



Brokers, Boot Camps and Graduate Degrees:

Pathways to Technically-Skilled Careers in Silicon Valley

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What pathways do women follow to acquire the educational credentials and work experience to secure technically skilled positions as engineers in Silicon Valley? What resources do American and Indian women mobilise to overcome the obstacles they encounter as they struggle to pursue advanced studies in engineering? This article draws upon interviews with 80 technically skilled women including Asian Americans, Blacks, Whites and Non-Resident Indians employed in Silicon Valley. It finds 5 distinct pathways to careers as an engineer. These pathways included 1) accelerated engineering academies also known as ‘coding boot camps’, 2) brokers (recruiters), 3) internships 4) graduate study on student visas and 5) family visas. This is significant contribution to the literature on IT workers, the technology industry, labour migration, the new economy, and post-graduate training in STEM.

Keywords: caste, class, gender, accelerated engineering academies, technology industry, labour migration

In 2016, only 17.9 percent of university degrees in computer science were awarded to women. During the past 3 decades employment in science, technology and engineering (STEM) has grown by 338 percent yet college educated Blacks and Hispanics are not being hired at the same rates as Asians and Whites (Funk & Parker 2018; Quoc Trung and Miller 2016; American Community Survey 2016). This job cluster of computing jobs that includes software engineers, software developers and programmers is one of the

highest paid, and prestigious jobs, yet racial disparities continue to characterise the technology workforce with non-Asian minorities being hired at much lower rates compared than in the private industry (Dickey 2016; Beasley 2016; Funk & Parker 2018). The high technology sector employs 25 percent of professionals in the United States. Jobs in computing have experienced the largest job growth of any sector of the US economy (US Census Bureau, 2016).

Studies of gender disparities in degree attainment has documented a persistent underrepresentation of women and non-Asian minorities who earn degrees in computer science, engineering, or mathematics (STEM). One stream of the science education research provides cross-national comparisons of the gender gap in the attainment of STEM degrees (Charles & Bradley 2006; Dabney, Chakraverty & Tai, 2013). A second stream of this literature examines a cultural climate in high schools that marginalises women, Blacks and Latino students in high schools that offer computer science classes (Margolis et. al), 2008). A third stream examines the transition from STEM degree to later employment in STEM occupations (Dickey 2016; Ma 2009; Ma and Yan 2017; Glass et al 2013). Finally, sociologists have documented class-based forms of ‘cultural’ matching that discriminates against qualified job candidates in elite labour markets (Rivera 2012; Rivera and Tilcsik 2016).

How do women who earned their degrees in non-STEM fields secure technically skilled jobs as engineers in Silicon Valley’s elite labour markets? There

are a number of limitations in the sociological literature on the 'new economy' and specifically on technology industry. First, career trajectories of technically skilled women who follow non-traditional pathways into engineering careers have been undertheorised. Second, a nuanced intersectional and comparative analysis of the obstacles that Black and South Asian women of different caste, class, ethnic and national origins negotiate as they struggle to enter the technology industry is needed. Finally, sociologists have not adequately considered the intersecting role that caste origins, class background and gender plays in the negotiation of visa regimes and labour migration among Non-Resident Indian women seeking to legally enter the US labour market as skilled workers.

Drawing upon interviews with 80 technically skilled, we identified 5 distinct pathways including: 1) Accelerated engineering academies or 'coding boot camps', 2) recruiters (brokers), 3) university job fairs, 4) international student visas and 5) family visas. This article examines these five distinct pathways found among technically skilled women employed in Silicon Valley who earned their first degrees from Indian or American universities. Their possession of economic, social, cultural and symbolic capital varied by class, caste and city and regional background. We argue that caste backgrounds, class privilege, family resources, social networks, and educational credentials are mobilised by women to negotiate obstacles to their securing job stability and permanent residency in Silicon Valley's technology sector. We provide an intersectional analysis of the career pathways of technically skilled women, primarily engineers who earned their first degrees in the arts, humanities, social sciences or engineering.

Research Site: Silicon Valley

The US Census Bureau defines Silicon Valley' as an area that includes San Francisco, Santa Clara, San Mateo and Alameda Counties. With a population of 852,000 people, San Francisco ranks 13th in population size among U.S. cities yet it ranks first in the nation for the number of technology workers. San

Francisco has the greatest high-tech related job growth of any city in the United States. The tech workers who occupy these positions are predominantly White or Asian, male, and typically earn between \$100,000 and \$ 300,000 annually, placing them in the top 10 percent of the labour force.¹

In the 1970s, the Santa Clara Valley located in the southern end of the San Francisco Bay, acquired the name 'Silicon Valley' from the main ingredient in semiconductors. Silicon Valley is now home to many of the worlds most powerful, innovative, and leading technology firms working in artificial intelligence (AI), biotechnology, cloud computing, data storage and video live streaming and the management of customer relations. In the United States, Silicon Valley ranks among the most desirable technology hubs and has a larger concentration of firms followed by Seattle, New York, Austin, Texas. Silicon Valley has a number of regional advantages compared to these other cities due to its long history of innovation and its relationship to Stanford University and the aerospace industry. Writing about the development of Silicon Valley Anna Lee Saxenian argues that by the 1970s Silicon Valley 'had already distinguished itself as the largest and most dynamic sector of the regional economy and . . . had established itself as the nation's leading center of semiconductor innovation and production' (Saxenian, 1994: p. 25).

Technology firms headquartered in the San Francisco Bay area offer some of the highest wages and benefit packages in the United States. Its workers comprise what can best be characterised as a 'labour aristocracy'. The salaries, annual bonuses, gourmet meals, and other onsite amenities and services distinguish them from other workplaces. However, diversity initiatives have produced no measurable increases in the numbers of non-Asian domestic minorities hired, especially Blacks and Hispanics (Twine 2018). We ask what strategies do women of diverse class, racial, ethnic, national backgrounds employ to secure these highly coveted jobs in the most desirable and concentrated technology hub in the United States? How do women who earned their first degrees in non-STEM fields secure jobs as engineers in Silicon Valley? We draw on original data to examine the

pathways women followed to enter the industry.

