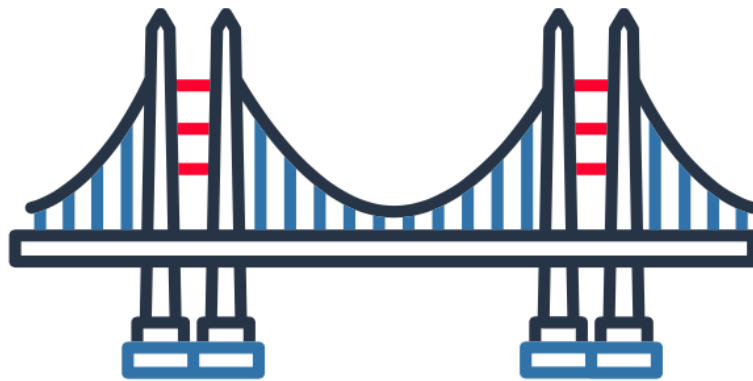# Growing the Tech Talent Pipeline in San Francisco

An Evaluation of Apprenticeship Expansion Efforts

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Executive Summary

The following report examines the efforts of one city, San Francisco, and their TechSF initiative run out of their Office of Economic and Workforce Development (OEWD) to help encourage the growth of apprenticeships in tech occupations in the Bay Area, and help employers go through the formal registration process with the California Division of Apprenticeship Standards. Even as one of the U.S.'s largest tech hubs, the San Francisco Bay Area is still experiencing a lack of skilled workers for web developers and other tech occupations, and apprenticeship expansion is one strategy that seeks to help close that skills gap, while also offering a stable pathway into tech for applicants from more diverse backgrounds. This specific effort is partially backed by a federal American Apprenticeship Initiative grant focused on growing apprenticeships in IT and other industries. [1]

TechSF's broader mission is to open up affordable training pathways for local residents to learn the coding, web development, and data science skills needed to compete for middle-and-high skill jobs available in the industry. They fund programs with an eye toward diversity, and primarily support programs focused on working with low-income residents, black and Latinx residents, women, and others traditionally underrepresented in technical occupations. The tech industry at large, and in the Bay Area, suffers from a sever lack of diversity, and TechSF aims to improve those disparities through their programming.

Problem Statement

How can TechSF increase the number of tech apprenticeships within Bay Area employers and ensure graduates of the tech training programs they help fund are well-positioned to compete for those positions?

San Francisco faces challenges in their mission of expanding apprenticeships in tech. While meeting with employers to advocate for more inclusive hiring and training practices, they've faced resistance. The main challenges are outlined below.

Key Challenges

1. **Libertarian bias.** The tech industry historically harbors a libertarian bias against government-backed programs.

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[1] [Apprenticeship Grant Opportunities](), Dept. of Labor

2. **Over $1.2 billion in private and philanthropy dollars spent on tech diversity initiatives with limited impact.** Hundreds of millions of private and foundation dollars have been poured into tech diversity initiatives, with no real impact on employee diversity figures. There's lots of support for feel-good light-touch investments, but less excitement about significant structural changes to hiring practices that would make an impact, like apprenticeships.

3. **Degree inflation.** Tech firms to date have mostly focused their recruitment and hiring practices on those with four-year college degrees. This limits the pool of potential diverse hires. Apprenticeship programs cut against these norms.

4. **Lack of awareness of apprenticeships.** There's confusion and a lack of awareness among employers about what a federal apprenticeship program involves. Confusion involves how these programs can be structured and how they can serve employer needs.

5. **Companies rank retraining programs for existing employees as their top workforce priority.** Because of senior-level skills gaps, many company training and upskilling initiatives involve efforts targeting existing employees, rather than new hires.

6. **Stipends have limited impact, especially for big employers.** The incentive packages TechSF currently offers to reward apprenticeship position creation may be too minimal to impact the behavior of mid-to-large sized firms.

We understand that the TechSF initiative can't make any radical changes in the near-term, and that as of April 2020 the entire OEWD office may re-evaluate and reimagine their role in serving San Franciscan's employment and job re-training needs in the wake of the coronavirus crisis. That said, within the scope of our project, we think there are a handful of things the TechSF team should consider in the coming months and years.

