisco attracted people who wanted to be entrepreneurs. Combine that with a couple of good educational institutions—Stanford and Cal—and you have a real entrepreneurial mentality. Today, consider eBay: Who would have thought selling used stuff online would be so profitable?*

During another more recent historic event, the firm saw the demand for and the supply of human capital in the Bay Area impacted by the dot-com bubble and bust. At the height of the bubble, when companies were driven more by the supply of rather than the demand for capital, companies hired executives who lacked deep experience:

> *There was too much money; too many hires. While I am nervous that there is still too much capital in today's economy, I think we are in a much healthier place. Today, it is still not easy to hire good people. It shouldn't be. There should be a natural tension between the supply and demand for human capital.*

Most recently, a trend in hiring that impacts today's high-end job seekers, and particularly those in the Bay Area, has to do with the increased demand awareness among the firm's clients for cross-sector skills—skills that are applicable from one industry to another. Adlerman explains, "A really good leader doesn't always bring industry experience to the table." The notion of crossing industries is relatively new. For example, as consumer technologies become increasingly popular, companies have had to shift their focus from engineering to brand and consumer appeal. "The lines have blurred and that creates opportunities for executives who can cross the chasm and are comfortable living with shades of gray."

The firm also helps negotiate the growing demand for high-level nonprofit managers. In the last 10 years, the number and influence of philanthropic foundations based in the Bay Area has grown, thanks in part to companies like Google and eBay and the values of their founders. These philanthropic institutions have bolstered the Bay Area's already large not-for-profit sector. Adlerman explains that philanthropic organizations—particularly those that promote the arts, education and the sciences—"contribute to the culture of innovation and entrepreneurialism in the Bay Area." The combination of support for innovation and entrepreneurship that many foundations offer, in conjunction with top educational institutions, make the Bay Area "an easier environment [in which] to take risks."

Part of the job for Russell Reynolds is to help clients locate and hire professionals with unique skills and natural leadership capacities. These individuals typically garner large compensation packages. The stakes are high and finding the right person for the job requires a complex and qualitative screening process. The firm evaluates candidates based on a subset of 32 leadership criteria that it has developed as part of its proprietary assessment process. These characteristics include the ability to exercise good judgment, thrive on challenges, drive results, resolve conflicts, etc. Recognizing that no single candidate possesses all

32 leadership characteristics, the firm typically helps its clients identify a set of five or six core competencies. Candidates are assessed based on these leadership skills. According to Adlerman, if she were to evaluate the Bay Area in terms of the supply of talented executives, the region would excel (not unlike New York City) in the supply of leaders with the capacity to drive results and also with entrepreneurial capacities, the ability to innovate, flexibility and cultural astuteness.

Some leadership roles demand exceptionally rare skills. To identify this talent, Russell Reynolds Associates casts a wide net. Adlerman has found that in nationwide or international searches, recruiting candidates to the Bay Area can prove difficult, but not impossible:

> *It is easier, for example, to recruit a candidate from New York City than from Cleveland, because the cost of living in New York is equivalent to that of San Francisco. Usually people at this level of management have families. This is not about someone looking for a one-bedroom apartment. If you're living in San Francisco, most likely your children are going to go to a private school. It can get very expensive to relocate.*

Is there a shortage of candidates in the Bay Area for any specific positions?

> *The markets can be cyclical. It is very hard to hire controllers these days because of Sarbanes-Oxley. More and more companies are looking for people with the requisite skills. Standards are higher. Controllers make 40 to 50 percent more than they did a couple of years ago. There is also a flurry of activity over marketing people. The demand for marketing is driven by underlying economic strength and increased budgets in the current environment.*

Since the economy has improved, companies can now budget for marketing campaigns. However, some of those that lost their jobs during the economic bust have retrained or left the area, making it difficult to find experienced and skilled job candidates. Alderman concludes:

> *In general, the good news, for us, is that the human capital economy is doing extremely well right now. There is a lot of hiring activity. Our clients are initiating executive searches in a more responsible, proactive and planned manner, rather than just responding to short-term opportunities. The more that organizations are able to look to longer horizons and plan their leadership needs around strategic as well as tactical imperatives, the better the chance we all have for rational, sustainable cycles.*