Silicon Valley has one of the lowest representations of non-Asians employed in the industry and one of highest concentrations of foreign nationals from South Asia among technology hubs in the United States. A 2014 report published by the Equal Employment Occupation Commission found that qualified blacks are not being hired by technology firms in Silicon Valley. According to this report:

Blacks and Hispanics, for example, comprise 16.9 percent of the American citizens in California with at least a bachelors' degree but represent only 6.9 percent of Silicon Valley's tech workforce. More importantly, the 70,111 foreign nationals in Silicon Valley comprise 29.1 percent of the tech workforce, which is roughly four times that of the 16,744 black and Hispanic tech workers employed in the area.

In Atlanta and Houston respectively, Blacks represent 20.6 percent in Atlanta and 11.9 percent of their technology workforce. The American Community Survey ²(2016) found that the technology hubs in Atlanta, Houston, Miami, New York, New Jersey and Washington, D.C. employ 1.5 times to 3.3 times the number of black and Hispanic tech workers as Silicon Valley.

Among Indian foreign nationals who arrived in the United States either as international students on student visas or on family visa as a spouse, our research found that they strategically deployed their education and social capital which they converted into full time jobs. According to a 2011 report by the Migration Policy Institute, international students from India were second only to Chinese students attending universities in the United States. Another report from the Institute of International Education claimed that Indian students comprise 13 percent of internationals students while Chinese students comprise 25 percent of international students. The Asian Indian women interviewed women were of middle class and upper caste (Brahmin) origins who deployed student and family networks in Indian to secure access to an education in the United States as international students.

Demographic Data of Participants

This article draws upon a sub-set of data from a larger qualitative study of interviews with 100 technology workers employed in San Francisco Bay Area technology firms and start-ups. This article draws upon interviews with 50 women from a larger sample of 80 women. They include 35 US natives (Asian, Black, White) and 15 Asian Indians. The women were employed at large established publicly-traded firms and smaller start-ups in San Francisco including: Amazon, Apple, Dropbox, Facebook, Google, Indiegogo, Intel, Lyft, Oracle, Simien, Square, Salesforce, SurveyMonkey, Twitter and Uber. The technology workers interviewed were between twenty-one and fifty-one years old. They earned annual salaries between \$75,000 and \$300,000.

In a comparative analysis of the occupational histories of Asian Americans, Asian Indians, Black, and White women, we identified 5 pathways to engineering jobs in Silicon Valley: 1) coding boot camps, 2) internships, 3) university job fairs, 4) brokers or recruiters and 5) international visas (student, non-migrant work and family). *The first pathway that we discovered was among white women who had earned degrees outside of the fields of computer science, engineering, mathematics or the life sciences.*

The first pathway is a significant finding because the sociological literature on STEM fields has assumed that pipeline into an engineering position requires an academic degree in computer science or engineering. We found that one-fourth of the White female engineers had earned their degrees in the humanities or social sciences before enrolling in an accelerated all women's engineering academy. They secured a position as an engineer after completing a 10- or 12-week intensive engineering curriculum. None of the Asian or Black women interviewed reported having attended an accelerated engineering academy, also referred to as coding boot camps.

A second pathway that among the Asian, Black and White Americans women is that summer internships provided them with work experience and connections that led to full time entry-level positions in the technology industry. These internships often led

to their first permanent full-time jobs after graduating from universities. Internships at various companies was described by women of diverse racial, ethnic and class backgrounds as providing women with technical experience and develop their coding skills while enrolled full time as students. A third pathway involved university job fairs which brought employers to campus where they could be directly recruited by company representatives.

A fourth pathway described by both domestic workers was a third party broke, also called recruiters, who pre-screened job candidates for a number of technology firms. Brokers recruited, referred and arranged interviews with employers. In exchange for these services, the job candidate would pay a portion of their salary during to the recruiter during their first years of employment.

Finally, the fifth pathway we identified only applied to Indian nationals who used the visa system to enter the US on either international student visas, a family visa or an employee- sponsored H-1B visa. Asian Indians women who pursued graduate study at an America university immigrated to the US on a student visa. A student visa functioned as a bridge to networks and permanent jobs by securing employment sponsorship on a H-1B visa in the United States. Most of the women interviewed entered the US as unmarried women on a student visa. A few entered on a family visa as a spouse. In the following sections we detail four of the pathways employed by Americans and Asian Indians women to acquire the educational credentials and develop the technical skills needed to secure jobs in the US-based technology firms.

All Women Accelerated Engineering Academies: A Fast-Track to an Engineering Career

The Hackbright Academy was founded in San Francisco in 2012 to 'change the ratio in engineering and technology by providing the industry with strong, smart, and talented women.' The Hackbright Academy is a for-profit organisation that now offers classes in three locations – in the East Bay (Oakland), the

South Bay (San Jose) and in its' founding location in San Francisco. In the summer of 2018, the cost for a 12-week (full time) or 24-week (part-time) curriculum was \$17,000. The Hackbright Academy provides an intensive short-term curriculum that provides college-educated women with technical skills in coding and programming languages. Hackbright is a 'pipeline' into a technology career for women seeking careers as software engineers. This type of sex segregated engineering school deserves sociological analysis since its' rapid growth in the Bay Area has quickly produced a cohort of alumna who have successfully secured jobs as engineers without having earned a Bachelors or Master's degree in computer science or engineering degree.

