How the Pathway to Engineering Affects Diversity in the Engineering Workforce: A Silicon Valley Case Study

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Abstract

The recent release of employment data from some of the top tech companies in Silicon Valley (SV) has stirred a national debate about diversity in the industry. Currently, most of the SV companies employ underrepresented minorities (URMs) and women at a percentage that is not representative of the U.S. population or degrees awarded to engineers. However, are the percentages representative with respect to URMs and women earning engineering degrees? This paper assesses the use of *population parity* as an adequate benchmark for measuring diversity in industry using SV as a case study. This work suggests using a novel measure called *degree parity* as a more appropriate measure. Furthermore, this paper addresses some of the factors that hinder companies from reaching degree parity and offers recommendations as to how companies can improve their diversity record. Results from our analyses indicate that for women, blacks, and Hispanics/Latinos, no company has reached population parity in regards to all domestic employees. However, for women, every SV company has met degree parity when looking at the overall representation of their respective companies. For women in the technical business sectors, only two SV companies have reached degree parity. For blacks, three out of the eleven largest SV companies have reached degree parity in both their overall company representation and technical business sectors. In regards to Hispanics/Latinos, one company has reached degree parity when looking at overall representation and technical business sectors. For Asian Americans, every SV company has met and exceeded degree and population parity in regards to overall representation and technical business sectors. For Whites, only one SV company has met and exceeded degree and population parity with respect to overall representation and technical business sectors. Colleges, universities, and companies continue to work hard to increase the numbers of successful URM and women students in the pathway to engineering careers. A more thorough review of the recruitment and promotion process is needed to ensure that the culture and environment of SV companies are equipped to receive and retain a more diverse pool of graduates and impact diversity in all areas of employment.

1 Introduction

The United States is known to be at the forefront of technical innovation and science, contributing significant advances in the areas of communications, defense, health, infrastructure, and manufacturing, among other areas[1]. Success in technology has been due to the tech industry's ability to develop products which serve the ever-changing requirements of today's world. Considering changes on a global scale, the world's population is growing at an enormous rate and is expected to reach 8 billion by the year 2020. Much of the anticipated growth is expected to occur in underdeveloped countries that have challenges with respect to economic, social, and physical infrastructures. The National Academy of Engineers states that one of the keys for the U.S. to remain at the forefront of economic leadership, is to remain innovative and responsive to the demands of an increasingly globalized world. Considering changes in the U.S., it is estimated that over half of the nation's population will be non-white by 2050[2].

Silicon Valley (SV) has been the avant-garde of a booming innovation and technology industry, enabling companies to employ the upper echelon of engineers by providing highly competitive salaries, bonuses, and perks[3,4]. With the ability to provide disruptive innovation and high compensation in today's economy, many have investigated the level of diversity exhibited by these SV companies[3,5]. Over the years, many technology companies have been reluctant to release their respective demographic employment information. In recent years, due to social pressure and the realization that diversity breeds innovation, tech companies have been making a more concerted effort to collect and publish their diversity data[6]. At the end of 2014, Jesse Jackson and the Rainbow PUSH Coalition convened at Intel's headquarters with representatives from more than 20 tech companies to discuss the issue of diversity in Silicon Valley. From those meetings Intel emerged as a bellwether, pledging a commitment of $300 million over the course of five years to increase the representation of women and URMs within the company[7]. Similarly, Apple recently announced two large commitments to improve diversity in STEM. The first is a $40 million contribution to the Thurgood Marshall College Fund, a non-profit that supports students enrolled in historically back colleges and universities. The second is a $10 million contribution to the National Center for Women and Information Technology, aimed to increase women's participation in computing and technology[8]. While some companies have shown improvements through diversity initiatives, many are still lagging behind, particularly in technical and leadership areas[9].

1.1 Why is There a Lack of Diversity?

It is no secret that the field of engineering is disproportionately dominated by males, with URMs and women left largely underrepresented[3,4,5,10]. It is clear that certain factors-both structural and institutional-are responsible for the persistent lack of racial and gender diversity in STEM education and the workplace[3,4,10,11]. Using the working definition provided by anthropologist Faye V. Harrison, racism can be defined as "any action, whether intended or not, that reinforces and reproduces racial inequalities, which are ultimately structured around disparities of power."[12] If we apply this definition similarly to sexism, it becomes evident that structures within the engineering pipeline may be inadvertently fostering racial and gender bias[3,5,9,10]. If the aforementioned type of bias is a possible endemic challenge for engineering, we should work together to identify and alleviate the elements that reinforce and reproduce these inequalities.