Recommendations

1. **Chart a ten-year strategic plan for apprenticeships**. TechSF would benefit from re-evaluating their strategic role and goals in the context of where this initiative could be in 10 years, rather than focusing on one-off employer asks to build new apprenticeship placements and one- and three-year request-for-proposal (RFP) cycles for funding training providers. There are a handful of examples of government-involved, public-private apprenticeship and career training models that are structured to have more direct involvement from education partners, business and employer leadership, and utilize independent non-profit organizations to facilitate systems-level cooperation,

long-term consistency, and strategic focus. CareerWise Colorado, for example, has seen success at scaling due to formal partnerships and the creation of clear and consistent pathways through the public high school and community college system.

2. **Extend employer prospecting beyond tech companies**. In the mid-term, it could also be fruitful to do a landscape analysis and expand employer partnership work to industries that employ those in technical roles without being a tech company. Looking beyond the biggest fish in the Silicon Valley ecosystem could benefit jobseekers.

3. **Tap into tech worker activism to build support for apprenticeships.** Another mid-term strategy could involve delving deeper into worker-led activism within tech firms to increase pressure on companies to adopt new recruiting and training models, using forums like Employee Resource Groups.

4. **Ensure curriculum is aligned with apprenticeship opportunities.** In the short term, TechSF would benefit from supporting training providers in better aligning their curriculum with the skills needed for particular occupational roles with input from employer partners.

5. **Update online resources for jobseekers and employers.** Finally, TechSF would also benefit from updating their web presence and resource materials to streamline the program search process for jobseekers and demystify the apprenticeship creation process for employers.

The rest of this report covers the history of TechSF, and root causes of the challenges we identified, and explains our rationale for the five recommendations in more detail.

Introduction

What is TechSF?

Tech SF is an initiative founded in 2012 under Mayor Ed Lee and run by the City of San Francisco's Office of Economic and Workforce Development (OEWD). OEWD has four industry-specific workforce initiatives covering construction, healthcare, hospitality, and technology. TechSF is the name of their technology-focused program. TechSF was originally funded by a $5 million federal grant.[2] The budget for TechSF shifts every year. The highest annual budget was in 2015-16 for $3 million compared to this fiscal year of $2 million. The salaries of the three dedicated staff members that assist with TechSF out of OEWD are partially taken out of a separate OEWD general fund.

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[2] Empson, Rip, "San Francisco vs. Silicon Valley: Where Should You Build Your Business?," Tech Crunch, 6/19/12.

TechSF's stated purpose is to provide "education, training and employment assistance to both jobseekers and employers in San Francisco's thriving Tech Sector."[3] The program was launched with two goals in mind. With the promise of a well-skilled workforce, it was intended to serve as an incentive for tech companies to keep or move their headquarters in downtown San Francisco instead of locating in Silicon Valley or San Jose. The city also offers tax breaks to companies that are located within city limits. It was also launched with the goals of helping local San Franciscans gain the skills necessary to be employed in a fast-growing industry, as well as providing a more diverse pipeline of qualified talent.

Part of the TechSF operating model involves awarding grants to local non-profit training providers that offer bootcamp-style training focused on three different tracks. The OEWD budget for FY 2018-2019 awarded funding to eight training providers specializing in tech skills training geared toward young adults ages 18 and older that are ready to enter the workforce or continue with post-secondary education. The city also has an informal partnership with City College of San Francisco (CCSF), which offers a cybersecurity apprenticeship program and associates degree programs in visual media design, broadcast electronic arts media, and computer science. OEWD awards funding to roughly 55 different workforce organizations every year. The TechSF grants are one piece of that total. This process is revisited every three years during OEWD's procurement process to determine if there are new tech companies to help assist, or new partnerships with training providers to foster. Occasionally that timeline is extended by a year. OEWD will also put out new RFPs in off-years when they receive new grant funds.

TechSF Training Tracks

1. Programming and coding
2. Digital media production and design
3. IT support, database administration, and network security

TechSF-Funded Skills-Based Training Providers

- <dev/Mission>
- Code Tenderloin
- Mission Economic Development Agency (MEDA)
- Bay Area Video Coalition (BAVC)
- MissionBit
- BAYCAT
- Jewish Vocational Services (JVS)
- Upwardly Global

Profiles of these organizations and their programs can be found in Appendix A.

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[3] City of San Francisco, Office of Economic and Workforce Development, TechSF, accessed 2/6/20.

