
# DIVERSITY IN HIGH TECH

**U.S. Equal Employment Opportunity Commission**
**May 2016**

# DIVERSITY IN HIGH TECH

## Executive Summary

The high tech sector has become a major source of economic growth fueling the U.S. economy. As an innovation leader, the high tech sector has impacted how we communicate and access information, distribute products and services, and address critical societal problems. Because this sector is the source of an increasing number of jobs, it is particularly important that the U.S. Equal Employment Opportunity Commission (EEOC) and its stakeholders understand the emerging trends in this industry. Ensuring a sufficient supply of workers with the appropriate skills and credentials and addressing the lack of diversity among high tech workers have become central public policy concerns. This report seeks to shed more light on employment patterns in the high tech industry by providing an overview of literature as a backdrop to understanding high tech employment, and analyzing corresponding summary data from the Employer Information EEO-1 Report (EEO-1)[1] collected in 2014.

Employment in computer science and engineering is growing at twice the rate of the national average.[2] These jobs tend to provide higher pay and better benefits, and they have been more resilient to economic downturns than other private sector industries over the past decade. In addition, jobs in the high tech industry have a strong potential for growth. These jobs are important to companies in all industries that require workers with technology skills. Employment trends in the high tech sector are therefore important to the national economic and employment outlook.

The industries and occupations associated with "high tech" are rapidly evolving. There is *no single high tech industry*—rather, new technology has transformed industries like telecommunications and manufacturing and the functions of numerous occupations. Sections I and II of this report define the high tech industry, or the "high tech sector," as industries that employ a high concentration of employees in science, technology, engineering and mathematics (STEM) occupations and the production of goods and services advancing the use of electronic and computer-based production methods. This sector requires a substantial professional labor force and employs about a quarter of U.S. professionals and about 5-6 percent of the total labor force. Section III of this report examines the top 75 high tech firms in the Silicon Valley area based on a ranking by the *San Jose Mercury News* that looked at revenue, profitability and other criteria to identify leading "Silicon Valley tech firms."

This report aims to add to the public policy discussion by exploring employment trends in the high tech sector in three ways: Section I provides a brief overview of some of the literature

[1] Beginning in 1966 all employers with 100 or more employees (lower thresholds apply to federal contractors) have been required by law to file the Employer Information Report EEO-1 with the EEOC. In FY 2013 approximately 70,000 employers filed an EEO-1. These forms indicate the composition of an employer's workforces by sex and by race/ethnic category. The EEO-1 form collects data on ten major job categories.

[2] Occupational Employment Projections to 2022, Bureau of Labor Statistics Monthly Labor Review: www.bls.gov/opub/mlr/2013/article/occupational-employment-projections-to-2022.htm .

addressing high tech employment; Section II analyzes EEO-1 data from the high tech sector both nationwide and in the geographic area generally referred to as Silicon Valley; and Section III reviews employment statistics derived from a group of leading Silicon Valley firms. Although growth in the high-tech sector has increasingly occurred in a wide range of geographic areas, this analysis provides a national picture along with a more focused examination on the well-established tech industry in Silicon Valley. The report also identifies geographic areas with high concentrations of high tech jobs that may benefit from future study. Additionally, important areas for further study include employment for older workers and individuals with disabilities.

Section I briefly reviews the literature addressing high tech employment, which has tended to focus on two issues: 1) the supply of labor with appropriate skills and 2) the reasons behind the underrepresentation of women and minority workers in the relevant labor force. One body of literature emphasizes the challenges for the U.S. education system to produce appropriately skilled workers and the factors that influence the prevalence of women and minorities in particular career paths and occupations. Another body of literature focuses on the attrition of women and minorities as students and as employees. This literature cites research and personal experience indicating that bias impedes the full and equal participation of women and minorities in STEM fields.

Section II examines employment trends in the high tech sector through an analysis of the available 2014 EEO-1 data. By using nationwide 2014 EEO-1 data to examine the participation of women and minorities in overall private sector employment compared to that of the high tech sector, we identified several concerning trends:

- Compared to overall private industry, the high tech sector employed a larger share of whites (63.5 percent to 68.5 percent), Asian Americans (5.8 percent to 14 percent) and men (52 percent to 64 percent), and a smaller share of African Americans (14.4 percent to 7.4 percent), Hispanics (13.9 percent to 8 percent), and women (48 percent to 36 percent).

- In the tech sector nationwide, whites are represented at a higher rate in the Executives category (83.3 percent), which typically encompasses the highest level jobs in the organization. This is roughly over 15 percentage points higher than their representation in the Professionals category (68 percent), which includes jobs such as computer programming. However, other groups are represented at significantly lower rates in the Executives category than in the Professionals category; African Americans (2 percent to 5.3 percent), Hispanics (3.1 percent to 5.3 percent), and Asian Americans (10.6 percent to 19.5 percent).

- Of those in the Executives category in high tech, about 80 percent are men and 20 percent are women. Within the overall private sector, 71 percent of Executive positions are men and about 29 percent are women.

Additionally, we examined 2014 EEO-1 data from a geographic area associated with Silicon Valley. This includes the San Francisco-Oakland-Fremont core-based statistical area (CBSA) and Santa Clara County. The labor force in these areas has notably different demographics from that of the U.S. as a whole. By using EEO-1 data specific to the Silicon Valley area, we can see how its tech workforce differs demographically from the tech workforce nationwide.

Finally, Section III, as the third avenue to examine the nature of employment in high tech industries, uses 2014 EEO-1 data to examine the labor force participation rate at select leading "Silicon Valley tech firms," identified by a San Jose Mercury News analysis. Below are some observations:

- Among Executives, 57 percent of employees were white, 36 percent were Asian American, 1.6 percent were Hispanic and less than 1 percent were African American.

- These firms had a notable contrast in the demographics of professional as compared to management jobs (executives and managers combined). Asian Americans make up 50 percent of professional jobs among these firms while comprising 36 percent of management positions. This is roughly a negative gap of 14 percentage points. White employees make up 41 percent of professional jobs and 57 percent of management jobs. This is roughly a positive difference of about 16 percentage points.

- In Silicon Valley, employment of women and men in non-technology firms is at about parity with 49 percent women and 51 percent men. This compares to the 30 percent participation rate for women at 75 select leading Silicon Valley tech firms.

- When the Executives and Managers job categories are combined, African American workers are less than 1 percent of this group at these select leading Silicon Valley firms, and Hispanic workers are 1.6 percent.

## DIVERSITY IN HIGH TECH

This report examines demographic diversity in the "high tech" sector. This is a timely and relevant topic for the Commission due to the growth of this sector, the quality of the jobs it provides, and the influence that this work has on other industries and on society in general.

This report is divided into three major sections. The first section provides a brief, introductory literature review to introduce the relevant issues and provide a backdrop for the data points that follow. The second section examines employment trends in the high tech sector using 2014 EEO-1 data[3] by comparing tech and overall private industry nationwide and within the Silicon Valley geographic area. The final section uses 2014 EEO-1 data to focus on the leading "Silicon Valley tech firms" as recently identified by a popular news source local to the area.

## I. LITERATURE REVIEW

### HIGH TECH: EVOLUTION OF THE INDUSTRY

Development of a high tech workforce has long been a source of concern; it is a major growth sector that requires workers with specific skills often perceived to be in relatively short supply among U.S. workers. The available work in this industry is considered to be highly sought after, as the jobs tend to pay well and offer attractive benefits. At the same time, lack of diversity in employment has led to under-utilization of available talent and under-recruitment of potentially valuable employees. When examining the pipeline for high tech jobs, a mixed story develops. The literature indicates some increase in employment of women and non-white workers in these occupations, accompanied by a steady exodus of these same workers, particularly women, from tech jobs.

The industries and occupations associated with "high tech" are rapidly evolving. There is no single high tech industry; rather, new technology has transformed industries like telecommunications and manufacturing and the functions of numerous occupations, from clerical work to scientific research. Occupations unknown a decade earlier have become common (Baldwin and Gellatly, 1998; DeSilver, 2014). Classification schemes that rely on a single-measure of technological expertise, as many do, may incorrectly rank industries and/or classify sectors.

Companies utilizing advanced technological processes, requiring a labor force with cutting-edge technical competencies to develop innovative products, are found in many industries, not only high tech. Industries perceived as low-tech are not devoid of high tech firms, nor are high tech industries comprised exclusively of high tech firms. Consequently, broad generalizations at the industry-level are imprecise. On average, industries that may be classified as low-tech by some indices contain half as many high tech firms as can be found in high tech industries.

[3] EEO-1 reports filed by employers with more than 100 employees provide data based on race, color, sex and national origin, but do not report data on age or disability. We are aware that both groups are underrepresented in the tech workforce, suggesting the need for research to understand the causes and potential solutions.

Consequently, it should not be claimed that high-knowledge, high tech firms are confined exclusively to these more visible high tech industries (Baldwin and Gellatly (1998). Research on this project revealed that "typical," well-known high tech companies were in such industries as auto manufacturing (NAICS 3361), retail stores (NAICS 4539), information services (NAICS 5191), consumer goods rental (NAICS 5322) and office administrative services (NAICS 5611).

Baldwin and Gellatly (1998) classify high tech firms as those producing innovative technology; they introduce new products and processes; they place great emphasis on technology; they appreciate the importance of a skilled workforce, and they train their workers.[4] This competency-based approach represented a considerable advance over previous efforts: it formally recognized the multidimensional nature of technological expertise.

DeSilver (2014) notes that based on data collected from November 2009 to May 2012, about 3.9 million workers — roughly 3 percent of the nation's payroll workforce (Occupational Employment Statistics, Bureau of Labor Statistics (BLS)) — work in what we might think of as "core" tech occupations — not people who simply use computing technology in their jobs, but whose jobs involve making that technology work for the rest of us. Occupations involving the installation and repair of telecommunications lines and equipment, as well as computer repairers were excluded.

Figure 1 shows just how different the structure of the technology industry was in 2012 compared to 15 years earlier.

[4] This classification is now dated as tech companies want educational institutions to bear the training cost, including software-specific training. See "The Hiring Dilemma for High Tech Firms: Make vs. Buy" ” Knowledge @ Wharton

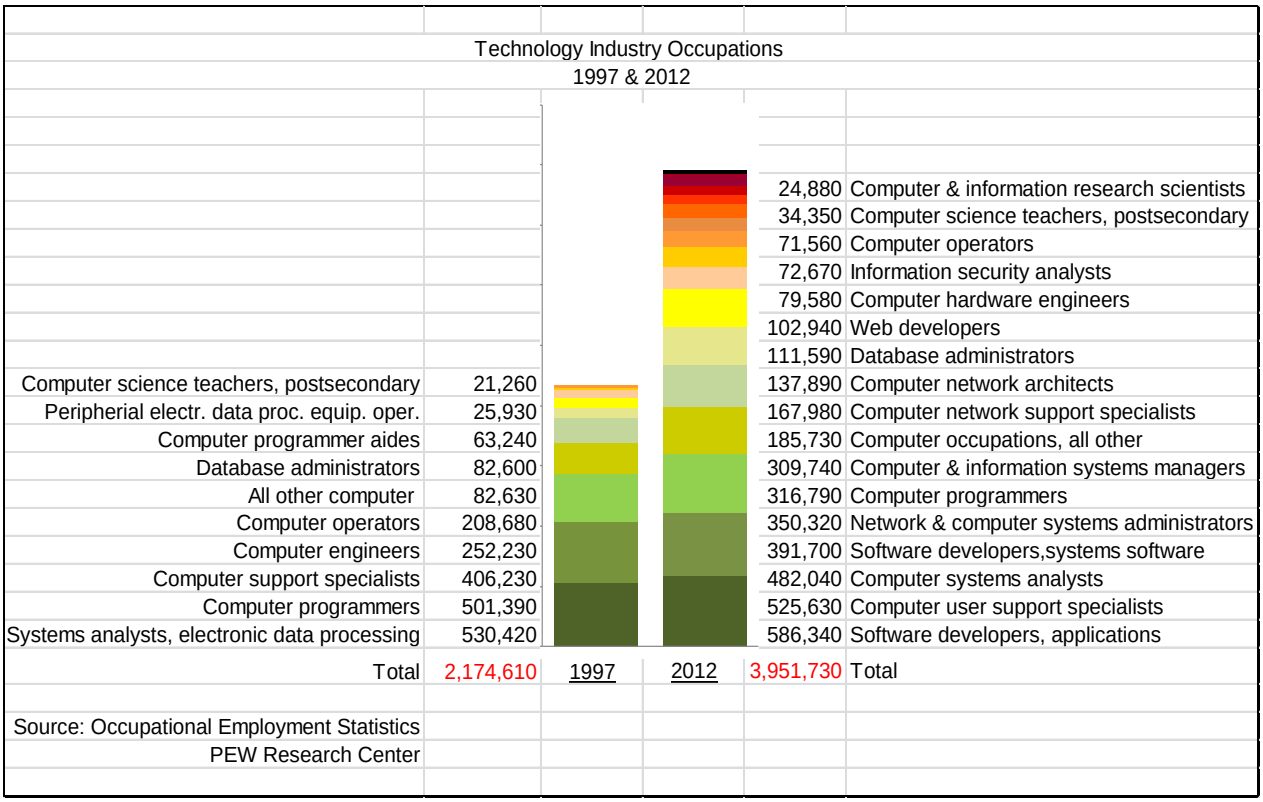



**Figure 1**

Some 2012 occupations, such as web developers and information security analysts, simply did not exist in 1997, while others have dramatically grown (programmers and software developers, computer and network support specialists) or shrunk (computer operators). Computers have become ubiquitous in the workplace; their use is no longer confined to a specialist. Use of computers is a general skill expected of most office, technical, and professional employees.

**HIGH TECH GEOGRAPHY: DISPERSING**

The location of high tech industries has also changed substantially. From its early establishment in large compounds in suburban office parks of Silicon Valley, CA and Route 128 in Boston, the industries dispersed to urban areas across the US and around the world (Florida, 2012). High tech companies, like their products, have become an integral part of the production of goods and services. They have moved from a niche economic product dependent on highly specialized expertise to become a major source of economic vitality.