1.2 The Importance of Diversity in Engineering

Most people agree that diversifying the field of engineering is important. The life experiences and research interests of people from diverse backgrounds brings to bear unique perspectives and talents that are needed to grow the field[3]. Furthermore, Strayhorn has noted that diversity in undergraduate programs can result in increased personal and social learning as well as critical thinking amongst STEM students. In analyzing the responses of 8000 undergraduate students from all academic levels, he concluded that "racially/culturally diversified campus environments do more than appear or 'sound' good, they promote cognitive growth and complex thinking."[13]

Diversity is equally as significant in the industrial sector as well. As tech companies continue to engage in relationships with more diverse clients and partners, cultural sensitivity and cultural competency become increasingly important. Additionally, it is important to ensure that upper-level managerial positions reflect the diversity that companies hope to achieve. In one case study, an unnamed SV company sought to employ a URM woman in their CFO position specifically to foster relationships with clients and partners from diverse background and to serve as a role model for women in the company[14]. It is unclear whether or not tactics such as hiring individual minorities in senior-level positions are effective at increasing diversity throughout all levels of the organization. For example, Hewlett-Packard has been led by CEO Meg Whitman since 2011 but the company exhibited the lowest percent of female employment amongst the eleven SV companies surveyed (Figure 1a). On the one hand, this type of "trickle-down diversity" could create negative, off-putting sentiments amongst URM employees and have an inverse reaction. Additionally, such practices do not address the larger systemic barriers that hinder URM and women recruitment and retention[15]. On the other hand, increased diversity at the managerial level can lead to diverse approaches to managerial strategies, as well as increased creativity and innovation[16].

1.3 Purpose

Historically, U.S. based companies have drawn from the white male population and have remained forefront of innovation[2]. It has been well documented that the participation of URM groups in the engineering degree pathway does not reflect their representation in the general U.S. population[1]. The comparison between actual participation in relation to U.S. demographics is often referred to as population parity. Previous studies have focused on high level groupings of URMs and women in respect to population parity. A review of blacks in the engineering pipeline revealed loss points at the bachelor's, master's, and doctoral degree points and compares the throughput to current industry demographics[17]. Few studies, however, have examined the output of the small but successful flow of degreed engineers into industry and the industries reflection of this flow, a sampling strategy Shaun Harper effectively used in his 2012 study on black male achievement in higher education."[18]

To assist in examining the flow of URMs and women engineers in the industrial sector, we have defined the following metrics: (1) *population parity* and (2) *degree parity*. Population parity reflects the proportion of a particular demographic in the U.S. compared to the proportion of that same demographic in the SV workforce. Since population parity may not take into account disparities in the engineering pathway and possibly creates unfair expectations for the workforce, which may not have a sufficient pool of a degree-holding candidates[5], a new designation has been developed: degree parity. Degree parity reflects the proportion of degrees in relation to a subset population in the workforce and takes into account the engineering pathway losses that inhibit companies from employing a particular demographic of engineers.

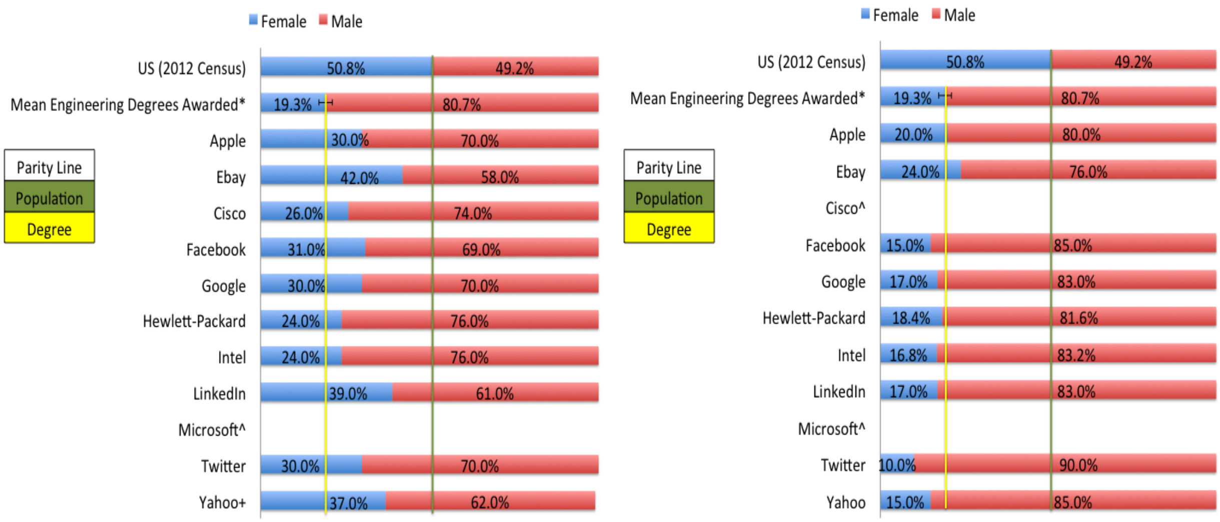
This work explores eleven of the most prominent companies in the Silicon Valley and provides insight on the status of keeping pace with the representation of each demographic. The results of this work address the following questions: (1) What does diversity currently look like for major companies in the Silicon Valley? (2) What should diversity look like in the work place? (3) Is there a lack of diverse talent for these companies to choose from? (4) What metrics should companies follow to properly measure their progress in diversity?