A Physical Science Perspective: Interview with Stanley Williams, Senior Fellow, Founder and Director, Quantum Science Research group, Hewlett-Packard Laboratories

The worldwide research laboratories of Hewlett-Packard (HP) employ between 600 and 700 workers—in Bristol, Ireland; St. Petersburg; Haifa; Bangalore; Tokyo and Beijing. Dr. Stanley Williams, director of the company's Quantum Science Research group, points out that it is no accident that each of these research laboratories are located on or directly adjacent to university campuses. Williams's lab, in the original Palo Alto HP headquarters, is no exception—the Stanford campus is literally across the street.

With HP offices spannning the globe, the Palo Alto Quantum Science Research group employs scientists and technicians from many global hot spots. Apart from some of the older employees, Williams characterizes his group as "exclusively non-American." Most were born in the People's Republic of China, and he has scientists from Brazil, Turkey, Canada, Iran and Europe—particularly Russia, France and Italy.

Williams is concerned that there are very few American-born physical scientists emerging from U.S. universities, and few are engaged in research and development (R&D). This phenomenon may have a long-term impact on the American economy and particularly on the Bay Area, where so many high-tech jobs are located. The problem stems in part from how federal science funding is divided between the scientific disciplines. He explains:

> *A vast amount of federal dollars has gone into medical and health-related research. The National Institute of Health has a budget of $36 billion for health-related sciences. On the other hand, the National Science Foundation budget is $6 billion. This money supports all sciences, with only $2 billion dedicated to the physical sciences.*

This discrepancy in funding has caused young people who are interested in science to gravitate toward the biological sciences. But, according to Williams, the problem with federal funding priorities is that there is relatively little industry behind all the money going into medical research. In the U.S., six times more companies rely on physical rather than biological sciences. Since there is an abundance of trained health scientists, many post-docs end up leaving their fields because there are not enough jobs or a large enough health-related industrial infrastructure outside the university.

Conversely, Williams's department at HP has grown from 5 to 60 researchers in the past five years. Because, as he sees it, there has been a relative neglect of R&D funding for physical science, his lab has had to rely on foreign-born scientists. "I've worked here for ten years, and haven't had a single U.S.-born scientist apply." Williams and HP management consider the relative funding shortage a critical economic development issue, and while lobbying the

U.S. Congress on traditional tax and trade issues, they also push for additional education and R&D funding in the physical sciences.

The potential offshoring of high-tech R&D, according to Williams, is related to this funding shortage, and is a self-fulfilling prophecy. "If there are not enough U.S.-born scientists and the number of H-1B visas is reduced, we will push industry offshore." The issue has more to do with the availability of good scientists than with the relative cost of labor between the U.S. and countries like China and India:

> *From my standpoint, I don't want to be flying all over the world managing people. By offshoring, you don't save nearly as much money as you think. Plus, turnover is ferocious overseas. Your employees are constantly looking for a new job. A lot of offshore work is coming back.*

According to Williams, neither the federal government nor the State of California sufficiently funds the physical sciences. And they don't understand the role of science in our national, state or local economies:

> *Science and technology plays a minimal role in federal and state policy decision-making. This is a suicidal mistake. California is the sixth largest economy in the world. Other governments around the world have science advisors. Singapore has a half dozen people advising on science. Why doesn't the Governor of California have a science advisor, since the vast majority of money in the state is coming from science? HP alone, for example, brings in more money than all of agriculture.*

Despite the Bay Area's high cost of living, a shortage of talented native scientists and an insufficient supply of H-1B visas, HP suffers from no shortage of job applicants. Upon posting an open scientist position:

> *We get 300 applications within a few days. At least 200 of the responses will come from India. The rest are from all over the world. We can afford to be selective. In general, we only look at applicants from the top universities—MIT, Stanford, Caltech, Harvard, UCLA and Berkeley.*

According to Williams, those that get into these graduate programs mostly make their decision to study science as undergraduates. "These are often people who were underprivileged in their home countries and worked themselves up the ladder. They come with a lot of native intelligence and a strong work ethic." While they receive PhDs from Berkeley or Stanford, the job applicants Williams describes are rarely native-born.