The remarkable growth and dispersion of high tech products and companies has been accompanied by anxiety over the ability of the US educational system to supply an adequate workforce to support its rapid expansion and development of new products. Appendix Table I-A shows employment growth in selected science, technology, engineering and mathematics (STEM) occupations. It has been noted that there are almost twice as many job postings in STEM fields as there are qualified applicants to fill them. Further, when ranked against other developed countries in the area of problem solving with technology the U.S. came in absolute

last. Groups such as the STEM Education Coalition urge that additional resources be allocated to the computer sciences, and higher educational standards for math and science education starting in elementary school to prepare the future workforce. Modern manufacturing requires a computer literate worker capable of dealing with highly specialized machines and tools that require advanced skills (STEM Education Coalition).

However, other sources note that stereotyping and bias, often implicit and unconscious, has led to underutilization of the available workforce. The result is an overwhelming dominance of white men and scant participation of African Americans and other racial minorities, Hispanics, and women in STEM and high tech related occupations. *The Athena Factor: Reversing the Brain Drain in Science, Engineering, and Technology*, published data in 2008 showing that while the female talent pipeline in SET[5] was surprisingly robust, women were dropping out of the field large numbers. Other accounts emphasize the importance of stereotypes and implicit bias in limiting the perceived labor pool (see discussion below).

Moughari et al., 2012 noted that men comprise at least 70 percent of graduates in engineering, mathematics, and computer science, while women dominate in the lower paying fields. Others point out that in this is not uniformly the case in all science and math occupations and that, while underrepresented among those educated for the industry, women and minorities are *more* underrepresented among those actually employed in the industry. It has been shown, for example, that men are twice as likely as women to be hired for a job in mathematics when the only difference between candidates is gender (Ernesto Reubena et al. 2014).

**LABOR DIVERSITY: SUPPLY vs. DEMAND**

Attributing lack of employment diversity in high tech industries to lack of applicant diversity and self-selection of minorities and women away from STEM fields focuses on only part of the industries' hiring and retention situation. While there is some truth to the "pipeline" theory and anxiety over the ability of the US educational system to provide a sufficiently large, well trained, and diverse labor pool, there are additional factors at play. For example, about nine percent of graduates from the nation's top computer science programs are from under-represented minority groups. However, only five percent of the large tech firm employees are from one of these groups.[6] This presents the unlikely scenarios that either major employers in the field are unable to attract four out of nine under-represented minority graduates from top schools or almost half of the minority graduates of top schools do not qualify for the positions for which they were educated.

Citing The Urban Institute[7], "labor market indicators do not demonstrate a supply shortage. The United States' education system produces a supply of qualified [science and engineering]

[5] Science, Engineering, and Technology (SET).

[6] according to Education Department data analyzed by Maya A. Beasley, associate professor of sociology at the University of Connecticut, quoted in Gonzalez and Kuenzi, 2012.

[7] Lowell, B. Lindsay, and Hal Salzman. The Urban Institute. Into the Eye of the Storm: Assessing the Evidence on Science and Engineering Education, Quality, and Workforce Demand. The Urban Institute, 2007.

graduates in much greater numbers than the jobs available." Estimates indicate that close to 50 percent of STEM graduates in the U.S. are not hired in STEM-related fields (Lindsay & Salzman, 2007).

Sources are largely consistent that the number of people receiving undergraduate degrees in science and engineering has increased markedly over the past decade. According to the U.S. Census Bureau, the percentage of U.S. college graduates with bachelor's degrees in science and engineering (S&E) was 36.4 percent in 2009 (approximately 20 million people). National Science Foundation[8] estimates are similar: the percentage of bachelor's degrees in S&E fields has been approximately 30 to 35 percent of all bachelor's degrees for the past four decades. However, because the U.S. college-age population grew during these years, the total number of science and engineering (S&E) bachelor's degrees awarded annually more than doubled between 1966 and 2008 (from 184,313 to 494,627).

Women account for relatively small percentages of degree recipients in certain STEM fields: only 18.5 percent of bachelor's degrees in engineering went to women in 2008. (Williams, 2015) Women accounted for 77.1 percent of the psychology degrees and 58.3 percent of the biological and agricultural sciences degrees in 2008 (Data from the National Science Foundation, National Center for Science and Engineering Statistics[9]).

Gonzalez and Kuenzi, 2012 make the following observations:

Graduate enrollments in science and engineering grew 35 percent over the last decade. Notably, science and engineering enrollments grew more for racial and ethnic groups generally under-represented in science and engineering.

- Hispanic/Latino enrollment increased by 65 percent
- American Indian/Alaska Native enrollment increased by 55 percent
- African American enrollment increased by 50 percent

Since 1966, the percentage of doctorates in S&E fields has ranged between approximately 56 percent and 67 percent of all graduate degrees (where a field of study has been reported). The total number of doctoral degrees in S&E fields has nearly tripled, growing from 11,570 in 1966 to 32,827 in 2008 (Peck, 2015). Graduate enrollments show similar upward trends.

The AFL-CIO reported that, based on Bureau of Labor Statistics data, the median weekly earnings for women (2012) were 11 to 25 percent lower than they were for men in every STEM occupation for which there is available data. But this may be less of a difference than in other

[8] National Science Foundation, cited in Gonzalez and Kuenzi 2012

[9] Bachelor's, master's, and doctor's degrees conferred by postsecondary institutions, by field of study: Selected years, 1970-71-2011-12. Available at: http://nces.ed.gov/programs/digest/2013menu_tables.asp

professional fields, as in 2013, on average, men employed in professional and related occupations earned 27 percent more than women.[10]

Additionally, black professionals represented 9.3 percent of the professional workforce and Hispanic professionals 8.2 percent.

- In computer and mathematical occupations, 8.3 percent of workers were black or African American, 6.3 were Hispanic or Latino.
- In the life, physical, and social sciences, black professionals were under-represented, making up 5.6 percent of the workforce, and in architecture and engineering occupations, Black professionals were just 5.5 percent of the workforce in 2013.
- Workers of Hispanic origin comprised 7.5 percent of the architecture and engineering field and 7.9 percent of life, physical, and social scientists.[11]

Based on data from the American Community Survey, there is a racial and ethnic pay gap as well: Asian Americans reported the highest average earnings in STEM occupations, while non-Hispanic whites also had above average earnings; black and Hispanic professionals earned below average wages in 2012.[12]

**EXITING TECH & RELATED FIELDS**

Over time, over half of highly qualified women working in science, engineering and technology companies quit their jobs (Hewlett et al., 2008). In 2013, just 26 percent of computing jobs in the U.S. were held by women, down from 35 percent in 1990, according to a study by the American Association of University Women. Although 80 percent of U.S. women working in STEM fields say they love their work, 32 percent also say they feel stalled and are likely to quit within a year. Research by The Center for Work-Life Policy shows that 41 percent of qualified scientists, engineers and technologists are women at the lower rungs of corporate ladders but more than half quit their jobs.

This loss appears attributable to the following: 1) inhospitable work cultures; 2) isolation; 3) conflict between women's preferred work rhythms and the "firefighting" work style generally rewarded; 4) long hours and travel schedules conflict with women's heavy household management workload; and 5) women's lack of advancement in the professions and corporate ladders. If corporate initiatives to stem the brain drain reduced attrition by just 25 percent, there would be 220,000 additional highly qualified female STEM workers (Hewlett et al., 2008).

Williams (2015) posits that it is bias that pushes women out of STEM jobs, rather than pipeline issues or personal choice accounting for their absence. Based on a survey and in-depth

[10] U.S. Department of Labor, Bureau of Labor Statistics, Current Population Survey, Household Data Annual Average 2012, Table 39. (Cited in AFL-CIO, 2014)
[11] U.S. Department of Labor, Bureau of Labor Statistics, Current Population Survey, Household Data Annual Average 2013, Table 11. (Cited in AFL-CIO, 2014)
[12] U.S. Census Bureau, DataFerrett, American Community Survey, Public Use Microdata, 2012. (Cited in AFL-CIO, 2014)

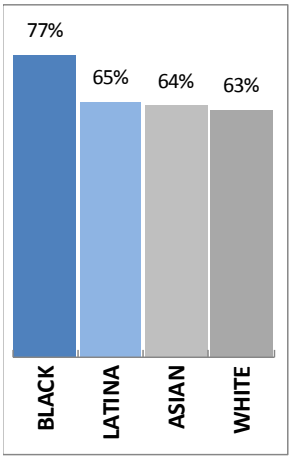
interviews of female scientists[13] (557 survey participants and 60 interviewees), Williams makes the following observations:

- Two-thirds of women report having to prove themselves over and over; their success discounted and their expertise questioned.
    - Three-fourths of Black women reported this phenomenon.
- Thirty-four percent reported pressure to play a traditionally feminine role, including 41 percent of Asian women.
    - Fifty-three percent reported backlash from speaking their minds directly or being outspoken or decisive.
    - Women, particularly Black and Latina women, are seen as angry when they fail to conform to female stereotypes
- Almost two thirds of women with children say their commitment and competence were questioned and opportunities decreased after having children.
- Three fourths of women surveyed said that women in their workplace supported each other; one fifth said they felt as if they were competing with women colleagues for "the woman spot."
- Bias functions differently depending on race and ethnicity. Isolation is a problem: 42 percent of Black women, 38 percent of Latinas, 37 percent of Asian women and 32 percent of white women agreed that socializing with colleagues negatively affect perceptions of their competence.

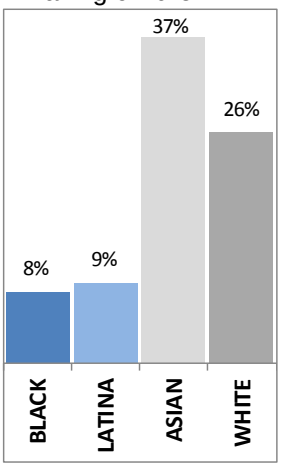
[13] Women in science, technology, engineering, or math.

**Percent of U.S. Women Who Report…**

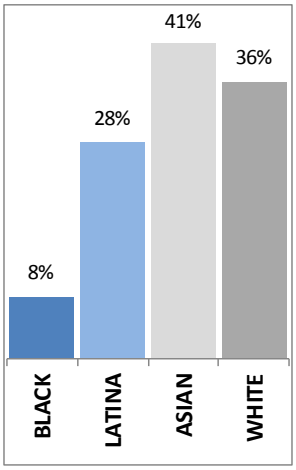
having to provide more evidence of competence than others to prove themselves.



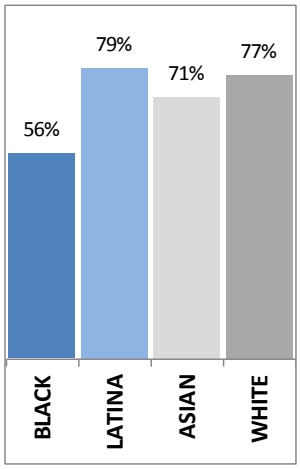

that colleagues have suggested they should work fewer hours after having children



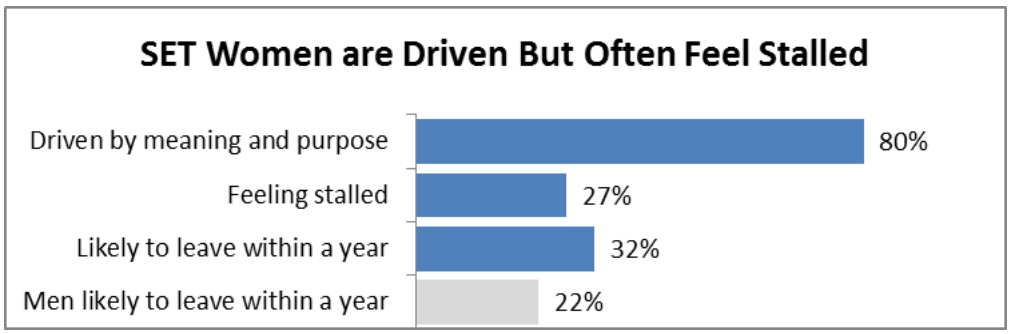

that at work, they find themselves pressured to play a stereotypically feminine role.*




that women in their work environments support one another.

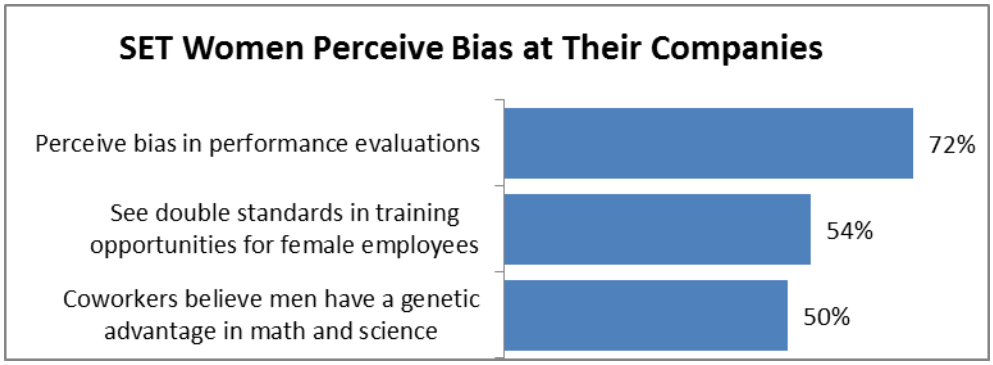



**Source:** Joan C Williams, Katherine W. Phillips, and Erika V. Hall from HBR.ORG
**Figure 2**




**Source:** Center for Talent Innovation from HBR.ORG
**Figure 3**[14]

[14] SET Science, Engineering, and Technology




**Source:** Center for Talent Innovation from HBR.ORG
**Figure 4**

**EXIT FROM THE EDUCATIONAL PIPELINE**

The impact of the "exits" discussed above is perhaps most problematic in the educational pipeline. Women are no longer a minority within higher education—in fact, women's enrollment in graduate education in the United States has been greater than men's for the past three decades. As of 2012, there were 13 women enrolled for every 10 men. However, a greater number of male students seem to graduate with science degrees, as compared to their female classmates. In the physical sciences for example, seven B.S. degrees are granted to women for every 10 granted to men; three M.S. degrees are granted to women for every five granted to men; one Ph.D. degree granted to a woman for every two granted to men (Jahren, 2016).