In the summer of 2018, Hackbright posted a blog titled '12 outstanding web apps built by female engineers.' Among the women featured were Israelis, Russians, Indian-Americans, East Asians and Whites. Although some of the women had previous experience in engineering, the majority had worked in non-technical careers. One engineer profiled was Juliette Gil, whose experience was described as follows:

She spent many years as a Concierge for a four-star luxury hotel in midtown Manhattan. Over time, she noticed that some of the more impact ways to make things easier came from the application of technology to real life problems. However, oftentimes a perfect solution to a problem would require a very customised solution, unavailable off-the-shelf. This sparked her interest in building customised software and shortly, after, she left the Big Apple to live remotely and focus full-time on her self-studied career switch into technology and to Hackbright.³

Like half of the women profiled in the class of 2018, Juliette had not earned a university degree in computer science or engineering. Other women in her cohort had worked as architects, acupuncturist, high school teachers, administrative staff and small business owners. A 2016 report published by Hackbright analysed the employment outcomes of 79 students who completed the curriculum during the first six months of 2016. Based upon self-reports of alumnae, Hackbright concluded that within six months after completing their curriculum, 71 percent of their alumnae were employed in paid in-field positions.

Eighty three percent of alumna in full-time positions earned more than \$80,000 per year with 37 percent earning more than \$110,000. Hackbright alumna earned higher salaries when compared to those who had earned a BSc. in Computer Science.

In the San Francisco Bay Area, all women 'coding boot camps' are providing a 'fast track' into an engineering career. This curriculum provides training for women who have not earned degrees in engineering or computer science. In addition to learning to code in a supportive environment with other women, Hackbright Academy provides its students with a network of mentors, access to employers and training in whiteboarding, which helps women market themselves to employers who want to hire more women as engineers. These engineering academies enable women to quickly gain access to an employment network and work in ways not unlike job fairs at traditional universities. While a 'leaky pipeline' of women departing the technology industry has been identified, less analytical attention has been given to women who enter the computing industry as software engineers after having worked in non-technical jobs. Instead of majoring in computer science or engineering, women who enroll in accelerated coding boot campus earned their bachelor's degrees in the arts, humanities and social sciences.

In five years the Hackbright Academy has produced a network of women engineers in Silicon Valley. It offers a credential that gives its students access to a network of employers that creates a 'door' into a new career as engineers. The engineers interviewed secured full-time positions as software engineers within 3 months of completing the curriculum and going on the job market. In the next section, we introduce three white women who represent this alternative career pathway. Prior to attending an accelerated boot camp, these women lacked the technical skills and mentors needed to secure an engineering job. Their career trajectories were only found among the white women interviewed. White female engineers who had earned their undergraduate degrees in the arts, humanities or social sciences secured full time positions as software engineers at major technology firms and San Francisco start-ups after completing a 12- week curricu-

lum. Hackbright Academy has created a powerful infrastructure and network of women engineers in the San Francisco Bay Area.

Isabella: The Path from Marketing to Engineering

A twenty-eight year-old engineer, Isabella works as a Front End Developer at a major technology firm. Isabella earned a B.A. in Psychology and worked at several San Francisco-based start-ups in non-technical positions before securing her current position as an engineer. The daughter of a mechanical engineer and the wife of a male software engineer, she was already socially embedded in the technology ecosystem. She learned about her first job in San Francisco through an alumni listserv. In her first job, Isabella worked 'in a marketing role at a smaller software as a service company. And that company, was small enough that even though my title I was doing marketing, like I was doing a bit of everything.'

After she began working as the liaison between the engineers and management, she recalled 'that was the first time . . . that I was actually interfacing and talking to other software engineers and realized like 'Hey this is a job and I have a little window to what this is.' Describing how she felt at her previous job with a 'catering concierge service' that organised meal deliveries for tech start-ups and venture capitalists, she recalled: 'I just felt so underutilised and I didn't feel like I was leveraging my strengths in my job.[...] And it was the first time in my life that I just left a job without anything lined up because I was like I have to do something else and figure out what that's going to be.' Describing her career trajectory to a technically skilled position, Isabella recalls:

So way back I worked in the nonprofit sector and worked for a series of companies that didn't have a lot of funding and then my next move was like, okay, I want to try and actually make some money while actually doing things that I love so I ended up at this company kind of hoping like can I actually make a living um, intersecting technology with food, something that I'm very passionate about and I found the opportunity through a friend so that's kind of how I landed in that particular startup.

After being burned out, Isabella quit her job and

took time off. She recognised that she did that she did not possess the technical skills to be hired as an engineer. So she developed a plan to reach her new career goals and transition to a job as a software engineer.

So I took a little bit of time to just like get myself back into a space where I felt more like myself. And then I dived into trying to teach myself to code on my own and I started by just reaching out to people that I knew and asked if they knew any engineers that they could put me in touch with. And so my first step that was like okay. . . I don't have the tech skills yet, but maybe I can find people that will have the tech skills.

For some women it took time for them to understand that they had the emotional makeup to become an engineer. Isabella's male partner is an engineer and she has worked with a lot of engineers, so she was already embedded in a network of engineers at her job. This gave her an opportunity to reflect upon and compare herself to these men.

I have worked with plenty of engineers who are great engineers but they are really lacking in a lot of other skill areas like communication, being courteous, being a good team-member - that builds people up. And I sort of had this idea in my mind as like, 'if I can just get the missing technical skills, that will be the missing piece to unlock the type of agency that I want in my life not only for financially, but just like the power and the influence to like make real decisions at work and have my voice be heard.

Isabella invested all of her energies into building a network and on learning what path to take to acquire more technical skills:

I'm aware that a lot of opportunities in my life have happened through personal connections, or people just directing me towards something, so I wanted to sort of build a professional network. I also just wanted like practical advice on what do I learn? [...] I asked a lot of people questions about what their pathways into the field were and that . . . , led me to a lot of people who had gone through these accelerated coding boot camps in the Bay Area. And once that sort of avenue had been revealed to me [...] 'Could I go to one of these 10 or 12-week programs and come out on the other end like with the skills that I need? It took me a few months of sort of networking and studying online to kind of like reach that point where I was like, I think a program like this is what I want to do.'