Another issue associated with the supply of scientists has to do with the newness of the field of quantum science, otherwise known as nanotechnology:

> *Nanotechnology is where physics, biology and chemistry meet. Our scientists come from a broad and eclectic range of disciplines. We have all flavors of chemists, material scientists, physicists, electrical engineers, mathematicians, architects and a few wild cards thrown in. In this environment, managers will spend a lot of time advertising for the person they are looking for, but usually in 6 months they are trying to convince the person to do something else. We will try to make the descriptions fairly broad. The best of the people we hire here end up creating the positions they would like to do. I look for the person with the most talent, not the most specific skill.*

Part of the hiring decision depends on how well the candidate communicates to someone who isn't in his or her field. The difficulty, according to Williams, has little to do with linguistic or cultural barriers. "We had to develop a common academic language." While some people can communicate more easily across disciplines, it is difficult for a manager who is also a scientist to train his or her employees in this type of skill. Williams explains, "When young people ask what is the best class to take, I suggest a really good journalism or English class. The most important [skill] is to be able to listen and talk well."

It is also critical for today's scientists to collaborate and problem solve together. "By working together, even our most arrogant scientists found out they could solve a problem that they could not solve on their own. When we began collaborating, we began creating amazing patents. Part of our expectation when we hire new scientists is that they will be working in areas in which they have very little expertise."

While staffing a laboratory with talented scientists can be a complex task in the Bay Area, finding good technicians has its own challenges. "We can't survive without good technicians. A lot of people believe that a top-flight researcher can do what a technician does. But the truth is, some people are naturals with what the head and the hands can do together." Williams is concerned that many of his best technicians, who have many years of industrial experience, are older and near retirement:

> *We've had very few inexperienced people applying for technician positions, trying to get into nanotechnology. It may be that younger people think the Bay Area is too expensive. Perhaps this is an example of the mid-level skilled workers fleeing the area. The people who apply for technician positions already have roots here. This is starting to worry me because we are hiring people who have already retired once. We're lucky to be able to hire them back.*

In spite of some of the issues Williams raised, he considers the Bay Area the perfect location for HP Labs. "This is an environment that hasn't been duplicated anywhere else. There is a broad intellectual community here in the Bay Area that includes scientists in the national laboratories, universities like Stanford and Berkeley, existing companies and venture capitalists."

A Nanotech Perspective: Interview with Dr. William Miller, Chairman & Founder, and Pankaj Dhingra, CEO, Nanostellar Inc.

Based in Redwood City, Nanostellar Inc. designs improved catalytic converters for diesel engines, reducing the cost of production and increasing efficiency. The company is one of a growing number of Bay Area high-tech firms that rely on interdisciplinary sciences such as biotechnology, molecular electronics, advanced materials and new manufacturing technologies. Nanostellar was founded in 2003 and now has 30 employees, 19 of whom hold PhDs. According to Chairman and Founder Dr. William Miller, only 4 or 5 Nanostellar employees were born in the United States, and even fewer were locally educated. The vast majority of employees are highly skilled immigrants from countries such as Korea, China, India, Turkey, Sweden, Kazakhstan, and Vietnam.

While the company's recruitment patterns are not unlike other high-tech firms in the Bay Area, Nanostellar is somewhat unique in that it has roots in the automotive industry. Traditionally, very little Bay Area research and development has focused on auto parts design and manufacturing. For Nanostellar, the lack of local expertise means that the company has found it advantageous to recruit from outside the region. Several of the firm's high-level managers have come to Nanostellar directly from the Midwest at a time when many management-level jobs in that region are disappearing. Miller says, "It is difficult to get employees with experience in computational modeling who have also had real experience in the industry. People with industrial experience are very valuable."

One such employee with extensive automotive industry experience is CEO Pankaj Dhingra. Dhingra, originally from Pilani, India, spent many years working for General Motors, Delphi and smaller automotive companies. According to Dhingra, not only is it difficult for Bay Area companies to attract employees with automotive experience, it is particularly difficult to attract prospective employees to come and work for a small start-up. But Dhingra explains, "I had already worked for a small company. I had already experienced the culture shock before coming to the Bay Area."