Women who leave science report both isolation and intimidation as barriers to their success. While 23 percent of freshmen reported not having experienced these barriers, only three percent of seniors did, suggesting that this reaction to women in science education is a lesson learned by female students over time (Jahren, 2016). In a survey of 191 female fellowship recipients, 12 percent indicated that they had been sexually harassed as a student or early professional (Jahren, 2016).

**SUMMARY AND CONCLUSION**

Despite rapid transformation in the field, the overwhelming dominance of white men in the industries and occupations associated with technology has remained. This tendency includes occupations requiring less education than a four-year bachelor's degree (*Fortune*, 2014).

Discussion of the lack of gender, racial and ethnic diversity in the high tech industries generally divides into two themes: the "pipeline" problem—STEM occupations attracting white men—and the inhospitable culture in relevant industries and occupations forcing women and minorities to tolerate the environment or leave the field.

The literature summarized below represents both themes. The “pipeline problem” is represented by Moughari et al. (2012) and Gonzalez and Kuenzi (2012). The second theme is documented through numerous published analyses, mostly addressing the challenges faced by women (D'Anastasio, 2015; Hewlett et al., 2014; Peck, 2015; Reubena et al., 2014; Lien, 2015; Hewlett et al., 2008). Evidence of dissatisfaction among minority groups is more likely to be found in the comments sections following “pipeline” articles. Attrition of women mid-career is described as a substantial contributor to the paucity of women in STEM professions and high tech industries (Jahren, 2016).

The reluctance of high tech companies to train new employees could be contributing to the lack of diversity. Williams (2015) provides a technological argument for this trend. The Harvard Business Review (2015) addresses the issue of “guest workers” on H-1B visas; immigration and jobs in high tech (*Knowledge* 2005). A high tech recruiter points to the mystique of elite colleges and advocates job candidate anonymity to increase diversity in hiring (*The Economist*, 2013). There are notable alternative efforts to spread high tech skills and introduce women and minorities to the joys of technology based work. A few of the many available examples are Black Girls Code, Hack the Hood, Lesbians Who Tech, Code 2040, #YesWeCode, and the Center for Talent Innovation.

The fast-changing nature of the high tech industry may contribute to the exit of new employees such as women and non-whites. A study by the Wharton School reports research findings and recommendations. They note that Human Resources strategy complements technology strategy; in a fast-paced industry, product life cycles are growing shorter. Firms are facing more opportunities for change, requiring more adjustments to the workforce. When skills need to be adjusted, firms may find that it pays to buy the skills instead of developing them.

The opposite is true for slower moving industries operating in marketplaces with less change — these findings could be significant for human resource management strategies. As the pace of technological change has quickened, and as global competition has shortened product life cycles, firms have had to rethink their technology investment strategies and their human resource management practices in order to remain competitive.

*See the Annotated Bibliography for supplemental tables and graphs.*

## II. EXAMINATION OF NATIONWIDE AND SILICON VALLEY EEO-1 DATA

### EMPLOYMENT DIVERSITY IN THE HIGH TECH SECTOR

### Explanation of Data

This section focuses on sex, race, and ethnicity diversity in the U.S. high tech sector. The definition of "high tech sector" that we use is the group of industries, based on the four-digit code of North American Industry Classification System (NAICS), listed in Table 1. An industry is considered high tech if "technology-oriented workers" within an industry, as identified by occupations of the staff, account for at least 25 percent of the total jobs within the listed industries.

**TABLE 1: INDUSTRIES USED TO DEFINE HIGH TECH**

| 4-Digit Code | INDUSTRY LABEL |
|---|---|
| 3254 | Pharmaceutical and Medicine Manufacturing |
| 3333 | Commercial and Service Industry Machinery Manufacturing |
| 3341 | Computer and Peripheral Equipment Manufacturing |
| 3342 | Communications Equipment Manufacturing |
| 3343 | Audio and Video Equipment Manufacturing |
| 3344 | Semiconductor and Other Electronic Component Manufacturing |
| 3345 | Navigational, Measuring, Electrometrical, and Control Instruments Manufacturing |
| 3346 | Manufacturing and Reproducing Magnetic and Optical Media |
| 3364 | Aerospace Product and Parts Manufacturing |
| 3391 | Medical Equipment and Supplies Manufacturing |
| 5112 | Software Publishers |
| 5179 | Other Telecommunications |
| 5191 | Other Information Services |
| 5413 | Architectural, Engineering, and Related Services |
| 5415 | Computer Systems Design and Related Services |
| 5417 | Scientific Research and Development Services |
| 5419 | Other Professional, Scientific, and Technical Services |

The data utilized for this section comes from the 2014 EEO-1 reports from US private sector employers.[15] The EEO-1 form collects data on ten major job categories.[16]

Because more than half of the high tech employment was made up of Professionals (44 percent) and Technicians (10.7 percent, see Figure 7), these job groups received separate analysis, along with the management job groups (Executives, Senior Level Officials & Managers, and First/Mid-Level Officials and Managers).

In our discussion below, we will use national high tech sector figures as well as figures from two geographic areas that we believe encompass the heart of what is known as Silicon Valley: San Francisco-Oakland-Fremont[17], in California (CA) and Santa Clara County, CA. Other high tech corridors in the U.S. were also identified for potential future research in Appendix Table I.

**Summary of Findings**Compared with all industries reported in the 2014 EEO-1 private sector survey, overall participation rates of whites, Asian Americans, and males in U.S high tech industries were disproportionally higher, especially in the Silicon Valley geographic area.
African Americans and Hispanics were under-represented nationwide in the high tech sector when compared with the overall private industries, (see Figure 5); African Americans and Hispanics were especially under-represented in the high tech sector in the Silicon Valley geographic area.

Whites and men dominated high tech leadership positions as Executive/Senior Level Officials and Managers (Executives) and First/Mid-Level Officials and Managers (Managers) nationwide, and dominated even more strongly in the Silicon Valley geographic area.

Women lagged behind men in leadership positions and in technology jobs, as Technicians and Professionals, in the high tech sector. These gender differences were particularly pronounced in high tech sector of Santa Clara County.

African Americans and Hispanics were disproportionately fewer in leadership positions and in technology jobs in the high tech sector nationwide. These groups had negligible employment representation in high tech industries in the San Francisco Bay Area.

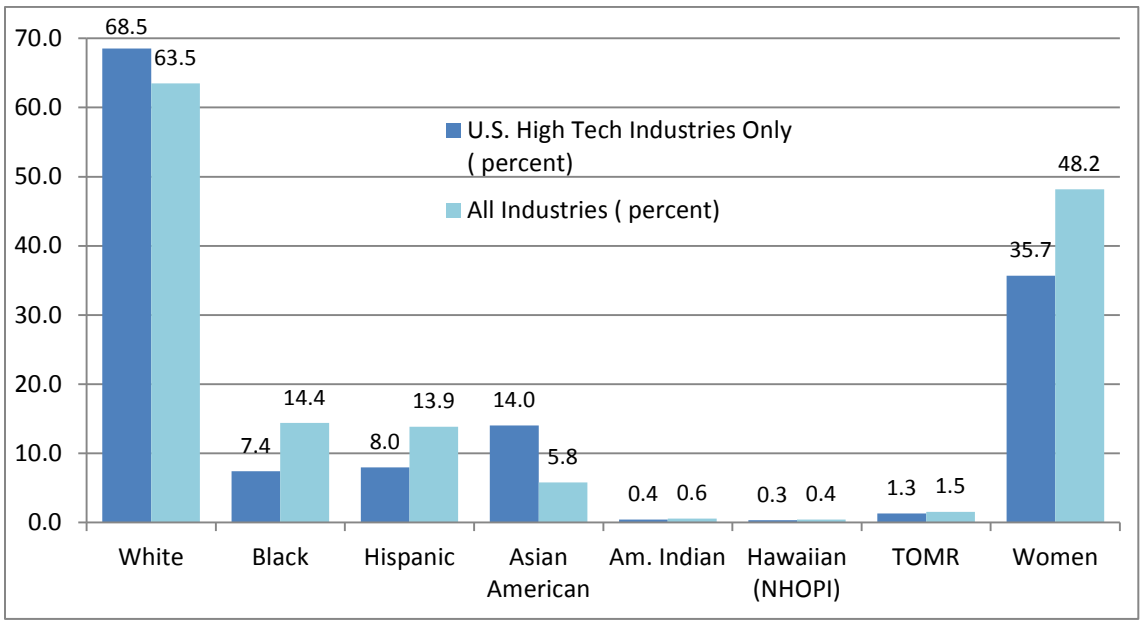
Asian Americans were represented in management and executive positions at a markedly lower rate than their representation in Professional occupations in the high tech industry both nationally and in Silicon Valley.

[15] Beginning in 1966 all employers with 100 or more employees (lower thresholds apply to federal contractors) have been required by law to file the Employer Information Report EEO-1 with the EEOC. In FY 2014 approximately 70,000 employers filed an EEO-1. These forms indicate the composition of an employer's workforces by sex and by race/ethnic category. More information about the EEO-1 survey and the associated reports can be found at www.eeoc.gov. Employment totals and subgroup aggregates were generated from four types of reports: single establishment report (Type 1 Report), headquarters report (Type 3 Report), multiple establishment report with at least 50 workers (Type 4 report), and multiple establishment report with fewer than 50 workers (Type 8 Report). This inclusion criterion is different from our typical EEO-1 aggregates which we release annually to the public on our website.

[16] 1) Executives, Senior Level Officials and Managers; 2) First/Mid-Level Officials and Managers; 3) Professionals; 4) Technicians; 5) Sales Workers; 6) Administrative Support Workers; 7) Craft Workers; 8) Operatives; 9) Laborers and Helpers; and 10) Service Workers. For examples of job titles and descriptions see https://www.eeoc.gov/employers/eeo1survey/jobclassguide.cfm

[17] This is a core-based statistical area, which is defined by Office of Management and Budget as an area that consists of one or more counties anchored by a large urban center, including at least 10,000 people. Adjacent counties are included if they are socioeconomically tied to the urban center.

**INDUSTRY PARTICIPATION BY GENDER SEX AND RACE GROUPS**
**HIGH TECH VS. ALL PRIVATE INDUSTRIES**



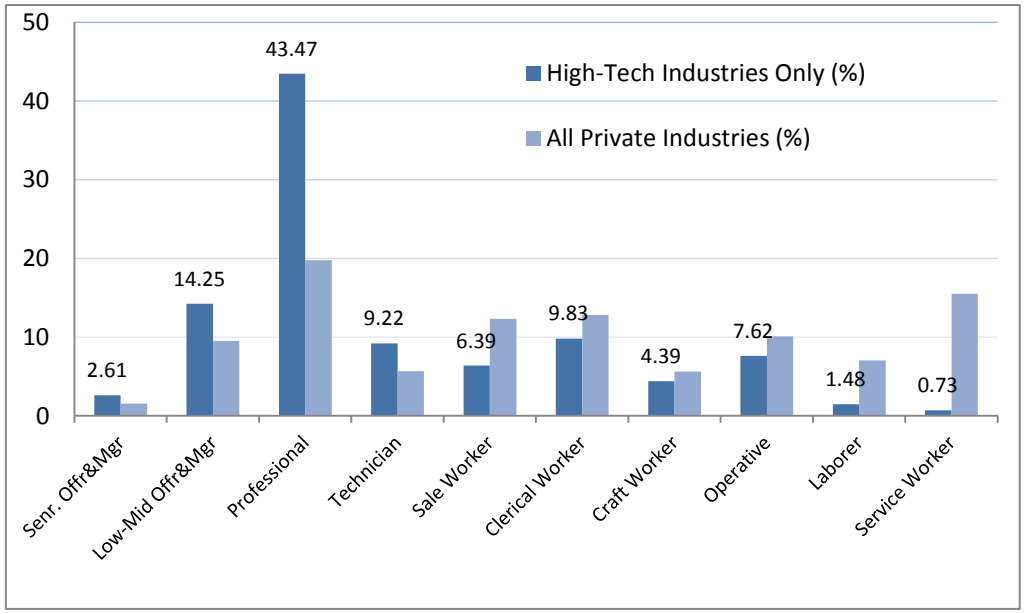

| | High Tech Industries Only (percent) | All Private Industries (percent) |
|---|---|---|
| **WHITE** | 68.53 | 63.47 |
| **BLACK** | 7.4 | 14.38 |
| **HISPANIC** | 7.97 | 13.86 |
| **ASIAN AMERICAN** | 14.04 | 5.77 |
| **AM. INDIAN** | 0.42 | 0.56 |
| **HAWAIIAN (NHOPI)** | 0.34 | 0.43 |
| **TWO OR MORE RACES** | 1.3 | 1.53 |
| **WOMEN** | 35.68 | 48.16 |
| **TOTAL EMPLOYMENT (N)** | **5,341,599** | **57,399,178** |

**Figure 5**
Source: Equal Employment Opportunity Commission, Employer Information Numbers may not add up to totals due to rounding.

As shown in Figure 5, compared to all industries in the U.S. private sector, high tech had a relatively larger share of whites (68.5 percent vs. 63.5 percent), and a larger share of Asian Americans (14 vs. 5.8 percent). Other groups were less represented by a significant margin in the tech sector compared to all private industry, including African Americans (7.4 vs. 14.3

percent) and Hispanics (8 vs. 13.9 percent). There was a 12-percentage-point difference between female participation in high tech versus all private industries (35.7 vs. 48.2 percent).