2 Methods

2.1 Data Collection

The data for these studies was collected as self-reported information from company websites[19,20,21,22,23,24,25,26,27,28]. These eleven SV companies were selected because they reported data on ethnic and gender diversity. Additionally, they are companies that hire a large percentage of engineers in fields covering the broad spectrum of engineering and computer science. It is important to note that some of the companies did not provide raw numbers, gender information for minorities in the technical fields, and data for Native Americans and Hawaiians. Many of the companies elected to round their diversity numbers to the nearest percentage, adding ambiguity to small populations such as Black, Hispanic, Native American, and Hawaiian. Additionally, companies' data do not define the term "technical" which means that the percentage of URMs calculated in the statistics may in fact be employed in non-engineering fields, therefore suggesting that URMs are less represented than what is reported.

The data associated with participation rates for U.S. students was collected from the American Society of Engineering Education[29,30]. These data are calculated annually and reflect participation rates from 343, 347, 348, 342, and 358 U.S. engineering colleges in years 2009, 2010, 2011, 2012, and 2013, respectively. Computer Science programs that are located within engineering colleges are reflected in these data. As should be expected, these data, along with the company data, are prone to biases associated with data collection that are out of the control of the researcher. In some cases respondents may choose not to report. Since raw numbers and statistics are not reported, it is difficult to determine how many non-respondents are excluded from the overall data. Additionally, it is unclear whether the designation of Black as reported by some companies refers solely to African Americans or also includes foreign-born Caribbean and African employees in the tabulation.



(a) All Gender

(b) Gender in Technology Sector

Figure 1: Genders in Engineering vs. Genders in Silicon Valley: Female standard deviation = $\pm 1.91\%$. Source: Corporate data derived from respective company diversity sites[19,20,21,22,23,24,25,26,27,28]. *Mean Engineering Degrees Awarded derived from ASEE Data Books (2009-13)[29,30]. Census data from U.S. Census Bureau[34]. ˆData not provided in respective company's diversity information for US demographics. +Data does not add up to 100% because some employees are other or undisclosed.

2.2 Data Analysis

Diversity data supplied by the companies present only a snapshot of their 2013 demographics. These data are compared to the mean participation rate of degrees awarded (bachelors, masters, and doctoral) from 2009 to 2013. The standard deviation for each mean is made available to provide insight into how the results varied over time. To compute the mean for degrees awarded, all engineering and computer science degrees were grouped together. We made symmetrical comparisons between degree, population, and industry data, comparing proportions of genders, ethnicities, and race, similar to other studies[1,5,3,31,32,33]. In Figures 1a-5a the percentages are derived from a ratio of the all URMs employed at a company in relation to the total number of employees. Similarly, the percentages for Figures 1b-5b are derived from a ratio of all URMs employed in technical fields at a company in relation to the total number of technical employees. Therefore it is possible for URMs to have a higher percentage representation in technical fields and a lower overall representation in an SV company.