In spite of the fact that the Bay Area is not known for automotive production, the region's synergistic relationship between science and industry makes it attractive to companies like Nanostellar and to the highly skilled and educated workers who seek employment at the heart of an expanding cluster of knowledge-based firms. Miller explains:

> *The Bay Area, in the past, was not about technology. It was about converting technology into business. Software, computers and semiconductors didn't start here. People brought these technologies from elsewhere. But now, more recently, biotech, nanotech, IT and semiconductor technologies are being developed here. When you have a region that excels in both entrepreneurship and innovation, now that's exciting.*

While researchers at Stanford, UC Berkeley and other Bay Area universities have limited practical experience in traditional automotive sciences and management, the cutting edge material science and engineering that distinguish Nanostellar from other automotive companies is coming out of Bay Area universities. Furthermore, the region's ability to transform science into innovation nurtures nontraditional industry. According to Miller:

> *Much of the initial design technology for Nanostellar came out of Stanford. We used Stanford's software. But, as is common with other technology companies, what we started with at Stanford was not what we finished with. We don't use the technology that was developed in the Stanford labs anymore.*

It was the synergistic relationship between industry and science that appealed to Dhingra, and, he believes, it is the science that will support Nanostellar's success:

> *The biggest concern I had about moving to the Bay Area was that there was not a lot of automotive talent here. We are also pretty far away from our customers. Despite these concerns, Nanostellar's science is really cool. You will not find the type of work Nanostellar does anywhere else but in the Bay Area, or maybe MIT or CalTech. For example, when I graduated from school, we thought a computer could not create a circuit board. You need the fuzzy knowledge that only humans have. Now circuit boards are so complicated that humans can't do it without the help of a computer. Similarly, with design, we used to do clay models and wind tunnel testing. Now automobiles are designed entirely on computers. Today, chemistry is still done the old-fashioned way. What Nanostellar is doing is trying to understand how chemical reactions are taking place at the atomic level. Once you understand this, you can do the work outside the chemistry lab, and design more complex materials than can be designed by trial and error.*

Nanostellar is poised for growth, but it is unlikely that the manufacturing end of the business will remain in the Bay Area. Production will likely begin in a region that has greater experience with automotive manufacturing. Nanostellar has a joint venture with a catalytic

converter company in Pennsylvania, and is looking to do additional production in Europe, due to the continent's large diesel market. The flagship Redwood City office, however, will continue to develop catalytic converters with greater emissions control, as well as additional product lines that can use the company's patented technologies.

More than likely, Nanostellar and similar start-up companies will continue attracting to the Bay Area highly skilled and educated workers from around the globe. Dhingra cautions, however, that in recent months the company has had severe difficulty finding the personnel it needs for growth ("we just can't find the people"), due to visa-related problems that restrict access to foreign talent that has been trained in local universities, the shortage of automotive industry skills in the Bay Area, and the fact that many experienced people are unable to relocate to the Bay Area because of its high housing costs. As a result, the company is starting an R&D center in Michigan and is considering whether to set up a computational center overseas (in India, Western or Eastern Europe.)

Conclusions and Policy Considerations

The Bay Area has traditionally maintained a highly educated and extraordinarily productive workforce. This was particularly the case in the lead-up to and during the economic boom of the late 1990s, when demand for highly skilled workers was at its peak. Since then, educational attainment levels have continued to rise, and the Bay Area boasts an array of other desirable workforce characteristics, including very high levels of cultural and linguistic diversity. The diversity of occupations and industries employing educated workers also suggests that the region's economy can continue to attract and absorb additional high-tech, highly creative and high-value-added talent.