**OCCUPATIONAL DISTRIBUTION**
**HIGH TECH VS. ALL PRIVATE INDUSTRIES**



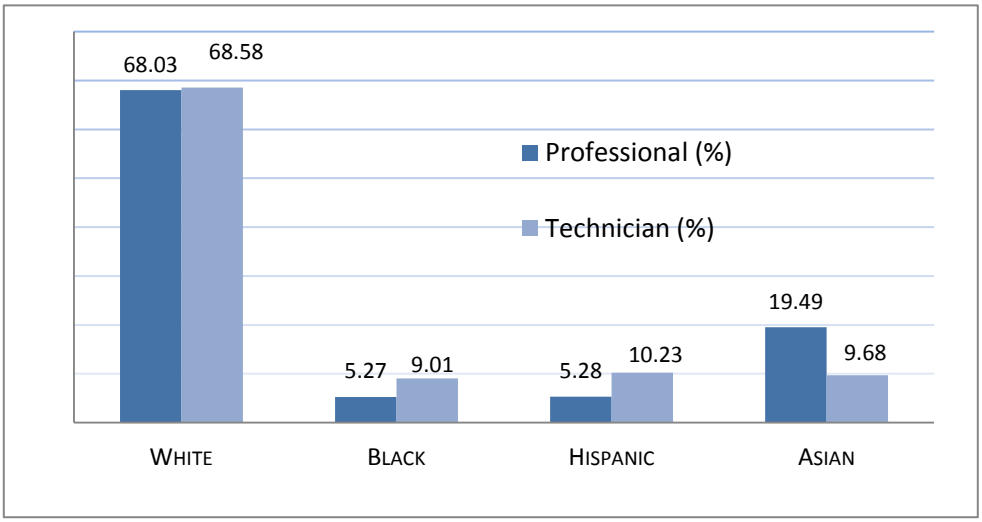

| | High Tech Industries Only (percent) | All Private Industries (percent) |
|---|---|---|
| **Executives, Senior Officials and Managers** | 2.61 | 1.58 |
| **First/Mid Officials and Managers** | 14.25 | 9.51 |
| **Professionals** | 43.47 | 19.76 |
| **Technicians** | 9.22 | 5.66 |
| **Sale Workers** | 6.39 | 12.32 |
| **Clerical Workers** | 9.83 | 12.84 |
| **Craft Workers** | 4.39 | 5.61 |
| **Operatives** | 7.62 | 10.09 |
| **Laborers** | 1.48 | 7.07 |
| **Service Workers** | 0.73 | 15.5 |
| **Total Employment ( percent)** | **100.00** | **100.00** |

**Figure 6**
Source: Equal Employment Opportunity Commission, Employer Information Reports Numbers may not add up to totals due to rounding.

Figure 6 shows that two occupational categories—Professionals and Technicians—are represented at higher rates in the tech sector than in other industries. Together they accounted

for approximately 54 percent of the total high tech employment, compared to the 25.4 percent of all industries combined nationally, meriting further examination. Technology workers in high tech industries, defined in this analysis as Professionals and Technicians, include significant numbers of engineers, software developers and programmers, life scientists and mathematicians.

**PROFESSIONALS AND TECHNICIANS IN HIGH TECH BY RACE AND ETHNICITY**




| | EEO-1 Professionals ( percent) | EEO-1 Technicians ( percent) |
|---|---|---|
| **White** | 68.03 | 68.58 |
| **Black** | 5.27 | 9.01 |
| **Hispanic** | 5.28 | 10.23 |
| **Asian American** | 19.49 | 9.68 |
| **Total Employment (N)** | **2,321,969** | **452,359** |

**Figure 7**
Source: Equal Employment Opportunity Commission, Employer Information Reports (EEO-1 Single, Headquarters, and Establishment Reports, 2014). Numbers may not add up to totals due to rounding.

Figure 7 examines employment figures in the Professional and the Technical occupational categories in the high tech sector. Examples of Professional occupations in this sector include computer programmers, software developers, web developers, and database administrators. Examples of technical occupations in this sector include electrical and electronics engineering

technicians, electro-mechanical technicians, and medical records and health information technicians.

Whites made up the largest share of Professionals (68.03 percent) with Asian Americans holding the second largest share at 19.5 percent. As a contrast, African Americans made up 5.27 percent and Hispanics 5.28 percent. Whites held a dominant share of the Technicians job group as well (68.6 percent). African Americans, Hispanics, and Asian Americans each represented approximately 9-10 percent of Technicians.

**TABLE 2: LEADERSHIP POSITIONS BY RACE AND ETHNICITY IN HIGH TECH**

| | **Executives (percent)** | **Managers (percent)** |
|---|---|---|
| **White** | 83.31 | 76.53 |
| **Black** | 1.92 | 4.12 |
| **Hispanic** | 3.11 | 4.91 |
| **Asian American** | 10.5 | 12.98 |
| **Totals (N)** | **139,575** | **761,380** |

Source: Equal Employment Opportunity Commission, Employer Information Reports (EEO-1 Single, Headquarters, and Establishment Reports, 2014). Numbers may not add up to totals due to rounding.

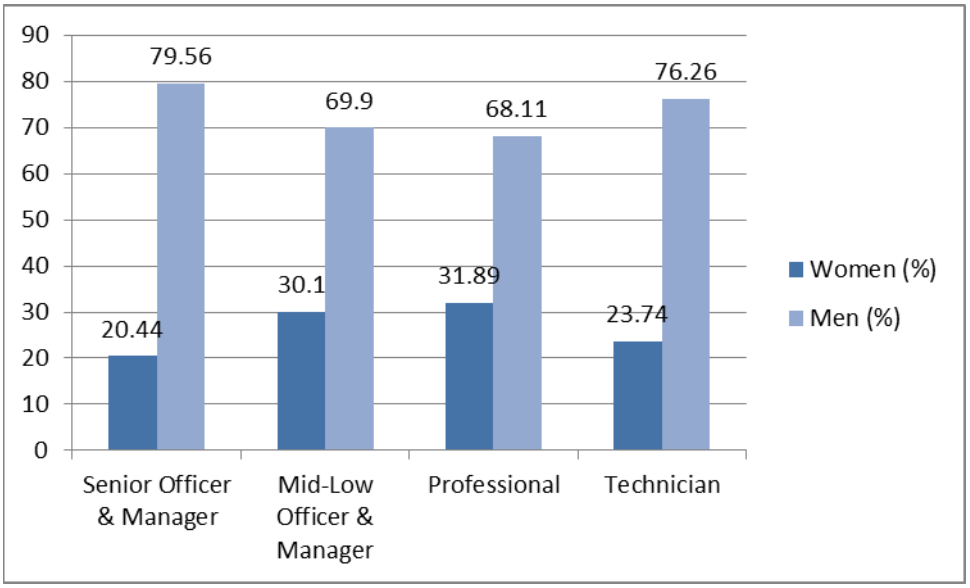
Table 2 shows that of leadership positions in high tech, over four-in-five, or 83.3 percent, of Executives were white compared to 10.5 percent for Asian Americans, 1.9 percent for African Americans and 3.1 percent for Hispanics. Executives in the high tech sector would likely include the chief executive officer, and the chief technology officer, as well as Executives found in other industries such as the chief human capital officer. Managers in the high tech industry would include occupations like computer and information systems managers. Note that Asian Americans make up around 19.5 percent of Professionals in the high tech industry but only 10.5 percent of its Executives, in this analysis of the data.

| TABLE 3: SELECT JOB CATEGORIES BY RACE AND ETHNICITY IN HIGH TECH v. ALL PRIVATE INDUSTRY | | | | | |
|---|---|---|---|---|---|
| High Tech | WHITE | BLACK | HISPANIC | ASIAN AMERICAN | Total Employment (N) |
| Executives, Senior Officials and Managers | 83.31% | 1.92% | 3.11% | 10.55% | 139,575 |
| First/Mid Officials & Managers | 76.53% | 4.12% | 4.91% | 12.98% | 761,380 |
| Professionals | 68.03% | 5.27% | 5.28% | 19.49% | 2,321,969 |
| Technicians | 68.58% | 9.01% | 10.23% | 9.68% | 452,359 |
| All Private Industry | WHITE | BLACK | HISPANIC | ASIAN AMERICAN | Total Employment (N) |
| Executives, Senior Officials & Managers | 86.97% | 3.13% | 3.87% | 4.88% | 833,367 |
| First/Mid Officials & Managers | 77.53% | 7.12% | 7.43% | 6.31% | 4,766,041 |
| Professionals | 72.89% | 7.64% | 5.79% | 11.74% | 10,534,689 |
| Technicians | 67.17% | 13.79% | 10.09% | 6.56% | 2,870,353 |

Table 3 examines select occupational categories by race and ethnicity in high tech and overall private industry. If we assume there is a path of advancement from the ranks of Professional into the Executives, Senior Officials and Managers category, we would expect that racial groups would be similar between the two job categories.[18] However, whites are represented at a larger rate in the Executives, Senior Officials and Managers category. African Americans and Asian Americans are represented at about half the rate within Executives, Senior Officials and Managers than in the Professionals job category. Hispanics are also less represented in Executives, Senior Officials and Managers than in Professionals.

[18] Another possibility is that CEOs and other top Executives may be more likely to be business management professionals and have a business management background as opposed to a tech or STEM background.

**WOMEN IN LEADERSHIP POSITIONS AND TECHNOLOGY JOBS IN U.S. HIGH TECH INDUSTRIES**




| | Women (percent) | Men (percent) |
|---|---|---|
| **Executives, Senior Officials & Managers** | 20.44 | 79.56 |
| **First/Mid Officials & Managers** | 30.10 | 69.90 |
| **Professionals** | 31.89 | 68.11 |
| **Technicians** | 23.74 | 76.26 |
| **Total Employment** | **1,846,801** | **3,494,798** |

**Figure 8**

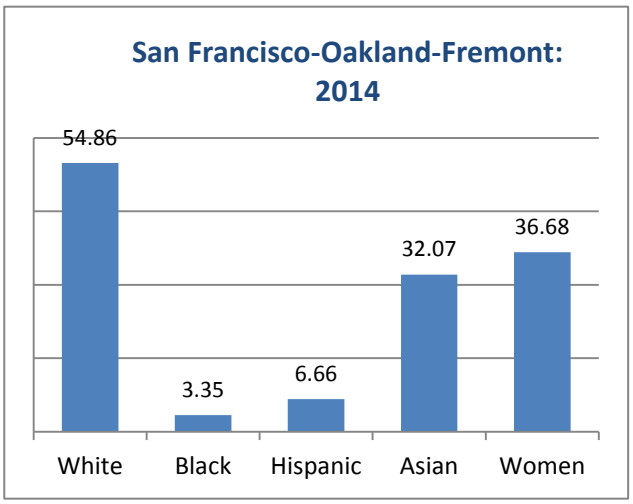
Source: Equal Employment Opportunity Commission, Employer Information Reports (EEO-1 Single, Headquarters, and Establishment Reports, 2014). Numbers may not add up to totals due to rounding.

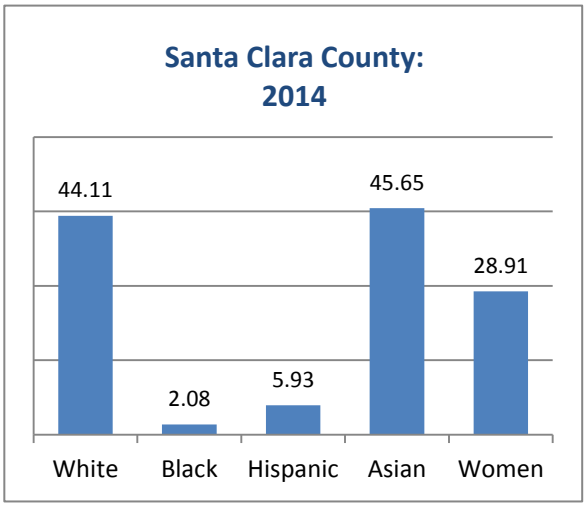
Figure 8 shows female employment in leadership positions in high tech industries. For every one female Executive, Senior Official and Manager there were four males in the same ranking position (79.6 percent vs. 20.4 percent). Female high tech workers, in contrast to their male counterparts, were also significantly outnumbered in technology jobs as Professionals (31.9 percent vs. 68.1 percent) and Technicians (23.7 percent vs. 76.3 percent).

| TABLE 4: SELECT JOB CATEGORIES BY SEX IN HIGH TECH v. ALL PRIVATE INDUSTRY | | | | |
|---|---|---|---|---|
| | High Tech | | All Private Industry | |
| | Women (percent) | Men ( percent) | Women (percent) | Men (percent) |
| Executives, Senior Officials and Managers | 20.44 | 79.56 | 28.81 | 71.19 |
| First/Mid Officials & Managers | 30.1 | 69.9 | 38.96 | 61.04 |
| Professionals | 31.89 | 68.11 | 53.42 | 46.58 |
| Technicians | 23.74 | 76.26 | 50.12 | 49.88 |
| Total Employment | 1,846,801 | 3,494,798 | 24,422,889 | 26,728,926 |

Table 4 presents select occupational categories by sex comparing the high tech sector with overall private industry. As you can see above, women comprise a smaller percentage (20 percent) of Executives, Senior Officials and Managers in the high tech industry than they do in the overall workforce (29 percent). Moreover, women are represented at lower rates in all high tech job categories as compared to overall private industry. The differences in the Professional (roughly a 21 percentage point difference) and Technician categories (roughly a 26 percentage point difference) are particularly striking.