She decided to enroll in the 12-week course at

Hackbright Academy. In her analysis of the people whom she networked with during this period she compared the boot camp versus the traditional computer science degree:

Yeah, I think it was probably like two-thirds of the people who went to a boot camp and were pretty new to the industry and the other section were people who had traditional computer science degrees and I think I talked to one person I think who was self-taught.

Isabella's exposure to women employed as engineers and already embedded in the technology industry helped her to identify an alternative path to a career in engineering. For women who have the financial resources to pay \$ 15,000 - \$20,000 for tuition and fees, coding boot camps are a 'fast track' to a network of technology firms and a support system of female alumnae who had graduated and were employed at top Silicon Valley technology firms.

Celeste: From International Relations to Engineering

The white daughter of a software engineer, who earned a degree from UC-San Diego in International Relations, Celeste had recently completed her 12-week course at Hackbright Academy and had begun the job search. With optimism, she described the forms of support and career preparation that she has since completing the program. Describing her job search:

There's a great alumni network and really great career counselor, and we also had a career day at the end of my session where we each presented projects that we developed to 25 different companies on this one day, and so we met some recruiters and engineers that way also, so I'm kind of trying to first exploit all of my connections that way. And so that's kind of one piece of it. And the because the interview process is technical and you have to, as you probably know, work out problems and do coding challenges and things like that during the interview process, I am also working on studying and reviewing and kind of preparing technically too.

There are two different components to the education received at Hackbright. There are 10 weeks of education followed by 2 weeks of 'good practices' for interviews. During the final two weeks, they receive

training and feedback on how to perform in interviews that require them to solve problems on a whiteboard. This is an addition that they made to the curriculum based upon feedback that they received from the first cohorts to complete their training.

So the education team kind of introduced us to white boarding and good practices for how they work and how you should approach it and everything, and then during our additional two weeks, the career counselor herself isn't a very technical person, but she set us up a bunch of speakers and kind of workshop event type things for us, during which two of which we kind of learned about white boarding from other people in the industry, and then there were two incidents where we actually went to two different tech companies that are partners of Hackbright and we did white boarding practice with some engineers.

One critical resource provided by coding academies is that they 'certify' or validate the knowledge and technical competence of the women who have completed their program. They also integrate them immediately into a network of female alumnae who have been hired within the last five years by a technology firm. The strength of Hackbright is that it provides a community of mentors who serve as a pipeline for women who have not earned CS degrees from prestigious universities and have no previous experience as interns or employees. An example that Celeste described is that an engineer at Uber who is an alumnus of Hackbright eagerly set up a site visit for the graduating class.

[W]e went on site for both of those and the Uber one we worked with a few Uber engineers because one of our alumni works there and she set the whole thing up[...], Hackbright has a bunch of mentors and people working in the industry that they match up with current students, and to help you with [...] interview prep, everything, so they invited all the mentors whether or not they worked for [company name] to come to that, so there was more of a mixture there. Those were really fun.

For women like Anastasia, Isabella and Celeste, accelerated coding boot camps have created an alternative pipeline into the technology industry. They allow women who have earned degrees in non-technical fields to 'reset' their career goals. Coding boot camps

produce a labour pool of female engineers who can be recruited and hired by companies like Uber who have had a 'leaky pipeline' of women leaving and who need to improve their gender statistics. One limitation of these camps is that they are a profit-based enterprise and the cost is prohibitive for most women from working class backgrounds. Economic barriers exclude women who lack the ability to pay or borrow money to cover the costs of these classes.

First Generation Geek Girls: Brokers and Breaking Through Glass Walls

First-generation technology workers who do not have parents, sibling, or extended family employed in the technology industry typically the social contacts and are may have more challenges accessing information about available jobs. This is significant challenge for Blacks, Native Americans, Pacific Islander and other underrepresented ethnic minorities who have earned degrees at HBCUs (historically black colleges and universities) or other marginalised state or regional schools not networks into the technology ecosystem. Members of underrepresented domestic minority groups do not have co-ethnics in managerial or leadership positions in the technology industry struggle to secure information about jobs and social referrals that most companies use to recruit.

Professional brokers or 'recruiters' play a key role for job candidates who lack social referrals. In the next section we introduce Maya, a black woman who represented one pattern among women who are from working class or poor families and lack the family resources and social capital to finance their education at the top schools. Lacking access to the alumni networks, opportunity structures that provide access to competitive internships, they turn to 'brokers' who recruit for the top technology firms. They do not have access to the alumni networks Brokers recruit from alumni networks, current students but they can also represent anyone seeking a job in the technology industry.

*Maya, a first generation technologist:
Information Barriers and Glass Walls*

Maya is a 28-year-old Black technically skilled Project Manager employed by one of the largest and most powerful technology firms in San Francisco. A native of Baltimore, she grew up in a working-class family. Her entrée into the Silicon Valley technology workforce was a dynamic and non-linear path that involved a decade of working full-time jobs in marketing, building websites, social media and systems analysis. After attending a Historically Black College (HBCU) for a year, she left without completing her degree to marry her husband, who was on active military duty. She then moved to California with her husband, where she enrolled in university courses. At the age of 20 while working full-time, she launched her own consulting business at the age of 20 and taught herself how to build websites.

Maya's career trajectory and learning experiences differ from those of the middle-class Asian Indian and White women interviewed. Maya did not possess any of the caste, class or racial privileges that characterised virtually all of the White, Asian Indian and Asian American women who participated in this study. Maya had earned a Bachelor's degree as a military spouse but she did not attend an elite school that provided access to alumni networks embedded in the technology ecosystem that would give her access to industry recruiters. She had never formerly studied engineering or computer science in college. Instead she taught herself to code while working full time. Like half of the second and third generation technology workers of Asian or European-American ancestry, a recruiter played a key role as her broker and helped Maya secure a short-term contract at [name of company], her current employer.