3 Results

3.1 Gender

3.1.1 Female

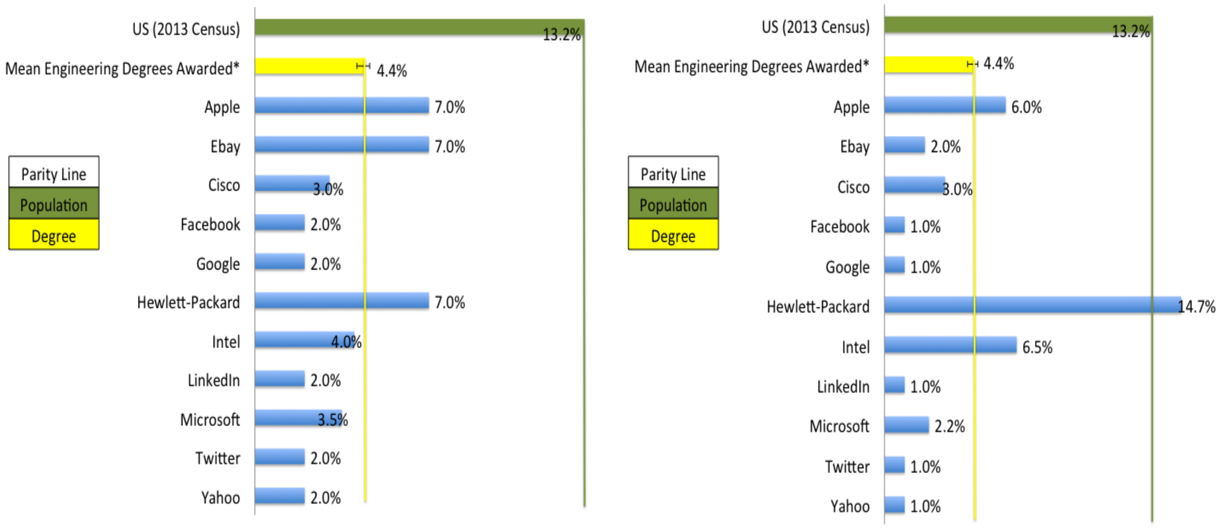
In regards to women, Figure 1 shows the gender demographics of all working areas of SV companies compared to U.S. Census data (population parity: 50.8%) and mean degrees awarded (degree parity: 19.3%). Comparing population parity directly to degree parity reveals a -31.5% underrepresentation of women receiving degrees in engineering. Figure 1a shows a significant amount of underrepresentation in women in every SV company when compared to population parity, with the smallest amount of underrepresentation by Ebay, -8.8%, and the largest amount of underrepresentation by Hewlett-Packard and Intel, both 26.8%.

When comparing degree parity to all women in the SV companies, every company has overrepresentation, with Ebay having the largest amount at +22.7%. The results in Figure 1b show the amount of women working in the technical sectors of SV companies compared to population parity and degree parity. As in Figure 1a, Figure 1b shows a significant amount of underrepresentation when compared to population parity, with Ebay having the smallest amount of underrepresentation, -26.8%, and Twitter having the most amount of underrepresentation, -40.8%. When comparing the amount of females in technical sectors at SV companies to degree parity, Facebook, Google, Hewlett-Packard, Intel, LinkedIn, Twitter, and Yahoo are all underrepresented with -4.3%, -2.3%, -0.9%, -2.5%, -2.3%, -39.2%, and -34.2% respectively. Conversely, Apple and Ebay have exceeded degree parity expectations for women by +0.7% and +4.7% respectively.

3.1.2 Male

In regards to men, Figure 1 shows the gender demographics of all working areas of SV companies compared to U.S. Census data (population parity: 49.2%) and mean degrees awarded (degree parity: 80.7%). Comparing population parity directly to degree parity reveals a +31.5% overrepresentation of men receiving degrees in engineering. Figure 1a shows a significant overrepresentation of men in every SV company when compared to population parity, with the smallest amount of overrepresentation by Ebay at +8.8%.

When comparing degree parity to all men in the SV companies, every company is below degree parity, with Hewlett-Packard and Intel being the closest to degree parity, both with -4.7%, and Ebay being the furthest away with -22.7%. The results in Figure 1b show the amount of men working in the technical sectors of SV companies compared to population parity and degree parity. As in Figure 1a, Figure 1b shows a significant amount of overrepresentation when compared to population parity, with Ebay having the smallest amount of overrepresentation at +26.8%, and Twitter exhibiting the most overrepresentation at +40.8%. When comparing the amount of males at SV companies to degree parity, Facebook, Google, Hewlett-Packard, Intel, LinkedIn, Twitter, and Yahoo all have overrepresentation with +4.3%, +2.3%, +0.9%, 2.5%,



(a) All Blacks (b) Blacks in Technology Sector

Figure 2: Blacks in Engineering vs. Blacks in Silicon Valley: standard deviation = ±0.25%. Source: Corporate data derived from respective company diversity sites[19,20,21,22,23,24,25,26,27,28]. *Mean Engineering Degrees Awarded derived from ASEE Data Books (2009-13)[29,30]. Census data from U.S. Census Bureau[34].