**HIGH TECH PARTICIPATION OF WOMEN AND MINORITIES IN SAN FRANCISCO BAY AREA: 2014**




| | San Francisco-Oakland-Fremont | Santa Clara County |
|---|---|---|
| **White** | 54.86 | 44.11 |
| **Black** | 3.35 | 2.08 |
| **Hispanic** | 6.66 | 5.93 |
| **Asian American** | 32.07 | 45.65 |
| **Am. Indian** | 0.28 | 0.22 |
| **Hawaiian (NHOPI)** | 0.71 | 0.5 |
| **TOMR** | 2.07 | 1.5 |
| **Women** | 36.68 | 28.91 |
| **Total Employment** | **198,275** | **257,342** |

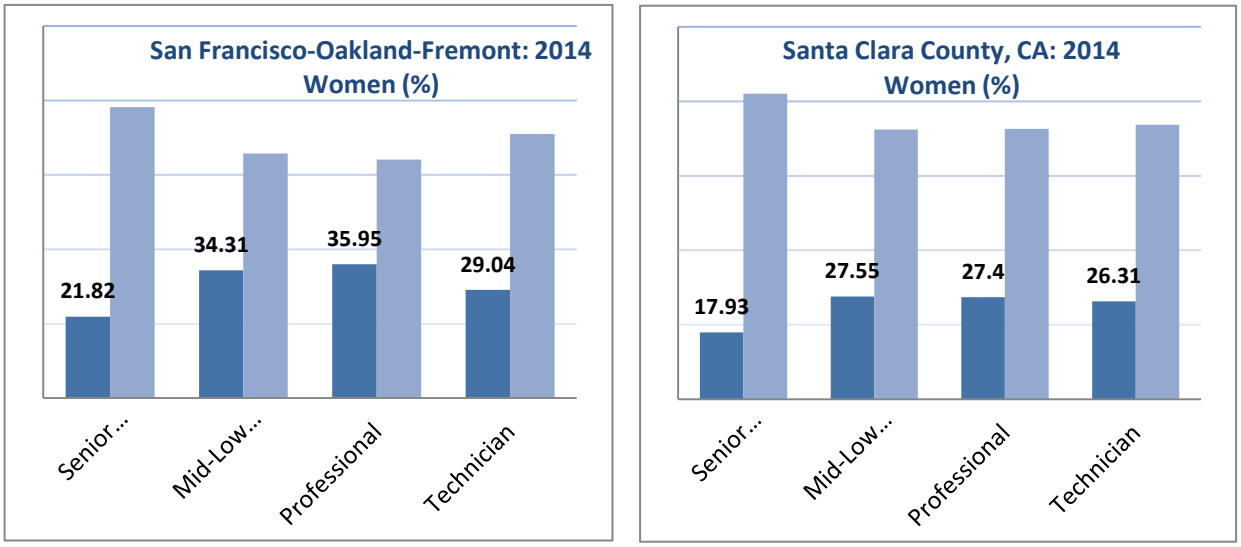
**Figure 9** Source: Equal Employment Opportunity Commission, Employer Information Reports (EEO-1 Single, Headquarters, and Establishment Reports, 2014). Numbers may not add up to totals due to rounding.

In Figure 9 we examine demographics of employment in the high tech sector in the Silicon Valley area specifically, defined by the geographic region including San Francisco-Oakland-Fremont and one county to the south, Santa Clara. These results show that in high tech in the San Francisco-Oakland-Fremont area, over half of the high tech employment was white (54.9 percent). African Americans and Hispanics were 3.3 and 6.6 percent, respectively. Women comprised 36.7 percent of the total high tech employment.

In Santa Clara County, where many of the top high tech firms are headquartered, whites and Asian Americans each comprised around 45 percent of the total high tech workforce, totaling about 90 percent. That means, on average, of one-hundred workers, only two were African

American and fewer than six were Hispanic. Women made up less than one-third of the county's high tech workforce (28.9 percent). Taken together, these results show under-representation of Black and Hispanic employees in Silicon Valley, and in the heart of Silicon Valley (Santa Clara County) in particular. The same pattern is observed for women.

**WOMEN IN LEADERSHIP POSITIONS AND PROFESSIONAL JOBS IN HIGH TECH INDUSTRIES IN SAN FRANCISCO BAY AREA: 2014**




| | San Francisco-Oakland-Fremont, CBSA | | CA Santa Clara County | |
|---|---|---|---|---|
| | **Women (percent)** | **Men ( percent)** | **Women (percent)** | **Men (percent)** |
| Executives, Senior Officials and Managers | 21.82 | 78.18 | 17.93 | 82.07 |
| First/Mid Officials and Managers | 34.31 | 65.69 | 27.55 | 72.45 |
| Professionals | 35.95 | 64.05 | 27.4 | 72.6 |
| Technicians | 29.04 | 70.96 | 26.31 | 73.69 |
| **Total Employment (N)** | **72,730** | **125,538** | **74,403** | **182,939** |

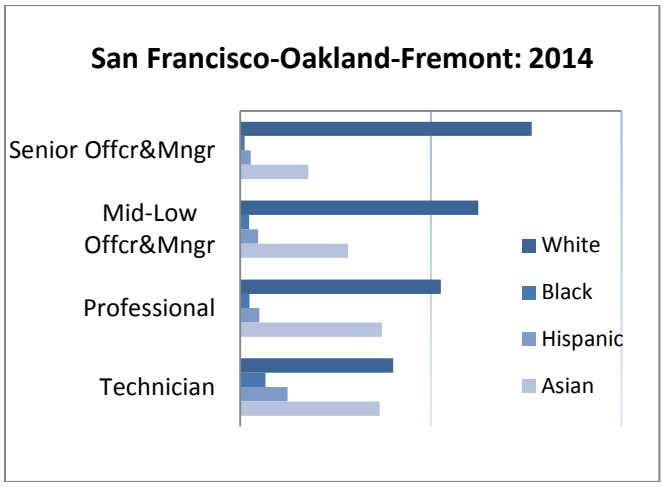
**Figure 10**

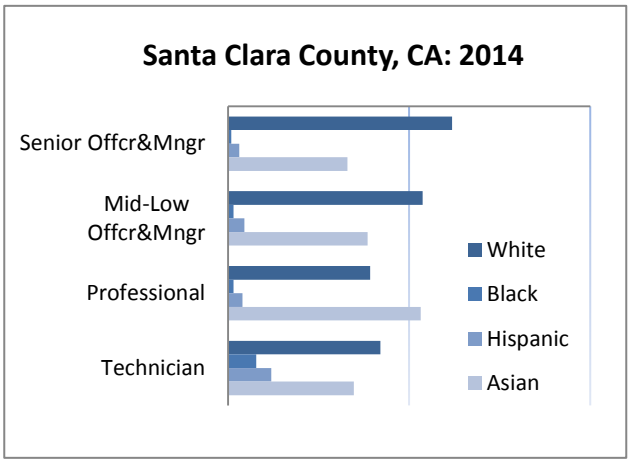
Source: Equal Employment Opportunity Commission, Employer Information Reports (EEO-1 Single, Headquarters, and Establishment Reports, 2014). Numbers may not add up to totals due to rounding.

Figure 10 illustrates that in San Francisco-Oakland-Fremont area, women made up 21.8 percent of the total Executives, Senior Officials and Managers and 34.3 percent of the total First/Mid

Officials and Managers in high tech industries. Over one-in-three, or 35.95 percent, of the total Professionals were female and about 29.2 percent of the Technicians were women, both lower than their male counterparts.

**LEADERSHIP POSITIONS AND TECHNOLOGY JOBS IN HIGH TECH INDUSTRIES BY RACE AND ETHNICITY IN SAN FRANCISCO BAY AREA: 2014**




| San Francisco-Oakland-Fremont, CBSA | WHITE | BLACK | HISPANIC | ASIAN AMERICAN |
|---|---|---|---|---|
| Executive, Senior Officials and Managers | 76.41 | 1.16 | 2.79 | 17.86 |
| First/Mid Officer and Manager | 62.43 | 2.31 | 4.69 | 28.25 |
| Professionals | 52.59 | 2.45 | 4.99 | 37.2 |
| Technicians | 40.08 | 6.59 | 12.38 | 36.54 |
| **Total Employment (N)** | **108,782** | **6,635** | **13,215** | **63,593** |
| **Santa Clara County, CA** | **WHITE** | **BLACK** | **HISPANIC** | **ASIAN AMERICAN** |
| Executive, Senior Officials and Managers | 61.9 | 0.86 | 3.14 | 32.92 |
| First/Mid Officials and Managers | 53.7 | 1.48 | 4.52 | 38.49 |
| Professionals | 39.32 | 1.52 | 3.97 | 51.15 |
| Technicians | 42.03 | 7.82 | 11.91 | 34.69 |
| **Total Employment (N)** | **113,501** | **5,352** | **15,272** | **117,482** |

**Figure 11**

Source: Equal Employment Opportunity Commission, Employer Information Reports (EEO-1 Single, Headquarters, and Establishment Reports, 2014). Numbers may not add up to totals due to rounding.

In Santa Clara County, women were 17.9 percent of the Executive, Senior Officials and Managers and 27.6 percent of the First/Mid Officials and Managers. About 27.6 percent of the Professionals were female and about 26.3 percent of the Technicians were women in the county's high tech industries.

In high tech for San Francisco-Oakland-Fremont area, whites make up over three-quarter of the Executive, Senior Officials and Managers (76.4 percent) and Asian Americans around 17.8 percent. African Americans were 2.8 percent and Hispanics were 7.7 percent. For every hundred Professionals, there were 1.5 African Americans and fewer than four Hispanics.

A similar picture was found in high tech in Santa Clara County. The majority of the Executive, Senior Officials and Managers positions were held by either whites (61.9 percent) or Asian Americans (32.9 percent). Over half of the Professional jobs reported in the EEO-1 were staffed by Asian Americans (51.2 percent) and about 40 percent by whites (39.3 percent). African Americans and Hispanics were less represented in both Executive, Senior Officials and Managers positions (0.86 percent and 3.14 percent, respectively) and in Professional jobs (1.52 percent and 3.97 percent, respectively).

Note that while Asian Americans made up large percentages of Professional employees in the the San Francisco metro area (37.2%), and especially in Santa Clara county (51.15%), representation of this demographic group in Executive, Senior Officials and Managers was markedly lower (17.86% and 32.92%, respectively). This preliminary finding may suggest something of a 'glass ceiling' for Asian Americans working in Silicon Valley, one that seems especially pronounced in what we consider to be the heart of the region, Santa Clara County.

## III. EXAMINATION OF LEADING HIGH TECH EMPLOYERS IN SILICON VALLEY

The firms analyzed in this section come from a 2015 San Jose Mercury news article, "*Silicon Valley's Top 150 Companies."* [19] The article produced a ranking of high tech firms in the Silicon Valley area based on revenue, profitability and other criteria.[20] To provide a more focused window on diversity in high tech employment, we examined the workforce composition of those tech companies regarded by industry insiders as leaders in the field. From the published list, we selected the first 75 rank-ordered firms that had an EEO-1 on file for 2014, which is the latest year available for EEO1 data at the time of this report**.**[21] In the case where a firm did not have an EEO-1 report on file, we moved to the next firm on the list.

We then created a data set containing the 2014 EEO-1 report data for the 75 firms and *all of their establishments* located within Silicon Valley. We defined Silicon Valley as all cites within the CBSAs of San Francisco-Oakland-Fremont and of San Jose-Sunnyvale-Santa Clara. A list of these cities included in these two CBSAs is included in Table 5.[22] We examined a total of 230 establishments belonging to the *Top 75 Tech Firms*.

### Workforce Composition[23]

In Table 6 we show in frequency and percent the workforce composition of the top 75 ranked firms in Silicon Valley by sex and race-ethnicity. Data come from 2014 EEO-1 reports for the firms and their establishments physically located in the Silicon Valley. In 2014, total employment for these firms aggregated was 209,089.

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[19] April 17, 2015, San Jose Mercury News, *http://www.mercurynews.com/business/ci_27932727/sv150-searchable-database-silicon-valleys-top-150-companies*.

[20] The article did not describe its ranking methodology.

[21] The NAICS reported in this section are from the Top Ranked 75 Firms in Silicon Valley and do not completely match the definition of high tech industries used elsewhere in this report.

[22] The "Silicon Valley" is generally understood to include the southern half of the San Francisco Peninsula, sections of the East Bay and all of the Santa Clara Valley. This includes parts of the Santa Clara County, San Mateo County and Alameda County. In the prior section the area is defined in terms of two metropolitan areas. For this section, we construct Silicon Valley as the physical location (cities, counties) of the top 75 ranked tech firms and their establishments. This is done in order to get a better fit with the ranking produced by the *San Jose Mercury News* (April 2015).

[23] As another matter of interest, we searched for federal contractor status for all 75 tech firms used in this section. Contractor status is a reporting item on the EEO-1 form. We found that more than half, 57 percent, had at least one current federal contract in 2014. Because federal contractors are now obligated to collect self-reported disability status, data on the employment of people with disabilities in High Tech firms will be available for future study (this is not a data point collected on EEOC surveys).

| TABLE 5: LIST OF CITY NAMES - VARIABLE IN EEO-1 DATABASE USED IN SILICON VALLEY REPORTING (CBSA 41860 and 41940) |
|---|
| ALAMEDA |
| BERKELEY |
| BRISBANE |
| BURLINGAME |
| CAMPBELL |
| CONCORD |
| CORTE MADERA |
| CUPERTINO |
| EMERYVILLE |
| FOSTER CITY |
| FREMONT |
| HAYWARD |
| HERCULES |
| LIVERMORE |
| LOS GATOS |
| MENLO PARK |
| MILPITAS |
| MOUNTAIN VIEW |
| NEWARK |
| OAKLAND |
| PALO ALTO |
| PLEASANTON |
| REDWOOD CITY |
| RICHMOND |
| SAN BRUNO |
| SAN FRANCISCO |
| SAN JOSE |
| SAN MATEO |
| SAN RAFAEL |
| SANTA CLARA |
| STANFORD |
| SUNNYVALE |
| WALNUT CREEK |

N=33

| **TABLE 6:** ***2014 EEO-1 DATA FOR TOP RANKED 75 SILICON VALLEY TECH FIRMS AGGREGATED*** | | |
|---|---|---|
| **Total Employed** | **209,089** | **100%** |
| Women | 62,960 | *30%* |
| Men | 146,129 | *70%* |
| Asian American | 86,340 | *41%* |
| Black | 5,720 | *3.%* |
| Hispanic | 12,824 | *6.%* |
| White | 99,222 | *47%* |

N=230 establishments

What is striking in this table is the degree of sex and race segregation. Women comprise just 30 percent of total employment and Asian Americans and Whites comprise 88 percent of all employment.