Maya also represents a pattern found among one-third of the Black women interviewed. Three of the 12 Black women interviewed had been self-employed entrepreneurs *prior to securing a full-time job at a technology firm*. In other words, while the White and Asian women typically acquired their coding skills in formal classroom instruction or on the job as interns or full-time employees, black women developed and acquired coding and other technical skills outside of

a formal or structured curriculum.

Describing her childhood, Maya recalls:

I grew up in Baltimore in a poor neighbourhood. My mother was a single mom and worked two jobs. I'm the oldest of six kids. . . I left Baltimore when I was 12 years. I didn't have any computer classes or anything like that until the 6th grade. I left Baltimore in the sixth grade. . . . But the crazy part is that I didn't have computer classes either. . . I didn't get into my Excel class until I moved in my senior class in high school when we moved to Delaware. And I only spent one year there. And in that one year, I had Microsoft Excel classes. Everything else I learned on my own..

All of the Black women interviewed were *first-generation technology workers* (FGT). In striking contrast to all of the Asian American and most of the Indian nationals in this study, none of the technically skilled Black women were embedded in families, kinship networks or alumni networks that included co-ethnics employed in Silicon Valley. In other words, they did not have parents, siblings, or spouses who could provide them with information, social contacts or who were entrepreneurs in the technology industry. This was a disadvantage that they had to work hard to overcome. They were typically the sole person of their racial, ethnic and class background in their company. They worked without having any co-ethnics on their teams or in their departments. Without a partner or family member employed in the industry, Maya did not possess an organic alumni network of support like her Asian and White, peers who had earned degrees at institutions like Carnegie Mellon, Harvard, MIT, UC-Berkeley, or Stanford or the technical universities in India; she had to generate one from scratch without any familial support by networking constantly.

While living on a military base, Maya took a series of exams that allowed her to test out of several courses, and earn her bachelor's degree in one year instead of 2 years. Maya paid for her education without taking out any student loans. Being debt free laid the foundation for her to be able to launch her own consulting business. After leaving college, she went to work full-time for a marketing company. She started out in marketing because the marketing classes she had taken in high school, enabled her to secure a job in this sector. That led her to moving to Los Angeles, as a sales

rep, to open a new sales office.

By the time she was 23 years old, Maya had cultivated a skill set that prepared her for a position in the technology industry. She had taught herself to code and build websites while working two full time jobs, Maya started a consulting business with another self-employed Black professional woman. They built websites and developed social media strategies for female authors and entrepreneurs in the on-line publishing industry. Maya recalled: 'I didn't have any web development experience so I had to go and learn. So that's the self-taught web development. Because work wasn't consistent, I also had a day job as well.'

White women interviewed typically acquired these skills through formal courses in school, boot camps, or coached by their boyfriends or significant others. Without a partner or family member employed in the industry, Maya did not possess an organic alumni network of support like her peers who had earned degrees at institutions like Carnegie Mellon, Harvard, Stanford, MIT, UC-Berkeley, and other Ivy-equivalent public universities. So she had to generate one by networking constantly. Her friendship with a Black-Filipina friend, whom she helped to secure a position at Google, marked a turning point in her career and led to her current position. Maya employed the skills that she developed to help her friend market herself to Google.

I just took [her resume] from her and just rewrote it. [...] Two weeks later, she comes back to the office and says 'You have to listen to this'. And I go 'Okay.. And it's a voice mail from a recruiter that says. 'Hey [name of friend], we saw your resume. We think that you would be perfect for this position. By the way, the company is Google.' And I freak out. . . . But she is actually really bad at her job. And I was really good at my job. And I had all of these other qualifications. I had an internet consulting business online. [...] And she got a phone call to work at Google.

After Google hired her friend, Maya realised that she also had experience and skills to secure a job at a top technology firm. So she devised a plan. She asked her friend for the recruiter's contact information so that she could contact him directly. She phoned him every day and eventually landed a part-time position on a temporary contract. Describing how much work

she invested in preparing for her interviews which gave her a foot in the door at her current firm, she recalls:

But I studied. And I studied. And I studied. And I studied. And I literally searched for everything. And there was one question that [interviewer] asked me. She said, 'How would you rework our community website?' And I'm sitting in my car in a parking lot not looking at a computer. [...] I guess I sounded like I knew what I was doing. [...] they put me to the next step where I had to do an on-site interview. I Googled 150 interview questions in every possible category: Behavioural, Analytical, Conflict-Management. Every question I had answers too.

Maya practiced her answers to 150 questions every day. She was over-prepared for her interview. She explained: 'All they really want is to see your train of thought. They don't care about the right answer.'

I practiced out-loud my answers every waking moment that I had. I had a week before my on-site interview. Every moment that I wasn't working I practiced all 150 questions. [...] I had interview and [interviewer] asked me. 'So come up with a Social Media strategy right now.'

She impressed the interviewer and secured a temporary contract job. Describing the challenges that she faced as a temporary worker on a three-month contract, she recounted:

When you're a contractor, it's incredibly hard to get converted into a full-time position. I kept asking questions about getting converted every week. I kept like - trying to network my way around [the barriers to full-time employment]. About a month in, they had told me that there was no head count⁴ for me. If I wanted to stay at [company] I had to find a job on another team. [...] I basically networked and went to every possible event that I could. I volunteered at everything. [...] I asked full-time [tech workers at the company] to help me with jobs. If you're a contractor, you can't see the internal jobs board. . . . You have to [...] ask a full time [employee] look at the internal board, which is breaking all the rules and help you reach out to the hiring manager. I also went to outside networking events. I think that I went to a networking event at least 3 times every week. And I then was going to internal events and meeting people all the time. I had a lunch appointment everyday with someone . . . And then I finally started getting traction. I interviewed for 4 different teams, internally. I had performance reviews. I had all of those things. And I still had 15 interviews.