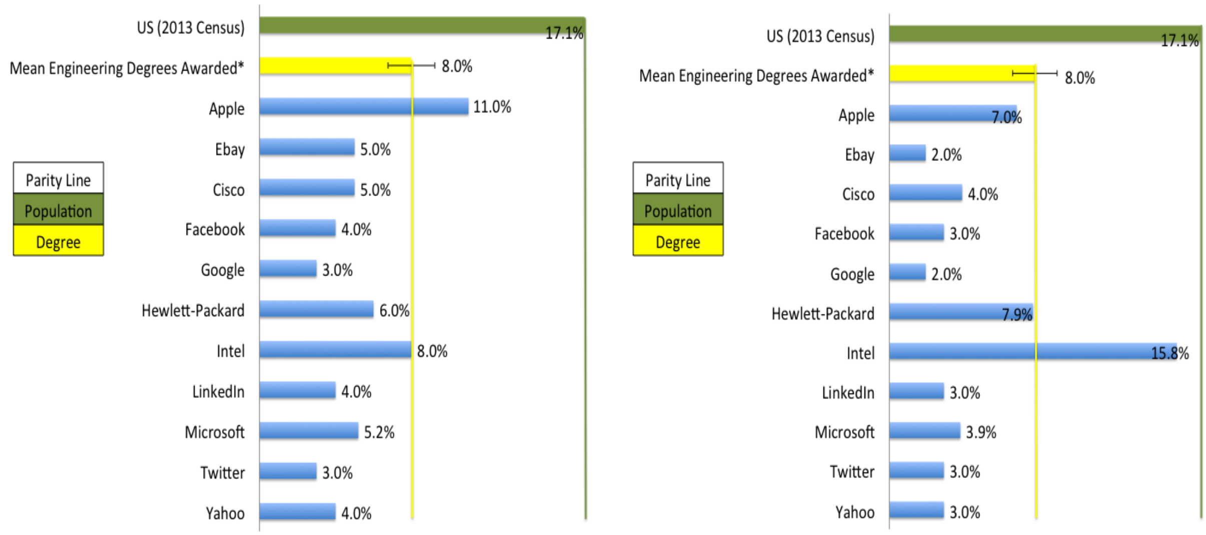
+2.3%, +9.3%, and +4.3% respectively. Conversely, Apple and Ebay have an underrepresentation of men with -0.7% and -4.7% respectively.

3.2 Ethnicity

3.2.1 Blacks

Results from our analyses of the black participation rate in regards to all blacks at SV companies compared to U.S. Census data (population parity: 13.2%) and mean engineering degrees awarded (degree parity: 4.4%) are reflected in Figure 2. Comparing population parity directly to degree parity reveals a -8.8% underrepresentation of blacks receiving degrees in engineering. Figure 2a shows a significant amount of underrepresentation of blacks in every SV company when compared to population parity, with the smallest amount of underrepresentation by Apple, Ebay, and Hewlett-Packard, all with -6.2%. Blacks are most severely underrepresented in Facebook, Google, LinkedIn, Twitter, and Yahoo, all at -11.2%.

When comparing degree parity to all blacks in SV companies, the following companies have underrepresentation: Cisco(-1.4%), Facebook(-2.4%), Google(-2.4%), Intel(-0.4%), LinkedIn(-2.4%), Microsoft(-0.9%), Twitter(-2.4%), and Yahoo(-2.4%). Apple, Ebay, and Hewlett-Packard have exceeded degree parity expectations for blacks by +2.6%. The results in Figure 2b show the amount of blacks working in technical sectors of SV companies compared to population parity and degree parity. As in Figure 2a, Figure 2b shows a significant amount of