They also partner with Galvanize and General Assembly for skills training components of apprenticeships, and have a formal collaboration with LaborX, a platform dedicated to sourcing and connecting employers to diverse tech talent with non-traditional credentials. Program graduates are encouraged to create profiles in LaborX, and employers are encouraged to search for potential internship, apprenticeship, and full-time hires on the platform.
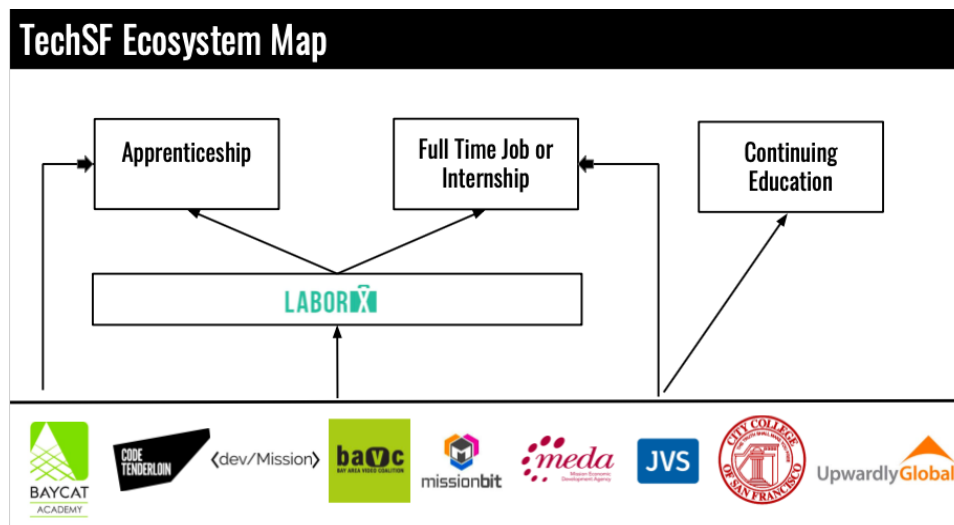
All eight non-profit training providers offer their programs free-of-charge to participants, who are typically, but not exclusively between the ages of 18 and 24, depending on the program. The City of San Francisco does not fully fund these organizations, but rather, contributes funding and therefore helps subsidize the cost of running these programs free of charge. Being tuition-free ensures maximum accessibility for low-income students and residents who may otherwise not be able to access one of the many tech bootcamp or training programs offered in the Bay Area that do require tuition, typically either up front or in the form of income share agreements.[4]

Some TechSF grants additionally fund nonprofit work focused on tech educational opportunities and exposure to tech careers (as opposed to lengthy skills training) for high school students. Some of the same eight training providers listed above also offer this type of programming.

To increase pathways into tech careers, TechSF staff at OEWD have been working to help employers create and register formal apprenticeship programs and convene conversations that encourage apprenticeship exploration. Apprenticeships offer more mentoring and structure than a traditional internship or entry-level job and are well suited to young workers entering the workforce. The main differences between a registered apprenticeship versus a non-registered one is the registered provides an accredited certification, mentorship and guidance and a competitive salary. Non-registered apprenticeships are often less structured but provide

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[4] Craig, Ryan. "A New U: Faster and Cheaper Alternatives to Higher Education," BenBella Books, Inc., Dallas, TX, 2018.

a viable option for individuals looking to gain exposure and gain potential full-time employment in a tech occupation. Technical roles are well-suited for the apprenticeship model, given that software, coding, and programming require specific sets of skills that can be learned in a sequence and aptitude can be tested and measured.

These efforts have been met with mixed success to date. There are 11 Bay Area employers who offer tech apprenticeship programs registered with the Department of Labor, most of which were registered with the support and encouragement of TechSF, and at least 9 more with unregistered apprenticeship programs.

Apprenticeship roles include those as a Cybersecurity Analyst, Salesforce Business Analyst, Data Science Analyst, Software Engineer, Graphic and Web Design, Digital Marketing, IT Project Manager, Web Developer, and IT Support Technician.

Bay Area Tech Apprenticeships	
DOL Registered Apprenticeships	**Unregistered Apprenticeships**
Postmates	Airbnb
Twilio	LinkedIn
Zendesk	Slack
BAVC	Twitter
Code for America	Square
SFO Airport	Pinterest
One World Communications	Pandora
Sentinel One	Lyft
OKTA	Uber
ARC Document Solutions	
Monkey Brains	

OEWD offers employers a $2,500 stipend per apprentice they hire to help cover the cost of hiring and training apprentices and an additional $2,500 stipend per apprentice to cover outside training costs, amounting to a $5,000 stipend per apprentice.[5] OEWD uses Galvanize, General Assembly, and LinkedIn Learning.