She worked the equivalent of two full-time jobs because she had to do so much 'extra' work to network and secure good performance reviews. Maya networked non-stop for 4 months. She spent every waking moment setting up meetings, volunteering, and taking on extra work so that she could generate multiple performance reviews.

Maya continually taught herself new coding languages and taught herself to build a website. But lacking social contacts, family or friends employed in the industry, her technical competence and experiences was not enough to get her in the door. Ultimately it was her friendship with an Asian American and her audacity that provided her with access to a recruiter. This recruiter then became a form of social capital. As a first generation technically-skilled engineer she had to cultivate a network of Asian American and White techies to authorise and validate her previous work experience without the support of family or former classmates. Despite her technical competence and wealth of experience, she was not offered a full-time position until a white technology worker with whom she had previously worked as an unpaid volunteer project vouched for her technical fitness. Unlike her white female peers who were able to secure contract positions after a 12-week curriculum, Maya did not have a mentor or industry insider to sponsor her or provide a social referral.

Transnational Migration as a Pathway to Engineering Careers

The Civil Rights Act of 1965 removed immigration policies that prohibited or restricted the flow of immigrants from Asia to the United States. Beginning in the 1970s, a growing stream of technically skilled Asian professionals from India were recruited by technology firms based in the United States (Banerjee 2006; Varma 2002). Between 1990 and 2000, close to 1 million skilled Indian workers entered the United States on H-1B visas. The H-1B visa enables companies to recruit foreign nationals to work on a temporary work permits that can be renewed. Indians now occupy a dominant position in Silicon Valley (Banerjee 2006). The South Asian diasporic community has

grown into an economically and politically powerful force in Silicon Valley.

Asian Indian men have achieved success and now occupy leadership positions in some of the most profitable and innovative technology firms headquartered in Silicon Valley. These innovators and luminaries include Vinod Dham, known as the 'Father of the Pentium', Vinod Khosla (co-founder of Sun Microsystems), Sanjay Jha (Globalfoundries), Satya Nadella (Microsoft), Sundar Pichai (CEO of Google) and Shantanu Narayen of Adobe. Although Asian Indian women have faced what has been called the 'bamboo ceiling', Asian Indian women also belong to this educated and talented transnational South Asian diaspora, referred to as NRIs in India. As such, they constitute part of an established transnational professional network established in the 1980s. Since their emergence in the late twentieth century, they have created networks, professional organisations and opportunity structures that advocate for Indians while also promoting, hiring, and training South Asians technology workers in Silicon Valley.

Indian technology workers endure a number of exploitative labor practices that benefit their employers (Banerjee 2006). Describing the racialisation of Indian information technology workers and their legally vulnerable status, Payal Banerjee argues that:

The exploitation that immigrants experience due to their legal status is also imbricated in the matrix of their race and gender. Shifts from manufacturing to IT and services have intersected with a bipolarisation of the post-industrial service economy into a two-tiered labour market, constituted by a high-skill/high-wage sector and a low-skill/low-wage one. This economic divide, systematised on a racial gradient where, minorities and immigrants of color are disproportionately employed in the latter category (Banerjee 2006, p. 428)

The women interviewed for this study reported that they could not complain about their labour conditions because they did not have the same flexibility to change jobs like their peers who are US citizens. On a H-1B visa, workers are legally tied to their employer. In order to accept another position, their current employer must be willing to officially transfer their visa to another employer who will sponsor them.

This is extremely difficult for employees to arrange. Furthermore, termination of employment results in termination of their visa and loss of legal status.

Some women described how they negotiated this period of contingent employment and their uncertain future which caused them emotional distress and suffering. However, these women also had many advantages due to their high caste position and their socioeconomic status. This allowed them to convert their caste and class privileges in India into permanent residency in the United States. They accomplished this by earning a graduate degree with the hopes that it would improve their chances of securing an H-1B employment sponsored visa. The dominant pattern among the uniformly middle-class Indian nationals was that they earned their first degree in engineering in India and a second degree in India or the United States before migrating. If they immigrated on students visa to pursue a graduate degree in the United States, they would later transition from an F1 visa to an H-1B visa.

Most women married men who shared their class and caste background and were employed by US firms on a H-1B visa, were naturalised US citizens, or in the process of securing permanent residency. Their struggles to secure US citizenship was a long process that was often shared with their spouse. Among the married heterosexual women, their husbands were usually ahead of them in the immigration process because women tended to marry older men who had embarked on their education and career years earlier.

The Indian nationals were all from urban, middle class and upper-class backgrounds that included high caste privileges. Although the women interviewed stated that they did not support or believe in the caste system, they acknowledged that their Brahmin caste background had generated labour market advantages that enabled them to immigrate to secure jobs in the US technology industry. Unmarried women who entered the United States as students described learning how to travel to the United States on international student visas. Many women married Indian nationals on employment visas, H-1B or Indian naturalised citizens after arriving in the United States. In the next section, we will introduce Lakshmi and Ishani who

are both Indian engineers. They followed a linear pathway on an international visa from an Indian university to a post-graduate program in an American university.

Lakshmi: a Software Architect

A 30-year-old software architect for 5 years, Lakshmi moved to the United States in 2011 to pursue a Masters degree in computer science. In remembering her childhood, she recounted:

One of the first thing my parents wanted me was a doctor. In India in school you choose between biology and mathematics. I did not do well in Biology. At my school, they had a computer science class and I grew my interest in coding. As far back as the 6th Standard, when I was 14, I was coding and I knew I was good at it.

After earning her Bachelors of Science degree in India, she began to carefully prepare her migration path to the United States to pursue graduate studies as an international student. Lakshmi found her first job in India through a campus placement job service. This is a recruitment fair where technology companies come to interview and search for talent. If students have not been receiving failing grades in any subject, they receive a general interview and are then recruited. Lakshmi felt that her first degree and the training she received in her first job did not provide the technical expertise that she desired. Most Indian engineering students supplement their first degree with a graduate degree in computer science and engineering from a US university.