(a) All Hispanics/Lantinos (b) Hispanic/Latinos in Technology Sector

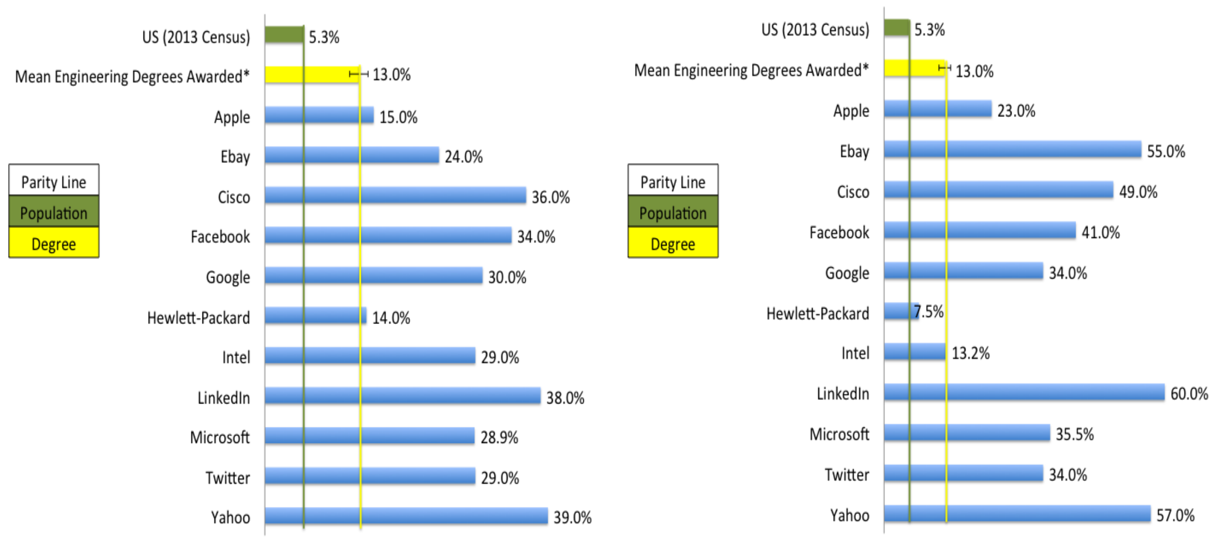
Figure 3: Hispanics/Latinos in Engineering vs. Hispanics/Latinos in Silicon Valley: standard deviation = $\pm$1.24%. Source: Corporate data derived from respective company diversity sites[19,20,21,22,23,24,25,26,27,28]. *Mean Engineering Degrees Awarded derived from ASEE Data Books (2009-13)[29,30]. Census data from U.S. Census Bureau[34].

underrepresentation for all companies except for Hewlett-Packard, which actually has an overrepresentation of blacks by +1.5%. When comparing the amount of blacks in technical sectors at SV companies to degree parity, Facebook, Ebay, Cisco, Facebook, Google, LinkedIn, Microsoft, Twitter, and Yahoo all have underrepresentation with -2.4%, -1.4%, -3.4%, -3.4%, -2.2%, -3.4% and -3.4% respectively. Conversely, Apple and Hewlett-Packard have an overrepresentation of blacks with +1.6% and +10.3% respectively.

3.2.2 Hispanics/Latinos

Results from our analyses of the Hispanic/Latinos participation rate in regards to all Hispanics/Latinos at SV companies compared to U.S. Census data (population parity: 17.1%) and mean engineering degrees awarded (degree parity: 8.0%) are reflected in Figure 3. Comparing population parity directly to degree parity reveals a -9.1% underrepresentation of Hispanics/Latinos receiving degrees in engineering. Figure 3a shows a significant amount of underrepresentation of Hispanics/Latinos in every SV company when compared to population parity, with the smallest amount of underrepresentation by Apple with -6.1%. Hispanics/Latinos are most severely underrepresented in Google and Twitter, both at -14.1%.

When comparing degree parity to all Hispanics/Latinos in SV companies, the following companies exhibit an underrepresentation: Ebay(-3.0%), Cisco(-3.0%), Facebook(-4.0%), Google(-5.0%), Hewlett Packard(-2.0%), LinkedIn(-4.0%), Microsoft(-2.8%), Twitter(-5.0%), and Yahoo(-4.0%). Apple has exceeded degree parity expectations for Hispanics/Latinos by



(a) All Asian Americans (b) Asian Americans in Technology Sector

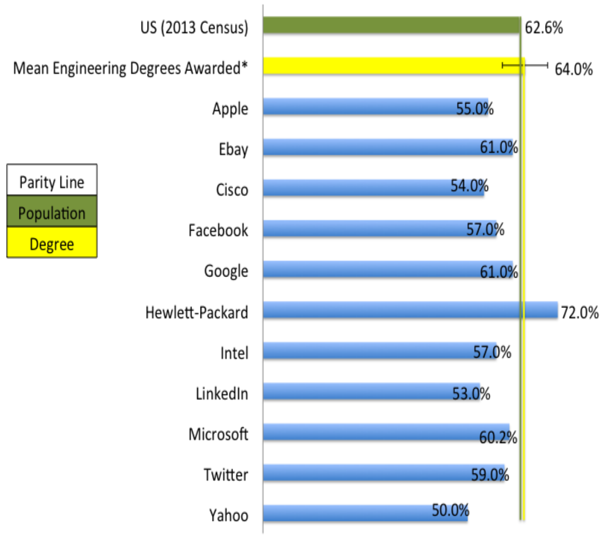
Figure 4: Asian Americans in Engineering vs. Asian Americans in Silicon Valley: standard deviation = ±1.26%. Source: Corporate data derived from respective company diversity sites[19,20,21,22,23,24,25,26,27,28]. *Mean Engineering Degrees Awarded derived from ASEE Data Books (2009-13)[29,30]. Census data from U.S. Census Bureau[34].