In Table 6, we see that composition of the select top ranked 75 Silicon Valley tech firms is strongly characterized by sex and race segregation; or, in another words, there is little diversity. But as a point of comparison, what does the workforce composition of the non-tech firms in Silicon Valley look like by sex and race?

Table 7 shows, in frequency and percent, the aggregated workforce composition for all other (non-tech) firms and their establishments also in Silicon Valley.[24] Based on 2014 EEO-1 reports for firms and their establishments, total employment for these firms was 770,290.

[24] After eliminating all firms with a technology industry NAIC, there are 2,939 firms (e.g., unique parent headquarter ID numbers) with a total of 9,278 establishments in the Silicon Valley.

| **TABLE 7: *2014 EEO-1 DATA FOR ALL OTHER (NON-TECH) SILICON VALLEY FIRMS AGGREGATED*** | | |
|---|---|---|
| **Total Employed** | **770,290** | **100%** |
| Women | 375,026 | *49%* |
| Men | 395,264 | *51%* |
| Asian American | 186,493 | *24%* |
| Black | 62,789 | *8.%* |
| Hispanic | 168,873 | *22%* |
| White | 312,627 | *41%* |

N=9,278 establishments

For these non-high tech firms, employment of women and men is at about parity with 49 percent women and 51 percent men. Whites make up less than half of total employment at 41 percent. Of the remainder, Asian Americans comprise 24 percent, Hispanics 22 percent and African Americans 8 percent.

In Table 8, we examine the distribution of occupations. We specifically examine the ten EEO occupations employers use to report employees' job duties for EEO-1 reporting purposes.

| **TABLE 8: *2014 EEO-1 DATA FOR TOP RANKED 75 SILICON VALLEY TECH FIRMS AGGREGATED*** **(EEO-1 job groups as a percent of total employment)** | | | | | |
|---|---|---|---|---|---|
| **Total Employment** | Professionals | Sales | Technicians | Executives & Managers Combined | All Other EEO-1 Occupations |
| **100%** | *58%* | *8.%* | *6.%* | *21%* | *6%* |

Two occupational types dominate, Professionals at 58 percent and Executives, Senior Officials and Managers combined with First/Mid Officials and Managers at 21 percent. In Table 9, we take the same view but examine the distribution of women and men, whites and non-whites for

the four most populous EEO occupations, Professionals, Sales, Technicians and Executives, Senior Officials and Managers combined with First/Mid Officials and Managers.

**TABLE 9: *2014 EEO-1 DATA FOR SELECT TOP RANKED 75 SILICON VALLEY TECH FIRMS AGGREGATED***
**(Women/Men and Non-Whites/Whites in EEO occupations)**

| | **Professionals** | **Sales** | **Technicians** | **Executives & Managers Combined** |
|---|---|---|---|---|
| Women | 30% | 25% | 23% | 28% |
| Men | 70% | 75% | 77% | 72% |
| Total | *100* | *100* | *100* | *100* |
| Asian American | 50% | 11% | 23% | 36% |
| Black | 2% | 3% | 11% | *Less than 1 percent* |
| Hispanic | 4% | 6% | 12% | 1.6% |
| White | 41% | 77% | 50.% | 57% |
| All other | 3% | 3% | 4% | 5% |
| Total | *100* | *100* | *100* | *100* |

Note that Asian Americans again make up a large percentage of Professional employees working at these firms (50%), but a smaller percentage of the management teams (36%). At the same time, African Americans and Hispanics make up a very small percentage of both employment groups (Professionals and Executives and Managers combined). Contrasting again with our aggregated pool of non-high tech firms in Silicon Valley, we see in Table 10, more diversity of occupational types---which we would expect.

**TABLE 10: *2014 EEO-1 DATA FOR ALL OTHER (NON-TECH) FIRMS IN SILICON VALLEY AGGREGATED***
**(EEO occupations as a percent of total employment)**

| **Total** | Prof | Sales | Tech | Blue Collar | Executive-Manager | Service | Clerical |
|---|---|---|---|---|---|---|---|
| **100%** | *24%* | *12%* | *5.%* | *16%* | *13%* | *18%* | *12%* |

Table 11 shows the occupational composition by sex and race.

| **TABLE 11: *2014 EEO-1 DATA FOR ALL OTHER (NON-TECH) FIRMS IN SILICON VALLEY AGGREGATED*** **(Women/Men and Non-Whites/Whites in EEO occupations)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Total** | **Prof** | **Sales** | **Tech** | **Blue Collar*** | **Executive-Manager** | **Service** | **Clerical** |
| ***Percent of Employment*** | 24% | 12% | 5.% | 16% | 13% | 18% | 12% |
| **Women** | 56% | 54% | 49% | 16% | 43% | 50% | 73% |
| **Men** | 44% | 46% | 51% | 84% | 57% | 50% | 27% |
| **Total** | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| **Asian American** | 32% | 20% | 35% | 16% | 20% | 24% | 25% |
| **Black** | 5% | 9% | 8% | 10% | 5% | 12% | 10% |
| **Hispanic** | 7.5% | 25% | 15% | 40% | 10% | 34% | 20% |
| **White** | 52% | 40% | 37% | 30% | 62% | 23% | 38% |
| **All Other** | 3.5% | 6% | 5% | 4% | 3% | 7% | 7% |
| **Total** | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

*This combines the EEO occupations Operatives, Laborers & Helpers and Craft Workers.

There is very little occupational segregation (unequal distribution among job groups) by gender within these occupations except for two: Blue-Collar and Clerical. For the remainder there is almost parity for the other EEO-1 occupations. Additionally, there is more race-ethnicity diversity than within the high tech firms examined in the previous table.

## APPENDIX FIGURE 1: STEM OCCUPATIONS

**Table 1: STEM Occupations, by occupational group**

| |
|---|
| Management |
| Architectural and engineering managers |
| Computer and information systems managers |
| Natural sciences managers |
| Computer and mathematics |
| Actuaries |
| Computer and information research scientists |
| Computer network architects |
| Computer network support specialists |
| Computer programmers |
| Computer systems analysts |
| Computer user support specialists |
| Database administrators |
| Information security analysts |
| Mathematical technicians |
| Mathematicians |
| Network and computer systems administrators |
| Operations research analysts |
| Software developers, applications |
| Software developers, systems software |
| Statisticians |
| Web developers |
| Computer occupations, all other |
| Mathematical science occupations, all other |
| Architecture and engineering |
| Aerospace engineering and operations technicians |
| Aerospace engineers |
| Agricultural engineers |
| Architectural and civil drafters |
| Biomedical engineers |
| Chemical engineers |
| Civil engineering technicians |
| Civil engineers |
| Computer hardware engineers |
| Electrical and electronics drafters |
| Electrical and electronics engineering technicians |
| Electrical engineers |
| Electro-mechanical technicians |
| Electronics engineers, except computer |
| Environmental engineering technicians |
| Environmental engineers |
| Health and safety engineers, except mining safety engineers and inspectors |
| Industrial engineering technicians |
| Industrial engineers |
| Marine engineers and naval architects |
| Materials engineers |
| Mechanical drafters |
| Mechanical engineering technicians |
| Mechanical engineers |
| Mining and geological engineers, including mining safety engineers |
| Nuclear engineers |
| Petroleum engineers |
| Surveying and mapping technicians |
| Drafters, all other |
| Engineering technicians, except drafters, all other |
| Engineers, all other |
| Life, physical, and social sciences |
| Agricultural and food science technicians |
| Animal scientists |
| Astronomers |
| Atmospheric and space scientists |
| Biochemists and biophysicists |
| Biological technicians |
| Chemical technicians |
| Chemists |
| Conservation scientists |
| Environmental science and protection technicians, including health |
| Environmental scientists and specialists, including health |
| Epidemiologists |
| Food scientists and technologists |
| Forensic science technicians |
| Forest and conservation technicians |
| Foresters |
| Geological and petroleum technicians |
| Geoscientists, except hydrologists and geographers |
| Hydrologists |
| Life, physical, and social science technicians, all other |
| Materials scientists |
| Medical scientists, except epidemiologists |
| Microbiologists |
| Nuclear technicians |
| Physicists |
| Soil and plant scientists |
| Zoologists and wildlife biologists |
| Biological scientists, all other |
| Life scientists, all other |
| Physical scientists, all other |
| Education, training, and library |
| Agricultural sciences teachers, postsecondary |
| Architecture teachers, postsecondary |
| Atmospheric, earth, marine, and space sciences teachers, postsecondary |
| Biological science teachers, postsecondary |
| Chemistry teachers, postsecondary |
| Computer science teachers, postsecondary |
| Engineering teachers, postsecondary |
| Environmental science teachers, postsecondary |
| Forestry and conservation science teachers, postsecondary |
| Mathematical science teachers, postsecondary |
| Physics teachers, postsecondary |
| Sales and related |
| Sales engineers |
| Sales representatives, wholesale and manufacturing, technical and scientific products |

Source: 2010 Standard Occupational Classification (SOC) System, SOC Policy Committee recommendation to the Office of Management and Budget. Healthcare occupations are not included.

| APPENDIX TABLE 1: TOP HIGH TECH GEOGRAPHIC AREAS IDENTIFIED FOR POTENTIAL FUTURE RESEARCH | | |
|---|---|---|
| CBSA TITLE | REPORTING UNITS (N) | TOTAL HIGH TECH EMPLOYMENT (N) |
| New York-Newark-Jersey City, NY-NJ-PA | 2,405 | 363,444 |
| Los Angeles-Long Beach-Anaheim, CA | 1,912 | 269,452 |
| Washington-Arlington-Alexandria, DC-VA-MD-WV | 3,561 | 266,378 |
| San Jose-Sunnyvale-Santa Clara, CA | 890 | 257,349 |
| Boston-Cambridge-Newton, MA-NH | 1,443 | 224,533 |
| Seattle-Tacoma-Bellevue, WA | 867 | 197,046 |
| Dallas-Fort Worth-Arlington, TX | 1,217 | 189,615 |
| Chicago-Naperville-Elgin, IL-IN-WI | 1,462 | 181,721 |
| Philadelphia-Camden-Wilmington, PA-NJ-DE-MD | 1,039 | 130,582 |
| Atlanta-Sandy Springs-Roswell, GA | 1,042 | 128,296 |

Source: Equal Employment Opportunity Commission, Employer Information Reports (EEO-1 Single, Headquarters, and Establishment Reports, 2014). Numbers may not add up to totals due to rounding.

| APPENDIX TABLE 2: NAICS-CODE BASED DEFINITION OF HIGH TECH INDUSTRIES | |
|---|---|
| 4-DIGIT CODE | INDUSTRY LABEL |
| 3254 | Pharmaceutical and Medicine Manufacturing |
| 3333 | Commercial and Service Industry Machinery Manufacturing |
| 3341 | Computer and Peripheral Equipment Manufacturing |
| 3342 | Communications Equipment Manufacturing |
| 3343 | Audio and Video Equipment Manufacturing |
| 3344 | Semiconductor and Other Electronic Component Manufacturing |
| 3345 | Navigational, Measuring, Electrometrical, and Control Instruments Manufacturing |
| 3346 | Manufacturing and Reproducing Magnetic and Optical Media |
| 3364 | Aerospace Product and Parts Manufacturing |
| 3391 | Medical Equipment and Supplies Manufacturing |
| 5112 | Software Publishers |
| 5179 | Other Telecommunications |
| 5191 | Other Information Services |
| 5413 | Architectural, Engineering, and Related Services |
| 5415 | Computer Systems Design and Related Services |
| 5417 | Scientific Research and Development Services |
| 5419 | Other Professional, Scientific, and Technical Services |

**ANNOTATED BIBLIOGRAPHY**

1. **"Are There High-Tech Industries or Only High-Tech Firms? Evidence From New Technology-Based Firms"** John R. Baldwin and Guy Gellatly. Microeconomics Division, Statistics Canada December 1998

Far from producing definitive classifications, existing measures of technological advancement are found to be wanting. Classification schemes that rely on a single-measure of technological prowess, as many do, may incorrectly rank industries and/or classify sectors. Second, firms that possess the advanced competencies that contribute to technological prowess are found in many industries, and are not as sector-specific as previous attempts at classification suggest. Simply stated, low-tech industries are not devoid of high tech firms, nor, are high tech industries comprised exclusively of high tech firms. Consequently, broad generalizations at the industry-level may prove dubious. The competency-based approach represents a considerable advance over previous efforts: it formally recognizes the multidimensional nature of technological prowess.

Firms that we identify as advanced in this study have the characteristics associated with new technology-based firms. They are innovative; they introduce new products and processes; they place great emphasis on technology; they appreciate the importance of a skilled workforce, and they train their workers. Industries that might be classified as low-tech on the basis of indices are not devoid of high tech firms—on average, they contain half as many high tech firms as can be found in high tech industries. It should not be claimed that high-knowledge, high tech firms are confined exclusively to these more visible industries.

2. **"How U.S. tech-sector jobs have grown, changed in 15 years**" by Drew DeSilver Pew Research Center, March 2014

Based on data collected from November 2009 to May 2012, about 3.9 million workers — roughly 3 percent of the nation's payroll workforce (Occupational Employment Statistics, BLS) — work in what we might think of as "core" tech occupations — not people who simply use computing technology in their jobs, but whose jobs involve making that technology work for the rest of us. (Occupations involving the installation and repair of telecommunications lines and equipment, as well as computer repairers were excluded.) The chart below shows just how different the structure of 2012's technology industry is from that of 15 years earlier. Some occupations, such as web developers and information security analysts, simply didn't exist back then (at least not under those names). Others have dramatically grown (programmers/software developers, support specialists) or shrunk (computer operators).