Research Conclusions

The research of this report on Bay Area industry and workers leads us to the following observations:

- The fastest growing occupations in the Bay Area are those that require either a great deal of education and training or very few skills and little training. These occupations correspond to relatively high and low wages. Mid-range salaried jobs are not on the list of fastest growing occupations.
- Educated workers are widely distributed throughout Bay Area occupations and within Bay Area industries. This is most likely due to the highly sophisticated and specialized nature of Bay Area industries, and it is good news for companies wishing to locate or remain in the Bay Area.
- The Bay Area has a relatively healthy supply of educated workers compared to other U.S. regions known for their high-tech industries. Forty-one percent of Bay Area residents have achieved a bachelor's degree, while only 27 percent of U.S. residents have achieved such a degree. Bay Area residents are twice as likely as their U.S. counterparts to have attained a doctorate degree.
- Between 1990 and 2004, Bay Area residents became more educated.
- A diverse workforce is better able to meet the challenges posed by the global economy.

- Thirty percent of Bay Area residents were born outside the United States and 6 percent of Bay Area workers are recent immigrants. Compared to other regions in the United States, a greater number of knowledge workers are recent immigrants.
- In the Bay Area, recent immigrants are less likely than non-immigrants to have completed high school, but among those Bay Area adults who are high school graduates, immigrants are more likely to have attained a bachelor's degree or a post-graduate degree.
- Recent arrivals to the Bay Area are more likely to be highly educated or to have attained less than a high school diploma. In the middle range, there has been a net loss of high school graduates and residents with associate's degrees.
- There is an abundance of leading educational institutions in the Bay Area, and these institutions play an important role in educating Bay Area workers, attracting talented people from around the world, and incubating new knowledge-based companies.

In spite of the generally positive conclusions suggested by this research, one risk facing the Bay Area appears to come not from a lack of highly educated workers, but rather from an increasing level of educational inequality. Domestic and international migration data points to an emerging two-tiered structure, with an influx of both uneducated and very educated workers, and signs of an exodus of working-class residents. Parallel with this, the fastest growing occupations appear to be those that require the highest levels of education and those that require very little education and minimal skill levels.

Related Issues

This report has focused on the needs of the high-tech employment sector, but a related issue has to do with the capacity of Bay Area residents to perform moderately skilled service sector jobs that cannot be exported. These are "bridge-building" occupations that help individuals move from entry-level jobs into those that require greater levels of skill and education.

Bay Area public schools are not consistently producing graduates with basic skills, even as many occupations now require a more complex set of skills than ever before. According to San Francisco City College chancellor Dr. Philip R. Day, Jr., businesses are having a hard time attracting workers with basic literacy, mathematical and computer skills.[32] This is occurring at the same time as restaurant workers and automobile mechanics are now expected to use computers to perform daily operations.

A related issue impacting the workforce at all levels is the general shortage of affordable housing in the region. This is a serious issue for workers with lower- and mid-level skills and

[32] Philip R. Day, Chancellor, City College of San Francisco. Interviewed by Jennifer Susskind, Jeanette Nelson and Margaret Salazar for UC Berkeley, Department of City and Regional Planning, CP2228. (March 1, 2006).

education, but affects even the highly skilled and educated workers the region needs to sustain a knowledge-based, innovation-led economy.

While Bay Area employers have ongoing need for workers with high levels of education and skills, they also need moderately skilled and educated workers as well. However, data on domestic out-migration suggests that that these workers are moving out of the region. As long as many Bay Area public schools continue to underperform and affordable housing continues to remain beyond the reach of the middle class, we should anticipate that more workers with needed skills will leave the Bay Area in search of better public schools and less expensive housing.

Policy Recommendations

The following policy recommendations are directed to the region's need to maintain, sustain and grow a highly skilled global workforce, while simultaneously boosting the capacities of local residents to meet local industry's needs. Some of these recommendations are directed toward local governments, others are directed at the state and federal levels, and others are best suited for industry involvement. Some require the combined efforts of government and industry.

Increase federal and state funds for research and development at university and federal research labs.

Government, whether federal, state or local, cannot single-handedly foster innovation and inspire a nation of entrepreneurs and scientists. However, as the history of Silicon Valley suggests, inspiration is not entirely self-seeded. A great deal of federal funding went into the Bay Area's high-tech sector during the early years of its scientific and industrial growth. Today's research funding should focus on core competencies, such as physical science, as well as growing sectors, such as biomedical and energy efficiency/clean energy technology.