+3.6%, while Intel is at degree parity. The results in Figure 3b show the amount of Hispanics/Latinos working in technical sectors of SV companies compared to population parity and degree parity. As in Figure 3a, Figure 3b shows a significant amount of underrepresentation for all companies ranging between -15.1% and -9.2%, except for Intel which has an underrepresentation of -1.3%. When comparing the amount of Hispanics/Latinos in technical sectors at SV companies to degree parity, every company has an underrepresentation ranging between -6% and -1%, except for Intel which is +7.8% over degree parity. Hewlett-Packard is slightly under degree parity by -0.1%.

3.2.3 Asian Americans

Results from our analyses of the Asian American participation rate in regards to all Asian Americans at SV companies compared to U.S. Census data (population parity: 5.3%) and mean engineering degrees awarded (degree parity: 13.0%) are reflected in Figure 4. Comparing population parity directly to degree parity reveals a +7.7% overrepresentation of Asian Americans receiving degrees in engineering. Figure 4a shows a significant amount of overrepresentation of Asian Americans in every SV company when compared to population parity, with the smallest amount of overrepresentation by Hewlett-Packard with +8.7%. Asian Americans are most overrepresented in Yahoo by +33.7%.

In relation to degree parity at SV companies, Asian Americans are overrepresented in all cases. Hewlett-Packard is +1% over degree parity, while Apple is +2% over. All other companies have a



(a) All Whites

(b) Whites in Technology Sector

Figure 5: Whites in Engineering vs. Whites in Silicon Valley: standard deviation = ±5.59%. Source: Corporate data derived from respective company diversity sites[19,20,21,22,23,24,25,26,27,28]. *Mean Engineering Degrees Awarded derived from ASEE Data Books (2009-13)[29,30]. Census data from U.S. Census Bureau[34].

significant overrepresentation of Asian Americans ranging from +11% to +26%. The results in Figure 4b show the amount of Asian Americans working in technical sectors of SV companies compared to population parity and degree parity. As in Figure 4a, Figure 4b shows a significant amount of overrepresentation for all companies ranging between +17.7% and +54.7%, except for Hewlett-Packard which has +2.2% overrepresentation of Asian Americans. When comparing technical sectors at SV companies to degree parity, every company has an overrepresentation of Asian Americans ranging between +10% and +47%, except for Hewlett-Packard which has an underrepresentation of -5.5%. Intel has a slight overrepresentation of +0.2%.

3.2.4 Whites

Results from our analyses of the white participation rate in regards to all whites at SV companies compared to U.S. Census data (population parity: 62.6%) and mean engineering degrees awarded (degree parity: 64%) are reflected in Figure 5. Comparing population parity directly to degree parity reveals a +1.4% overrepresentation of whites receiving degrees in engineering. Figure 5a shows underrepresentation of whites in almost every SV company when compared to population parity, ranging from -12.6% to -1.6%. Whites are only overrepresented in one company, Hewlett-Packard, with +9.4%.

When comparing degree parity to all whites in SV companies, almost every company has underrepresentation, ranging between -14% and -3%. Hewlett-Packard is the only company with overrepresentation of whites at +8%. The results in Figure 5b show the amount of whites working in technical sectors of SV companies compared to population parity and degree parity. As in Figure 5a, Figure 5b shows a significant amount of underrepresentation for most companies ranging between -28.6% and -2.6%, except for Hewlett-Packard which has +5.2% overrepresentation of whites. When comparing the amount of whites in technical sectors at SV companies to degree parity, every company has underrepresentation ranging between -30% and -2.5%, except for Hewlett-Packard which has an overrepresentation of +3.8%.

4 Discussion

From the data it is evident that diversity in SV companies remains an important point of discussion. The percentage of women receiving degrees in engineering is significantly below population parity. None of the SV companies sampled matched population parity for women and Apple and Ebay were the only two companies that met degree parity for women employed in technical fields. In regards to the overall composition of SV companies, Figure 1a shows that all companies are over degree parity for women, meaning that the percentage of women working at SV companies is higher than the percentage of degrees awarded to women. As is to be expected, men exceed population parity for engineering degrees awarded. In regards to the overall composition of SV companies, Figure 1a shows that men are below degree parity, meaning that the percentage of men working at SV companies is less than the percentage of degrees awarded to men. Most companies met degree parity for technical fields with the exception of Apple and Ebay where men in technical fields were below degree parity.