3. **"The Joys of Urban Tech: Goodbye, office parks. Drawn by amenities and talent, tech firms are opting for cities"** By Richard Florida Wall Street Journal, Aug. 31, 2012

A generation or so ago, high tech companies were more like factories. They developed proprietary software systems, designed and manufactured chips, built computers, they

deployed big engineering teams and created the infrastructure that made the Internet possible and they needed big suburban campuses to house them.

The changing nature of technology—cloud-based applications in particular—enable new start-ups to succeed more quickly, with smaller teams and much smaller footprints. High tech products and industries are more multidisciplinary than they used to be so success often requires excellence in more than one field of technology and in other lines of business. The companies that succeed are the ones that stay in the closest contact with their end-users and first adopters. Design is central to successful new hardware products Design talent is overwhelmingly concentrated in big cities, with their leading design schools and multiple industries that draw upon such skills. Other areas of high tech are premised less on breakthrough innovations and more on the application of technology to massive new markets in retailing, advertising, media, financial services, education, publishing, communications, fashion and music. Tech companies are dispersing to areas where access to their need for diverse talent can be accommodated.

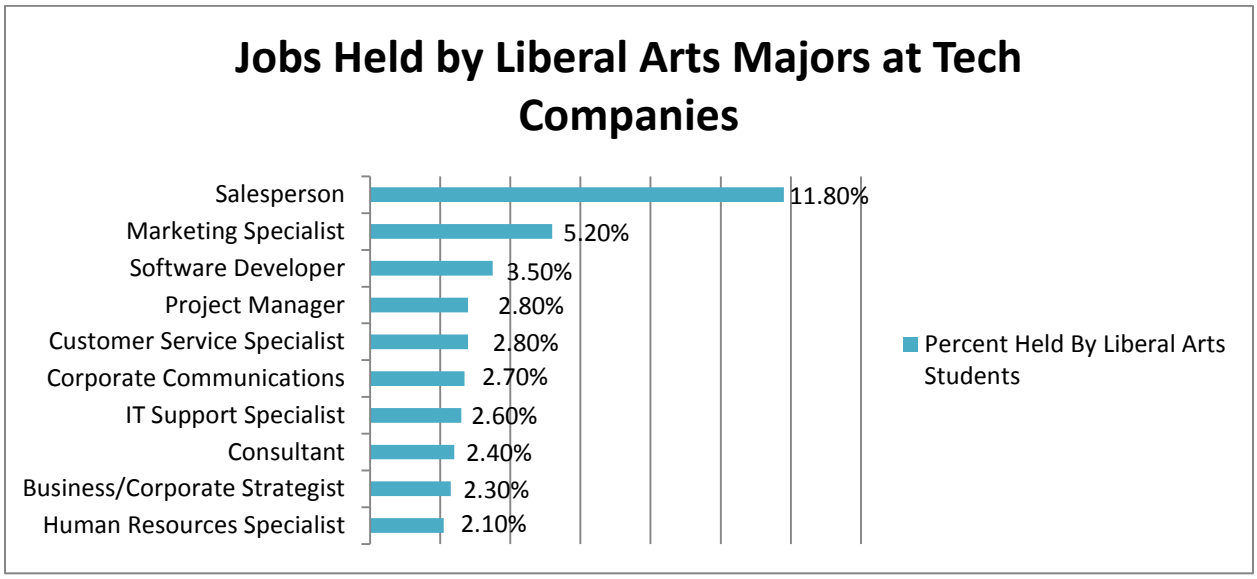
4. **"STEM 101: Intro to Tomorrow's Jobs"** Dennis Vilorio. Occupational Outlook Quarterly; Spring 2014 www.bls.org/ooq

There is no universally agreed-upon definition of STEM. STEM workers use their knowledge of science, technology, engineering, or math to try to understand how the world works and to solve problems. A list of 100 STEM occupations (excluding healthcare) was compiled by several federal agencies; see Appendix Figure I for this list. The BLS projects overall STEM employment to grow about 13 percent 2012-2022, somewhat faster than the 11 percent projected for all occupations. The largest numbers of professional and technical jobs (not fastest growing) are expected to be in software development and applications, computer systems analysis and user support. Software development and systems analysis jobs generally require a Bachelor's Degree while user support requires "some college, no degree (See Appendix TABLE I A for lists of 15 rapidly growing occupations and occupations with the largest number of jobs.)

5. **"Want A Tech Career? LinkedIn Finds 12 Eye-Catching Paths"** by George Anders. Forbes, Tech (August 25, 2015)

LinkedIn data scientist Alice Ma has crunched the numbers. In a new blog post, she highlights 12 eye-catching ways that non-technical strivers can be welcomed into the coders' lair. From 2010 to 2013, hiring of liberal-arts majors in tech companies actually grew 10 percent faster than the rate of job offers to computer-science and engineering majors.

**BIBLIOGRAPHY FIGURE I**




6. "**Gender Segregation in Fields of Study at Community Colleges and Implications for Future Earnings**" Layla Moughari, Rhiana Gunn-Wright, and Barbara Gault, Ph.D. Institute for Women's Policy Research IPWR#C395 (May 2012)

While men out earn women regardless of occupation, occupational field contributes substantially to the pay gap. Women outnumber men in community colleges, receiving 56.8 percent of associate degrees but men comprise at least seventy percent of graduates in engineering, mathematics, and computer science while women dominate in the lower paying fields.

7. "**Closing the STEM Skills Gap"** by STEM Education Coalition www.stemedcoalition.org

The STEM Coalition meets with legislators, legislative staff, and community leaders to discuss STEM policy and education. The Coalition works with U.S. House STEM Education Caucus. The Coalition recommends "robust and targeted investments" preparing and training elementary and secondary school teachers in "STEM-specific pedagogical knowledge" enabling them to excite students and foster strong student learning in STEM subjects through a strong emphasis on hands-on, inquiry-based learning activities for students from an early age. We should encourage learning through working directly with STEM professionals in internships, and participating in field experiences and STEM-related competitions. Informal education such as museums, maker-spaces, or after school groups – are valuable and essential partners for STEM education improvement

There are almost twice as many job postings in STEM fields as there are qualified applicants to fill them. Half of STEM jobs do not require a traditional four-year degree and pay on average 10

per cent higher than non-STEM jobs.[25] Public/private partnerships are recommended to create a suitable workforce.

8. **Science, Technology, Engineering, and Mathematics (STEM) Education: A Primer** by Heather B. Gonzalez and Jeffrey J. Kuenzi. Congressional Research Service, 11-15-2012

Graduate enrollments in science and engineering (S&E) grew 35 percent over the last decade. S&E enrollments grew for groups generally under-represented in S&E, increase by demographic group:

- Hispanic/Latino, 65 percent
- American Indian/Alaska Native, 55 percent
- African American students 50 percent

Analysts have identified between 105 and 252 STEM education programs or activities at 13 to 15 federal agencies.

According to the U.S. Census Bureau, the percentage of U.S. bachelor's degree holders with undergraduate degrees in science and engineering (S&E) was 36.4 percent in 2009 (approximately 20 million people).

The NSF estimates that the percentage of bachelor's degrees in S&E fields has held relatively constant—at between approximately 30 percent and 35 percent of all bachelor's degrees—for the past four decades. However, because the U.S. college-age population grew during these years, the total number of S&E bachelor's degrees awarded annually more than doubled between 1966 and 2008 (from 184,313 to 494,627). Since 1966, the percentage of doctorates in S&E fields has ranged between approximately 56 percent and 67 percent of all graduate degrees (where a field of study has been reported). The total number of doctoral degrees in S&E fields has nearly tripled, growing from 11,570 in 1966 to 32,827 in 2008.33 Graduate enrollments show similar upward trends.

In the decade between 2000 and 2010, graduate enrollments in S&E fields grew by 35 percent. Further, among U.S. citizens and permanent residents, S&E graduate enrollments among Hispanic/Latino, American Indian/Alaska Native, and black/African American students grew at a higher rate than that of whites (not of Hispanic origin) and Asian Americanss.39 While women account for relatively small percentages of degree recipients in certain STEM fields (only 18.5 percent of bachelor's degrees in engineering went to women in 2008)38 they accounted for 77.1 percent of the psychology degrees and 58.3 percent of the biological and agricultural sciences degrees in 2008,[26]

[25] Note from RT: This is disputed in other articles cited here. The focus on elite degrees and hostile atmosphere may contribute to the shortage. The perceived shortage in turn may motivate the higher salaries, absent which salaries would drop.

[26] Data from the National Science Foundation, National Center for Science and Engineering Statistics

Foreign students earn roughly one-third of all U.S. S&E doctoral degrees and earn half (or more) of U.S. doctoral degrees in the specific fields of engineering, physics, computer sciences, and economics. In 2009, there were 611,629 graduate students in science and engineering fields in the United States. Of these 168,850 (27.6 percent) were temporary residents.[27]

9. "**How tech companies compare in employee diversity**" FORTUNE August 29, 2014

At least 14 high tech companies have released data on their gender, racial, and ethnic diversity. Fortune ranked them in individual categories (leadership team, technical workers) and overall diversity. These graphs are shown in Appendix Figure II. Here's how they stacked up, overall by Fortune's measure:

| | | |
|---|---|---|
| • LinkedIn<br>• Apple<br>• EBay<br>• Indiegogo & Yahoo (tied) | • Pinterest<br>• Pandora<br>• Facebook<br>• Intel & Google (tied) | • Twitter<br>• Cisco<br>• Hewlett-Packard<br>• Microsoft |

10. **"Does the Tech Industry Even Deserve Women**?" By Cecilia D'Anastasio https://broadly.vice.com/en_us/article/does-the-tech-industry-even-deserve-women September 6, 2015

Women and minorities in tech have a special responsibility; in addition to their jobs, minorities in tech are employed as demographic icons. In that capacity, they often must defend their identity against a culturally-sanctioned exclusivity. That job never pays. Feminists weigh being tolerant of abuse or out of a job. Harassment happens, startlingly often and unprovoked, and it can feel it comes with the territory of tech jobs.

The problem isn't necessarily that women don't care about programming, or that women in tech aren't measuring up, according to *Lean Out* contributors, the problem is that internalized misogyny and financially-reinforced tokenism runs through the veins of tech. Women in tech are the canary in the coal mine. When the canary starts dying you know the environment is toxic. Instead, the tech industry is looking at the canary, wondering why it can't breathe, saying 'Lean in!

[27] National Science Board, Science and Engineering Indicators: 2012, NSB 12-01, National Science Foundation, January 13, 2012, p. 2-28.

11. **Athena Factor 2.0: Accelerating Female Talent in Science, Engineering & Technology** by Sylvia Ann Hewlett and Laura Sherbin with Fabiola Dieudonné, Christina Fargnoli, and Catherine Fredman TalentInnovation.org, 2014

In 2008, when we published *The Athena Factor: Reversing the Brain Drain in Science, Engineering, and Technology*, our data showed that while the female talent pipeline in SET was surprisingly robust, women were dropping out of the field in droves. Over time, fully 52 percent of highly qualified women working for SET companies quit their jobs. While 80 percent of U.S., 87 percent of Brazilian, 90 percent of Chinese and 93 percent of Indian SET women say they love their work. However, a sizable proportion say they feel stalled and say they are likely to quit their jobs within a year. Women who say they are likely to quit within a year: 32 percent U.S.; 22 percent Brazil; 30 percent China; 20 percent India.

Looking at the barriers to SET women's advancement through a lens refined by our recent we see promising levers for change. The most obvious solution: sponsorship. Sponsors help their protégés crack the unwritten code of executive presence, improving their chances of being perceived as leadership material. Most important to the companies employing them, sponsors help women get their ideas heard.

Our research shows that when SET women are fully engaged, and when leadership creates the speak-up culture wherein their ideas might be heard, companies enjoy a "diversity dividend" that translates into increased market share and entry into altogether new markets.

12. **Why So Few? Women in Science, Technology, Engineering, and Math. Catherine Hill, Ph.D. Christianne Corbett Andresse St. Rose, Ed.D. AAUW 2010, updated 2015 in Solving the Equation and reported The Stats On Women In Tech Are Actually Getting Worse by** Emily Peck, Executive Editor, Business and Technology **Huffington Post,** Updated Mar 27, 2015

In 2013, just 26 percent of computing jobs in the U.S. were held by women, down from 35 percent in 1990, according to the study released Thursday by the American Association of University Women. In 2013, more than half of the biological scientists in the U.S. were women, compared to 42 percent in 1990.

Prejudices tend to make their way into the hiring process. .Men are twice as likely as women to be hired for a job in mathematics when the only difference between candidates is gender, (Proceedings of the National Academy of Sciences March 10, 2014).

At Google, women make up 30 percent of the company's overall workforce, but hold only 17 percent of the company's tech jobs. At Facebook, 15 percent of tech roles are staffed by women. At Twitter, it's a laughable 10 percent. For non-technical jobs at Twitter (think marketing, HR, sales), the gender split is 50-50.

Diversity needs to be made a clear priority at companies. That happens only when diversity moves out of workshops and becomes factored into the hiring managers' bottom lines.

13. "**How stereotypes impair women's careers in science"** by Ernesto Reubena, Paola Sapienzab, and Luigi Zingalesc Proceedings of the National Academy of Sciences, January 31, 2014

Without provision of information about candidates other than their appearance, men are twice more likely to be hired for a mathematical task than women. If ability is self-reported, women still are discriminated against, because employers do not fully account for men's tendency to boast about performance. Providing full information about candidates' past performance reduces discrimination but does not eliminate it. Implicit stereotypes (as measured by the Implicit Association Test) predict not only the initial bias in beliefs but also the suboptimal updating of gender-related expectations when performance-related information comes from the subjects themselves.