Promote the exchange of ideas and people between the United States and regions of talent across the globe. Increase opportunities for foreign workers to share their skills with Bay Area companies and for Bay Area companies to offer opportunities to these workers.

Bay Area companies are well positioned to take advantage of growing research and industry relationships with Asian and other scientists and entrepreneurs. Specifically, Bay Area policymakers should advocate for an expanded number of educational and work visas, to encourage the brightest foreign students to study in the Bay Area, and once they arrive, to encourage them to stay and help build the economy. The federal government should also consider granting a green card to any foreign student who receives a post-graduate degree in designated disciplines at an American university, and should consider granting work visas to the spouses of foreign workers as well. By educating foreign students and training foreign

workers, Bay Area universities and companies are not in danger of losing their global competitive edge. On the contrary, they enrich both communities. One of the most important conclusions from UC Berkeley's Dr. AnnaLee Saxenian's study of immigrant entrepreneurs is that:

> *The Argonauts have made America richer, not poorer. Far from stealing jobs, immigrant entrepreneurs have created them in very large numbers, both in the United States and overseas. America benefits from the dramatic reductions in the cost of both producer and consumer technologies made available by the growth of overseas technology regions, as well as from access to fast-growing foreign markets.*[33]

Increase support for K–12 education and community colleges and the engagement of industry with community colleges to support targeted workforce development.

At the K–12 level, graduates need the basic skills required either to be employed directly or to go on to higher education—without remedial education. A failure to develop those skills risks the creation over time of a large under-educated, under-skilled population that is ill-equipped to contribute and compete in today's global economy. Renewed focus is needed on education to help workers advance from entry-level positions to more highly paid and skill-intensive employment in growing knowledge-based industries. This is an important role for community colleges.

If industry works more closely with community colleges to identify needed skills, develop curricula and support students and programs, industry and the colleges together can help ensure a seamless supply of qualified workers at every employment level. Finally, since in today's more fluid global economy, jobs and job descriptions change rapidly, so will careers. This points to a growing need for lifelong skills development and training, as workers periodically retool to meet changing industry needs.

Increase the supply of housing at all levels, but particularly in more affordable brackets.

Although industry leaders cite the Bay Area's high cost of housing as one of the most negative factors in recruiting upper management and senior research personnel, an equally serious consequence of the region's high housing costs may be the loss of local talent to fill entry-level and mid-level jobs in both the knowledge and local service economies.

[33] Saxenian. (2006).

Promote cross-disciplinary activity in research and education. Innovation is increasingly taking place at the boundaries between different disciplines.

Many of the Bay Area's cutting-edge technologies, such as synthetic biology, draw from fields as diverse as chemistry, biology and engineering. Michael Borrus of Mohr Davidow Ventures explains, "The Bay Area's advantage is in the depth and breath of our science. Not in specific scientific disciplines."[34] Ikhlaq Sidhu of the Center for Entrepreneurship and Technology emphasizes the importance of educating students at the intersection of the disciplines. Critical crossover skills are required not only between scientific fields, but between science and business, as entrepreneurs translate research into economic value. These crossovers point to the importance of extended networks that permit diverse communities with different skills and knowledge to interact. Sidhu states:

> *The real technical problems are no longer solved in a single discipline. There are plenty of electrical engineers that can design a circuit board, but engineers also need a sense of the market, an understanding of customer needs. Bringing together two scientists is complicated, and it is even more complicated when you bring in businesspeople. But the mixing of different kinds of knowledge and experience leads to innovation. What we in the Bay Area do well is put all the pieces together.*[35]

Develop and strengthen ties between educational institutions and industry.

Bay Area high-tech industries enjoy the benefit of proximity to such world-renowned educational institutions as UC Berkeley, Stanford and UC San Francisco. These universities draw to the region some of the brightest students and faculty, many of whom go on to create companies or technologies that are licensed to both large and small businesses. Faculty members also serve in an advisory capacity to industry groups and help steer research to answer critical questions industry is facing. Even as universities help nurture and strengthen the capacity of future knowledge workers from the Bay Area and around the world, the public K–12 and community college systems also develop the capacity of local residents to participate in industry and the global marketplace. The quality of interaction between industry and educational institutions, in both research and workforce development, will be critical to the region's future as an innovation-led, knowledge-based economy that is flexible and globally competitive.