In relation to the racial and ethnic composition of SV companies, blacks were the most underrepresented. No SV companies hired blacks at population parity and Apple, Ebay, and Hewlett-Packard were the only companies to exceed degree parity. Additionally, Apple, Hewlett-Packard, and Intel were the only companies where blacks exceeded degree parity in technical fields. Hispanics/Latinos receive engineering degrees below population parity and no SV company met population parity for the demographic. Apple exceeds degree parity for Hispanics/Latinos while Intel met parity; Hispanics/Latinos were underrepresented at all other SV companies. In regards to degree parity specifically technical positions, Hispanics/Latinos were underrepresented in all SV companies, except Hewlett-Packard and Intel. Asian Americans represent a unique aspect of URMs and some have designated Asian American as the "model minority" in regards to the field of engineering[35]. Unlike all other URM categories, Asian Americans receive engineering degrees well above population parity and most SV companies are significantly above population parity and degree parity which becomes even more definitive in the technical sectors of companies. Finally, whites receive engineering degrees above population parity. However, they are employed below population and degree parity for all sampled SV companies except for Hewlett-Packard as both general employees and in technical positions.

As evidenced in the results, it would appear that Apple and Ebay excel amongst the SV companies at employing women in technical sectors at the rate of which women are being awarded degrees in engineering. Furthermore, Apple, Hewlett-Packard, and Intel were the most successful at employing URM groups to technical sectors of their respective companies.

5 Conclusion and Future Work

It is evident that SV companies are having difficulties recruiting URMs and women. Few companies have managed to attain degree parity, and none have managed population parity. It is unclear exactly why many companies have not yet met degree parity. Potential factors could include the draw to academia, although that would only account for a small number of degreed URMs and women. Many degreed URMs and women do in fact go on to obtain industry jobs but better tracking of URM graduates and women are needed to understand the multiple factors that divert them to other areas of industry and academe[4]. Furthermore, it can be assumed that there is a percentage of URM and women engineers-albeit likely small-employed in technical fields at SV companies that have not obtained engineering degrees which could improve their overall diversity numbers.

Various studies have offered countless recommendations for ways to increase URM and women participation in engineering. Structurally, more specific recommendations have included creating support networks for URM graduate students and faculty as well as fostering reentry programs to attract URMs practicing engineering back to academe[1]. Many companies are directing their efforts toward capacity building at America's top Historically Black Colleges and Universities (HBCUs)[36]. While these interventions are necessary, they may not be addressing the infrastructural flaws at the most critical points. As it appears, the greatest leak in the pipeline occurs during K-12 education where millions of URM boys and girls opt for out engineering for various reasons[17].

With the newly published reports on diversity, SV companies stand to make great improvements to their diversity record. Collecting and publishing demographic employment data is the first step toward action. As companies are beginning to invest serious money into diversity programs (Intel $300 million and Pandora close to $300k[37]), a more thorough review of the recruitment and promotion process is needed to ensure that the culture and environment of the companies at the output are equipped to receive these graduates and impact diversity in all areas of employment. Although SV companies generally report their demographic data in a similar manner, the categorizations do not fully align with the manner in which matriculation and graduation data are reported for engineering students by NSF, ASEE, and other organizations. There is a need to develop a standardized system of cataloging and reporting data on the education and employment of URMs and women and to encourage companies to make it publicly available.

It has been argued that SV companies should not be expected to hire URMs at population parity if the pool of qualified engineers is inadequate[32]. Thus, degree parity may be a more adequate measure, and a more attainable goal for SV companies. Aside from the few engineers that enter into higher education, SV companies can consider degree parity when measuring success with hiring and retaining URMs and women at or near degree parity. Although we should expect to lose some degreed engineers to non-technical areas and/or the education sector, companies should strive to take full advantage of the pool of URM degreed engineers[4,31].

Additionally, we must ask whether SV companies should be expected to have all URMs represented at degree or population parity[32]. Further research needs to disaggregate the data for URM men and women to better understand how the intersectionality of race and gender impact recruitment and retention of URM men and women. Finally, data reporting on the recruitment and retention of LGBT men and women could reveal additional insights into the diversity record of companies and perhaps help identify additional issues these vulnerable populations may confront in education and the workplace. Simultaneously, institutions of higher education, in addition to governmental and non-governmental organizations, should continue to work together to fix the cracks in the pipeline and increase persistence rates [1,38] to produce more domestic engineering talent by bridging the gaps between degree parity and population parity. If the U.S. educational and corporate system can accomplish this then it will remain at the forefront of economic leadership and provide the most innovative solutions to the worlds problems.

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