TechSF's work within OEWD is informally guided by the Information and Computer Technology Sector Committee, which is made up of industry representatives who provide feedback on

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[5] Ginsberg, Maggie, "Small Businesses Are Now Hiring Apprentices.Should You?" Entrepreneur, 3/3/20.

TechSF's work. The committee hosts a Diversity Working Group and an Apprenticeship Working Group.[6]

Jewish Vocational Services (JVS) serves as OEWD's tech sector coordinator and they receive extra funding to fulfil this role. They help direct jobseekers to appropriate tech workforce programs on TechSF's behalf.

Our Project

For the purposes of this project, we were tasked with analyzing and evaluating the efficacy of TechSF's current model at achieving its ultimate goal, which is to help local San Franciscans who complete a TechSF funded training program, particularly people of color, women, and those without a four year college degree, to secure job placements within the tech industry with a specific emphasis on apprenticeships.

Since 2012, over 3,000 participants from TechSF funded programs have matriculated into an internship, apprenticeship, full-time employment, or continuing tech training. TechSF has helped place 52 individuals into the 11 employer-sponsored apprenticeship programs they helped register.

As part of our project, we focused on:

1. Identifying the main challenges TechSF is experiencing expanding apprenticeships,
2. Offering a series of short term, medium term, and long-term recommendations.

The Coronavirus Pandemic: Impact on Workforce Development

Before the coronavirus pandemic struck in February 2020, U.S. workforce development initiatives were benefiting from low levels of unemployment.[7] Employers across sectors were struggling to fill open positions, giving low-wage workers and workers with non-traditional backgrounds greater leverage.[8] The tight labor market was helpful to veterans, individuals with disabilities, individuals with criminal records, and others who have traditionally faced barriers to stable employment. In January 2020, the U.S. unemployment rate was at 3.6%. In December 2019 California's unemployment rate was 3.9%, and the unemployment rate in the San Francisco-Oakland-Fremont U.S. Census region was 2.2%.[9]

Even when things were good, there was concern that an economic downturn would leave employers less receptive to expanding hiring among non-traditional candidates, which could impact diverse hiring initiatives and apprenticeship programs. Now that we're confronting an

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[6] TechSF Advisory Board, OEWD, accessed 4/6/20
[7] Rubin, Jerry, "The Catapult Papers, Essay One: Next Generation Workforce Development Organizations for Our Times: How JVS is Re-Tooling for a New Economy," The Boston Foundation, 2019.
[8] Ibid
[9] Bureau of Labor Statistics, accessed 2/8/20

unprecedented economic crisis because of COVID-19, these fears may be born out. Unemployment claims have spiked since mid-March 2020 as millions of businesses have shut down. OEWD reported that some of their TechSF-funded bootcamp and employment programs have had to halt their training operations since they were unable to transfer to an online format.[10] They've had to stop holding community information sessions and networking events, and their job listings are primarily focused on healthcare and food distribution services.[11]

National, State, and Regional Trends

National Trends

The TechSF program launched in the context of national and global concerns over the digitization of work, automation, the growth of the tech sector, and concern that education, training, and employment opportunities aren't aligned with employer's future workforce needs.

The Tech Skills Gap

Tech jobs represent a pathway to the middle class in today's shifting economy. Research from Rutgers University Professor Hal Salzman shows "70 percent growth in information technology jobs" in the U.S. "over 15 years, to 4.7 million in 2018." By comparison, manufacturing employs roughly 12.8 million Americans, and shed 1.5 million jobs during that period.[12] Salzman estimates "about one-fourth of the tech jobs are held by workers without four-year degrees."[13]

Data from LinkedIn Economic Graph found six of ten projected skills shortages in the Bay Area were technical skills, and included digital literacy, data science, data storage technology, social media, web development, and computer networking.[14]

The type of skills necessary to fill these opportunities varies. A report from the Brookings Institute found that "fifteen years ago, only 49% of middle-skill jobs required digital competence; now, that number has climbed to 87%.[15] The Brookings report also found that the San Francisco metropolitan area ranked highest in the country for rates of digitization across all industries, and with digital competency as a prerequisite for employment.