Lakshmi gained the education and skills she needed after immigrating to the United States to secure employment as an engineer in the technology industry. Describing her undergraduate degree, Lakshmi recalls: 'The education that I got in my undergraduate – it was not good. The teaching was not good. I didn't really learn anything[...] It was a very general computer science degree... It gave me an entrance into the industry. My title at the company I worked for in India was Programmer Analyst Trainee.'

Lakshmi's father worked in the finance sector and her mother is a housewife. She did not own a personal computer but she had access to one at school.

Computer science is a very popular subject and thousands apply to get admitted to Anna University, a technical university in the state of Tamil Nadu, which is ranked as the eighth best engineering university in India. The significant role that Lakshmi's class and caste background played in her pathway to an engineering career was clear as she detailed the social and economic resources that her family provided her parents' social and economic resources to gain access to a spot in one of the universities in India. She recalls:

There is this thing called Management Quota to get into colleges (engineering universities) This is when you have to get in or you know someone who can get you into the college. And computer science degree is one of the most sought-after major. So to get into computer science you would have to pay someone.... [my parents] knew someone who had contacts in that college that I got into – So I got into that college. Otherwise I would not have gotten into that school. [...] The reasons I moved my M.A. application (to US university) by a year was not to join work but because the financial planning that I had to do.

To finance her graduate degree in the United States, Lakshmi worked and sought financial assistance from family members. She worked for a year to save money to partially finance her graduate degree. She also persuaded her parents to help pay for admissions fees and to provide financial support while she studied in the United States. She also mobilised social, economic and symbolic resources that her parents and grandparents possessed. She describes how she qualified for a bank loan:

My grandma owned a property in Chennai which she had owned for quite a while. That property was enough for me to get a loan at a bank so I had this done to show proof financially that I could afford the degree [in the United States].

A support system that enabled her to have a smooth transition reflects the social infrastructure that the South Asians have produced during the past 3 decades. Although she has relatives in the States of Texas and California, she did not have any family in the state where she attended the state university. Recalling her first weeks in the US, Lakshmi recalled a very organised and vibrant South Asian student net-

work that functioned like a surrogate family. This enabled her to experience no culture shock during her first days in the United States.

There were 100 students going to [name of her school] who were already there. There are Facebook groups... there are Indian students who were already there [at her graduate institution]. They had set up a system that would help pick up students at the airport. There was a network which helped me find a roommate....and an apartment where I could stay [...] They showed me how to get around. It was kind of familiar.... I didn't have any immediate culture shock. It was interesting how easy it was to find resources.

The South Asian student network compensated for the fact that her extended family lived more than 1,000 miles away. In contrast to the Black women interviewed, she had a smoother pathway than domestic students who moved for school. Also, in contrast to other Asian Indian interviewees, who described a cultural shock of arrival, Lakshmi's arrival in the USA was smooth and easy.

Ishani: Entering the Industry as a Spouse on a Family Visa

A forty-four year old married Brahmin, Ishani has worked in the technology industry for twenty years. The Director of Engineering, she is a native of Tamil Nadu in South India. She acquired her skills as an engineer and her technical expertise in Bangalore, India prior to immigrating to the United States. Her trajectory represents one pattern that we found among highly educated Asian Indian women who were over qualified for their first jobs in the United States. She earned her first degree in Physics followed by a graduate degree in Engineering three years later. Describing her family background and the expectations that determined her career aspirations, family, Ishani recalled her childhood as a member of a Brahmin family:

I was the only girl among a group of cousins. And I was never treated like a girl because my cousins were very well accomplished. They went to IITs (Indian Institute of Technology Universities). You have to either get into IIT, become a doctor or get into a

REC (regional engineering college). You have to get into those otherwise your life is ruined. That mentality was always there. [] my cousins are all in the technology industry...my grandfather was a professor, my aunt and uncle were mathematics professor. My mom was a gold medalist in mathematics.

Ishani was sent to the United States by her employer to complete a 6-month internship training program. During this period, she became engaged to an Indian student in Philadelphia, who had immigrated to the United States on an international student visa. After her marriage, she quit her job in India and returned to the United States on a family visa.

Ishani's experiences represent a pattern among the Indian women interviewed. Since a spousal visa did not permit her to work, she remained unemployed for nineteen months. Being bored at home, Ishani was concerned that she would not be employable if she did not keep her skills updated. Her husband was working full time so she only saw him in the evenings and in the weekend. Feeling bored and socially isolated due to her nationality, her accent and lack of South Asian friends in Philadelphia, she described the support that she received from a White American couple:

Most people were working and very busy. I used to research everything. I would go and ask people questions because I am not shy I just go up and ask – Initially I was shy and but once I worked with the American couple, both the lady and her husband were very kind and taught me, how to be in America. I had an Indian accent; they said they did not understand my accent on phone. They taught me how to answer the phone. They told me if you smile then hello comes across different, tips like that they helped me. This gave me confidence. I learned from the American family and even today I am in touch with them.

Because there was a single store where all of the South Asians shopped for familiar food, spices and ingredients, she had a lucky break. She recalls how she found a job through a social referral that she received during a chance meeting at an Indian grocery store with a former work colleague with whom she knew from Bangalore:

There was only one Indian store where I went to do grocery shopping and I ran into a lady. This lady was smiling at me and she remembered my name and she said [her name], I worked with you in (name of com-

pany) in Bangalore. [...] she asked me what I was doing. I told her I was not allowed to work and I was looking for work. She referred my resume and in 2003.... I was able to interview and they offered me a job and they sponsored my H-1B visa...In March, 2003, I went back to India, got a visa stamp that you need. I was employed as a senior software engineer at [name of company]. I was coding, working for medical solution developing a medical platform, trying to manage end of lifecycle platform.