14. **"Why are women leaving the tech industry in droves?"** by Tracey Lien Los Angeles Times Feb.22, 2015

Reasons include a "hostile" male culture, a sense of isolation and lack of a clear career path. The attitudes holding them back are subtle, and hence more difficult to challenge.

"The continuous pattern of all these people treating me like I didn't know what was going on, or excluding me from conversations and not trusting my assertions, all these things added up and it felt like there was an undercurrent of sexism," Tracy Chou said.

That's one difficulty in tackling the problem, said Alaina Percival of Women Who Code "They're [things that are] so small you'd never even complain about them," Percival said. "But they happen day after day. They're the kind of things that separate and exclude you from the team…". So far, no company has found a solution for retaining women.

15. "**Stopping the Exodus of Women in Science**" by Sylvia Ann Hewlett, Carolyn Buck Luce, Lisa J. Servon. Harvard Business Review June 2008

Fifty-two percent of female scientists, engineers, and technologists abandon their careers! Business leaders decry the shortage and lobby for more H-1B visas although the talent they seek is available. Research by The Center for Work-Life Policy shows that 41 percent of qualified scientists, engineers and technologists are women at the lower rungs of corporate ladders but more than half quit their jobs. Five reasons appear to account for the loss: workplace hostility, isolation, conflict between women's preferred work rhythms and the "firefighting" work style generally rewarded, long hours and travel schedules conflict with women's heavy household management workload, and women's lack of advancement in the professions and corporate ladders. If corporate initiatives to stem the brain drain reduce attrition by 25 percent there would be 220 thousand additional highly qualified female STEM workers.

16. **"Why Women Quit Science"** on line title "**She Wanted to Do Her Research. He Wanted to Talk 'Feelings**.'" by A. Hope Jahren. New York Times (March 4, 2016)

Women are no longer a race and ethnic within higher education; women's enrollment in graduate education in the United States has been greater than men's for each of the last 30 years; as of 2012, there were 13 women enrolled for every 10 men. Yet, in physical sciences, seven B.S. degrees are granted to women for every 10 granted to men; three M.S. degrees granted to women for every five granted to men; one Ph.D. degree granted to a woman for every two granted to men. The absence of women is progressive and persistent — despite more than 20 years of programs intended to encourage the participation of girls and women.

Women reported both isolation and intimidation as barriers blocking their scholarly path; and while 23 percent of freshmen reported not having experienced these barriers, only 3 percent of seniors did. Few studies exist, but in a survey of 191 female fellowship recipients, 12 percent indicated that they had been sexually harassed as a student or early professional. Sexual harassment is very rarely publicly punished when reported, and then only after a pattern of relatively egregious offenses. And, it never stops.

17. "**The 5 Biases Pushing Women Out of STEM**" by Joan C. Williams Harvard Business Review (March 24, 2015)

Bias, not pipeline issues or personal choices pushes women out of science. Bias functions differently depending on race and ethnicity. Based on a survey and in-depth interviews of female scientists (557 and 60 respectively):

- Two-thirds of women report having to prove themselves over and over; their success discounted and their expertise questioned.
    - Three-fourths of Black women reported this phenomenon
- Thirty-four percent reported pressure to play a traditionally feminine role, including 41 percent of Asian women.
    - Fifty-three percent reported backlash from speaking their minds directly or being outspoken or decisive.
    - Women, particularly Black and Latina women, are seen as angry when they fail to conform to female stereotypes
- Almost two thirds of women with children say their commitment and competence were questioned and opportunities decreased after having children.
- Three fourths of women surveyed said that women in their workplace supported each other; one fifth said they felt as if they were competing with women colleagues for "the woman spot".
- Isolation is a problem: 42 percent of Black women, 38percent of Latinas, 37 percent of Asian women and 32 percent of White women agreed that socializing with colleagues negatively affect perceptions of their competence.

18. "**What's Holding Women Back in Science and Technology Industries" Center for Talent Innovation and Hewlett Consulting Partners LLC** Harvard Business Review, September 2015

New research from the Center for Talent Innovation shows that U.S. women working in SET fields are 45 percent more likely than their male peers to leave the industry within the year. Over 80 percent of U.S. women love what they do; in Brazil, China, and India, the numbers are close to 90 percent. Over three-quarters (76 percent) of U.S. women consider themselves "very ambitious," as do 92 percent of Chinese and 89 percent of Indian SET women. Yet, they feel stalled, blocked from contributing to their full potential, and stymied by bias and a double standard. They feel marginalized by the environment of "arrogant nerds" and "hard hat culture". Thirty-two percent of U.S. women say they are likely to leave within a year, as do 22 percent of Brazilian women, 30 percent of women in China, and 20 percent in India.

19. **"The Hiring Dilemma for High-tech Firms: 'Make vs. Buy'"** Knowledge @ Wharton http://knowledge.wharton.upenn.edu/article/the-hiring-dilemma-for-high-tech-firms-make-vs-buy/ (Nov 02, 2005)

The article reports research findings and recommendations. HR strategy complements technology strategy; in a fast-paced industry, product life cycles are growing shorter. Firms are facing more opportunities for change and more adjustments to the workforce. When skills need to be adjusted, it pays to buy the skills instead of developing them.

The opposite is true for slower moving industries operating in marketplaces with less change — these findings could be significant for human resource management strategies. As the pace of technological change has quickened, and as global competition has shortened product life cycles, firms have had to rethink their technology investment strategies and their human resource management practices in order to remain competitive.

A classic example of this phenomenon is Hewlett Packard over the last 20 years. They had such a reputation for use of internal labor markets, where they hired employees at an early stage and then developed them throughout their careers. But now they are operating more on the spot market. In order to keep pace with other technology firms, they hire on the outside.[28]

Technology firms in short product life markets, and thus with high R&D spending, must have a mix of engineers dominated by the new skills required for the new technology with a small emphasis on engineers with experience on the last generation of technology. High tech firms need to balance the two strategies; experienced workers have firm-specific knowledge that

[28] There is substantial pressure for educators to train students in specific skills rather than focus on developing fundamental abilities, and has been noted for decades. The tendency for companies to externalize the cost of firm specific training is also a cost-cutting strategy. These workers are shed with the next product cycle.

can't be replaced on the outside market, but when you are not investing a lot in developing the skills of a work force, employees will leave.

20. **"Immigration and America's high tech industry: The jobs machine"** The Economist April 13, 2013

A bunch of other Silicon Valley types are planning to launch a well-funded political-advocacy group to lobby for more visas for skilled immigrants. Applications for this year's quota of 65,000 "H-1B" visas for such workers began on April 1st. In less than a week they were oversubscribed. The proportion of start-ups in Silicon Valley founded by immigrants has fallen from 52 percent to 44 percent since 2005.

High tech employment growing fastest in places you might not associate with bits and bytes. Some are being created by start-ups local to the area. Other companies in tech hubs have opened faraway offices to tap new pools of skilled labor. Logistics matter, too. Bloom Energy decided to open a factory in Delaware to make it easier to get its fuel cells, which are the size of a small car, to customers on the east coast. And View, another immigrant-founded Californian start-up, has opened its only factory in Mississippi, because it is a good place from which to ship stuff to the rest of America.

High tech jobs matter not just to software engineers, scientists and the folk working in factories, estimates indicate that for every job created in the high tech sector, another 4.3 jobs emerge over time in the local economy. That is more than three times the local "multiplier" for manufacturing jobs.[29]

21. "**The STEM Workforce: An Overview**" Fact Sheet 2014, AFL-CIO Department for Professional Employees.

This fact sheet outlines the employment and earning trends in STEM occupations; unionization in STEM fields; the location of STEM jobs; gender, race, and ethnicity in STEM; and the challenges offshoring and U.S. guest worker visa programs pose for U.S. STEM workers. Data is drawn from the U.S. Census, American Community Survey, Bureau of Labor Statistics and other public sources.

[29] This would make the multiplier for manufacturing very low; The key is in how the "local" economy is defined and the wage level of the manufacturing (vs. tech) jobs. It may be the case that the multiplier effect is geographically larger in manufacturing in high tech.

22. "**About Face: Most Companies say they want to attract a diverse workforce, but few deliver."** by Claire Cain Miller. New York Times Magazine, The Work Issue, Feb. 28,2010

GapJumpers was formed to recruit tech workers in Silicon Valley based on applicant performance in challenges that mimic job tasks. The goal was to increase diversity by eliminating the effect of elite colleges in the hiring process. But, companies still received applicant names and photos in addition to test results. It wasn't until the company adopted the practice used by symphony orchestras, anonymity for all candidates and selection based on test results alone, that non-White applicants increased from 20 to 60 percent of those chosen for an interview. The tech industry is well suited to this approach as jobs require the ability to produce something that can be evaluated by peers.

There is some truth to the "pipeline" theory attributing lack of employment diversity in tech industries to lack of applicant diversity and self-selection of minorities and women away from STEM fields. Yet, nearly 9 percent of graduates from the top 25 computer science programs are Black, Latino, or Native American while only 5 percent of the large tech firms are from one of these groups. There are "a handful" of Silicon Valley start-ups like Gild and Textio working on technological fixes to increase diversity in hiring.

**BIBLIOGRAPHY TABLE I A:**
**Selected STEM occupations with many job openings, projected 2012–22**

| Occupation | Job openings, projected 2012–22 | Employment | | Median annual wage, May 2013 | Typical entry-level education[1] |
|---|---|---|---|---|---|
| | | 2012 | Projected 2022 | | |
| Software developers, applications | 218,500 | 613,000 | 752,900 | $92,660 | Bachelor's degree |
| Computer systems analysts | 209,600 | 520,600 | 648,400 | 81,190 | Bachelor's degree |
| Computer user support specialists[2] | 196,900 | 547,700 | 658,500 | 46,620 | Some college, no degree |
| Software developers, systems software | 134,700 | 405,000 | 487,800 | 101,410 | Bachelor's degree |
| Civil engineers | 120,100 | 272,900 | 326,600 | 80,770 | Bachelor's degree |
| Computer programmers | 118,100 | 343,700 | 372,100 | 76,140 | Bachelor's degree |
| Sales representatives, wholesale and manufacturing, technical and scientific products[2] | 111,800 | 382,300 | 419,500 | 74,520 | Bachelor's degree |
| Network and computer systems administrators | 100,500 | 366,400 | 409,400 | 74,000 | Bachelor's degree |
| Mechanical engineers | 99,700 | 258,100 | 269,700 | 82,100 | Bachelor's degree |
| Computer and information systems managers[3] | 97,100 | 332,700 | 383,600 | 123,950 | Bachelor's degree |
| Industrial engineers | 75,400 | 223,300 | 233,400 | 80,300 | Bachelor's degree |
| Architectural and engineering managers[3] | 60,600 | 193,800 | 206,900 | 128,170 | Bachelor's degree |
| Web developers | 50,700 | 141,400 | 169,900 | 63,160 | Associate's degree |
| Electrical engineers | 44,100 | 166,100 | 174,000 | 89,180 | Bachelor's degree |
| Computer network architects[3] | 43,500 | 143,400 | 164,300 | 95,380 | Bachelor's degree |

1 Unless otherwise specified, occupations typically require neither work experience in a related occupation nor on-the-job training to obtain competency.

2 In addition to the education specified, this occupation typically requires moderate-term on-the-job training for workers to obtain competency.

3 In addition to the education specified, this occupation typically requires 5 years or more of work experience in a related occupation.

Source: U.S. Bureau of Labor Statistics, Employment Projections program (employment, projections, and education data) and Occupational Employment Statistics survey (wage data).

| BIBLIOGRAPHY TABLE I B: Selected STEM occupations with fast employment growth, projected 2012–22 | | | | | |
|---|---|---|---|---|---|
| Occupation | Employment growth, projected 2012–22 (percent) | Employment | | Median annual wage, May 2013 | Typical entry-level education[1] |
| | | 2012 | Projected 2022 | | |
| Information security analysts[2] | 37 percent | 75,100 | 102,500 | $88,590 | Bachelor's degree |
| Operations research analysts | 27 | 73,200 | 92,700 | 74,630 | Bachelor's degree |
| Statisticians | 27 | 27,600 | 34,900 | 79,290 | Master's degree |
| Biomedical engineers | 27 | 19,400 | 24,600 | 88,670 | Bachelor's degree |
| Actuaries[3] | 26 | 24,300 | 30,600 | 94,340 | Bachelor's degree |
| Petroleum engineers | 26 | 38,500 | 48,400 | 132,320 | Bachelor's degree |
| Computer systems analysts | 25 | 520,600 | 648,400 | 81,190 | Bachelor's degree |
| Software developers, applications | 23 | 613,000 | 752,900 | 92,660 | Bachelor's degree |
| Mathematicians | 23 | 3,500 | 4,300 | 102,440 | Master's degree |
| Software developers, systems software | 20 | 405,000 | 487,800 | 101,410 | Bachelor's degree |
| Computer user support specialists[4] | 20 | 547,700 | 658,500 | 46,620 | Some college, no degree |
| Web developers | 20 | 141,400 | 169,900 | 63,160 | Associate's degree |
| Civil engineers | 20 | 272,900 | 326,600 | 80,770 | Bachelor's degree |
| Biological science teachers, postsecondary | 20 | 61,400 | 73,400 | 75,740 | Doctoral or professional |
| Environmental science and protection technicians, including health | 19 | 32,800 | 38,900 | 41,700 | Associate's degree |

1 Unless otherwise specified, occupations typically require neither work experience in a related occupation nor on-the-job training to obtain competency.
2 In addition to the education specified, this occupation typically requires less than 5 years of work experience in a related occupation.
3 In addition to the education specified, this occupation typically requires long-term on-the-job training for workers to obtain competency.
4 In addition to the education specified, this occupation typically requires moderate-term on-the-job training for workers to obtain competency.
Source: U.S. Bureau of Labor Statistics, Employment Projections program (employment, projections, and education data) and Occupational Employment Statistics survey (wage data).