[34] Borrus, 2006.

[35] Sidhu, 2006.

Human Capital for the Future

Interaction across disciplines, between universities and industry, between industry and community colleges, across communities and internationally is central to innovation and economic competitiveness in an interconnected and rapidly changing global economy. A diverse, educated and flexible workforce is fundamental to innovation and competitiveness. These are Bay Area strengths that will require continued investment if we are to sustain this region's uniquely innovative economy into the future.

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Appendix

Languages Spoken in the Bay Area

Bay Area Languages	Total Language Speakers	Percent of Population	English Proficient	Percent English Proficient
Total Bay Area Population	6,467,150			
English Only	3,998,071	61.82%	3,998,071	100%
Spanish	1,063,276	16.44%	520,439	49%
French	47,144	0.73%	37,374	79%
French Creole	634	0.01%	634	100%
Italian	21,958	0.34%	15,374	70%
Portuguese	26,498	0.41%	16,545	62%
German	31,136	0.48%	26,744	86%
Yiddish	868	0.01%	635	73%
Other West Germanic	1,485	0.02%	1,447	97%
Scandinavian	9,959	0.15%	9,448	95%
Greek	12,164	0.19%	8,651	71%
Russinan	47,769	0.74%	23,119	48%
Polish	5,091	0.08%	3,932	77%
Serbo-Croatian	7,811	0.12%	5,700	73%
Other Slavic	4,143	0.06%	2,865	69%
Armenian	2,660	0.04%	1,427	54%
Persian	28,102	0.43%	16,677	59%
Gujarathi	21,852	0.34%	18,549	85%
Hindi	31,808	0.49%	25,493	80%
Urdu	7,182	0.11%	5,642	79%
Other Indic	39,713	0.61%	27,244	69%
Other Indo-European	4,321	0.07%	3,516	81%
Chinese	402,016	6.22%	168,961	42%
Japanese	56,587	0.87%	29,977	53%
Korean	46,957	0.73%	20,837	44%
Mon-Khmer	11,572	0.18%	4,903	42%
Miao-Hmong	277	0.00%	277	100%
Thai	8,997	0.14%	4,327	48%
Laotian	5,516	0.09%	4,908	89%
Vietnamese	140,999	2.18%	56,061	40%
Other Asian	69,305	1.07%	47,766	69%
Tagolog	229,222	3.54%	153,768	67%
Other Pacific Islander	26,272	0.41%	17,317	66%
Navajo	53	0.00%	0	0%
Other Native North American	1,123	0.02%	1,123	100%
Hungarian	5,335	0.08%	3,723	70%
Arabic	26,656	0.41%	19,617	74%
Hebrew	6,732	0.10%	6,166	92%
African Language	10,596	0.16%	5,174	49%
Other	5,290	0.08%	4,174	79%

Source: American Community Survey, 2004, U.S. Census, San Francisco–Oakland–San Jose, CA CMSA

The Bay Area Council Economic Institute is a public-private partnership of business, labor, government and higher education, that works to support the economic vitality and competitiveness of California and the Bay Area. Its work builds on the twenty-year record of fact-based economic analysis and policy leadership of the Bay Area Economic Forum, which merged with the Bay Area Council in January 2008. The Bay Area Council and the Association of Bay Area Governments (ABAG) are its leading institutional partners. The Economic Institute also supports and manages the Bay Area Science and Innovation Consortium (BASIC), a partnership of Northern California's leading scientific research institutions and laboratories. Through its economic and policy research and partnerships, the Economic Institute addresses major issues impacting the competitiveness, economic development and quality of life of the region and the state, including infrastructure, globalization, science and innovation, and governance. Its Board of Trustees, which oversees its products and initiatives, is composed of leaders representing business, labor, government, higher education, science and technology, philanthropy and the community.

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Human Capital in the Bay Area

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