As a recently arrived immigrant with no close friends and a husband she saw only weekends, Ishani struggled to adjust to the social isolation and long periods of unemployment. Several Asian Indian women in this study recounted the obstacles in their pathways as they desperately searched for employment that included sponsorship by a technology firm. They were then dependent upon this employer for a minimum of three years. A few women perceived their employment contracts as a form of bonded labour. However, Ishani and the other Indian women interviewed acknowledged the long-term benefits that they accumulated while negotiating the visa process. They noted that despite the hardships they endured including long periods of separation from their families in India, they achieved the financial stability and permanent residency they desired in the United States. They tolerated years of stressful labour conditions in exchange for highly paid jobs with benefits and made sacrifices that they did not regret because it enabled them to achieve their long-term career goals.

Conclusion: First Generation versus Second Generation Geek Girls

Gender scholars have provided sociological concepts that theorise how 'inequality regimes' operate in organisations (Reskin and Poos 1990; Reskin 1993; Acker 2006; Rivera 2012; Ribera and Tilisck 2016). These inequality regimes reproduce and sustain racial and gender disparities in hiring, job classifications, and retention. A comparative analysis of the distinct challenges and barriers that women of diverse caste, ethnic class and national backgrounds face illuminates the ways that gender hierarchies are reproduced even for Asian Indian women who, as a group, have been successfully recruited Silicon Valley technology firms.

Asian Indian and Black women negotiate different barriers to entry into the technology industry. Their narratives of their struggles and career maps illuminate the differences in the quantity and quality of resources that they possessed on their journeys to stable careers in Silicon Valley.

The barriers to entry that women described highlight the emotional, social, financial and cultural resources needed to secure permanent jobs in the technology industry. Women of diverse caste, racial, and national origins struggled to achieve their occupational goals. The occupational trajectories and immigration experiences we have detailed represent 4 distinct domestic and transnational pathways to engineering careers. University educated women of diverse national backgrounds negotiated barriers to entry depending upon their race, ethnicity, nationality, family resources, social capital, and class status into the technology industry in the United States. The professional challenges that women negotiated varied significantly among the Black, White and Asian Indian women. For the *first-generation technology* Black technology workers, they lacked the social capital needed to gain social referrals. They were also excluded from information networks. As we saw in the case of Maya, she struggled to develop the social networks among technology workers so that she could acquire the social referrals to positions that were only advertised on internal job boards. Without access to these information networks they are denied access to the opportunity structures available to women whose social, class and symbolic capital is rich.

Maya's experiences as a contract worker before securing a full-time position illuminates the precarity and vulnerability of her position as well as the structural obstacles that both citizens and H-1B visa holders endure. These are produced by corporate policies that establish a 'glass wall' between individuals working on temporary contracts and permanent employees. These glass walls restrict the flow of information between people working on the same teams. Information about job openings is not available to contract workers so they are segregated in an occupational ghetto. Maya broke explicit rules that denied access to the internal job board to 'contract' workers. She

benefitted from the fact that her teammates were not aware that by sharing information about job openings with her, they were violating company policies.

The Black women interviewed did not have access to the opportunity structures available to the non-Blacks employed in Silicon Valley. Maya's experiences as a first-generation technology worker represents a pattern among the black women in this study. Maya's career trajectory illuminates the structural obstacles created by corporate policies that establish a 'glass wall' between workers employed on temporary contracts and permanent employees. These glass walls restrict the flow of information between people working on the same teams. Information about job openings is not available to contract workers so they are segregated in an occupational ghetto. Maya broke explicit rules that denied access to the internal job board to 'contract' workers. She benefitted from the fact that her teammates were not aware that by sharing information about job openings with her, they were violating company policies.

Maya actually had less job security than the H-1B visa workers described by Payal Banerjee (2006) because she was on a 3-month contract rather than a 3-year contract and was not sponsored by her employer. Virtually all of the Black women in this study were from working class backgrounds and did not possess the ethnic, educational and class advantages of their non-Black peers. If they did secure an internship in Silicon Valley, they were rarely offered full time positions at these firms at the conclusion (Alfrey and Twine 2017, Vara 2016). Furthermore, recent diversity initiatives and unconscious bias trainings have produced no measurable impact on the numbers or increase in the hiring of technically-skilled black employees in Silicon Valley's (Twine 2018).

The Asian Indian women in this study had to negotiate their vulnerabilities as workers on temporary H-1B visas during the early part of their careers. Their legal status placed them in a vulnerable position that made it difficult for them to directly challenge unfavourable labour conditions (Banerjee 2006). Most of the Asian Indian women interviewed were *second-generation technology workers* whose parents, aunts, uncles, older siblings, or cousins had also earned

degrees in science, engineering or mathematics. They belonged to networks that included technically trained parents, siblings, and extended family who had been educated, employed or engaged in the technology industry. Transnational employment networks and Brahmin kinship networks, combined with hard work on their part, enabled the Indian women in this study to successfully negotiate the challenges that they endured. They eventually succeeded in establishing permanent residency which led to lucrative careers as engineers in the United States. Although Asian Indian women immigrated in smaller numbers compared to men, they learned to navigate the inequality regimes produced by immigration policies they drew upon South Asian networks to assist them in navigating a complex, expensive and arduous visa and migration process.

Notes

¹ In May 2014, Google released the demographics of its employees. Among technical workers: 83 percent were men, 60 percent were White, and 34 percent were Asian (Jacobson 2014). Demographic representation of technical workers was similar at other top tech companies that released their diversity numbers during the same period, including Facebook, Twitter, Apple, LinkedIn, and Pandora, although there were cases of technical teams with greater proportions of Asian workers (see Conner 2014).

² 'The American Community Survey', 2016. U.S. Census Bureau.

³ Accessed on August 25, 2018 at: <https://hackbrigh-tacademy.com/blog/12-outstanding-web-apps-built-by-female-engineers/>

⁴ This phrase means 'There's no money in the budget for you to be full-time'.

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