Beyond basic digital competence, there's also demand for the ability to use specific software, like Salesforce, ZenDesk Plus, or Google Adwords. Software skills and experience using software-as-a-service (Saas) platforms open to the doorway to middle-skills jobs in supply chain

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[10] Interview with Orrian Willis, 3/27/20
[11] Ibid
[12] Lohr, Steve, "Tech Jobs Lead to the Middle Class.Just Not for the Masses," New York Times, 5/19/19.
[13] Ibid
[14] "High Tech Diversity in the San Francisco Bay Area, Task One: Industry Analysis," Brightline Defense, July 2019.
[15] Mark Muro, et al., The Brookings Institution, *Digitalization and the American Workforce*, 11, The Brookings Institution, (Nov 2017)

management, sales, marketing, customer service, finance, IT, and HR that exist across sectors, not specifically within technology companies.[16]

Data analytics, web development and back-end coding represent separate skill sets. Many experts predict that the modern path to the middle class for people without four-year college degrees will lie in mastering coding and programming.[17]

The Emergence of Bootcamps

A patchwork of hundreds of tech workforce training initiatives have emerged across the U.S. over the past decade in response to these trends. These efforts lack standardization and only a few organizations have demonstrated the ability to scale their efforts beyond the city or region in which they operate. Programs that have scaled nationally include Year Up, Apprenti, IBM's P-Tech program, and Catalyte.

Coding bootcamps are one model that's emerged and turned into a $300 million industry.[18] Course Report catalogues bootcamp and "last mile" training programs and collects industry data. In 2020, Course Report documented that there are 100 full-time, in-person coding schools with campuses in 85 different cities in the U.S. and Canada.[19] There are hundreds more that are part-time or online. Nationally, the average bootcamp program costs participants $13,500 and lasts 14 weeks. The average participant has a bachelor's degree and six years of work experience, and no programming experience.

However, the percent of bootcamp enrollees without any college experience has been increasing in recent years. This cohort increased from 16% of all bootcamp participants in 2017, to 27% in 2019. Course Report projected that 23,000 people would graduate from coding bootcamps in 2019.[20] This compares to an estimated 106,000 students at four-year colleges majoring in computer science in 2017, up from 40,000 in 2014.[21] Bootcamps are an affordable pathway for many, rather than the four-year degree.

The clients served through TechSF funded CBOs aren't immune from these trends. The enrollment and placement data found in Appendix B shows over one-third of all TechSF participants in FY 2018-2019 already had a bachelor's degree.

Most bootcamp programs do charge tuition, and some offer income share agreements (ISAs) and other flexible payment plans that enable students to pay tuition like a loan repayment after

[16] Craig, Ryan. "A New U: Faster and Cheaper Alternatives to Higher Education," BenBella Books, Inc., Dallas, TX, 2018

[17] "Tech Jobs Lead to the Middle Class.Just Not for the Masses," New York Times, Steve Lohr, 5/19/19.

[18] "Coding Bootcamps in 2020: Your Complete Guide to the World of Bootcamps," Course Report, accessed 2/11/20.

[19] Ibid

[20] Ibid

[21] Singer, Natasha, "The Hard Part of Computer Science? Getting Into Class," New York Times, 1/24/19.

they gain employment. Programs including Make School and Holberton School in San Francisco don't require participants to start paying back their tuition until they obtain a job with salaries in excess of certain thresholds if they opt not to pay upfront. Make School charges applicants 20% of their gross income until the debt is paid. Many boot-camps also claim to have a money-back guarantee if the applicant is unable to land placement upon completing the program.

All TechSF funded programs, by comparison, are free to participants.

There are estimated to be at least 33 full-time, in person coding bootcamp programs with a physical presence in San Francisco.[22] A handful of companies specializing in online bootcamps are also based in San Francisco.

Most coding bootcamps and many of the non-profit training providers funded by TechSF focus on front and back end programming. Coding bootcamps typically offer courses in full stack web development, data science, digital marketing, and UX/UI design.[23] Bootcamps often teach widely used programming languages and frameworks including HTML, CSS, Python, Ruby on Rails, and JavaScript.[24] Appendix A offers an overview of the bootcamp programs funded by TechSF and Appendix D reviews the offerings of competing bootcamps in the Bay Area.

Apprenticeships

Jobs for the Future (JFF), a national workforce accelerator, defines apprenticeships in California as the following:

"Apprenticeship is a proven approach for preparing workers for jobs while meeting the needs of business for a highly skilled workforce. It is an employer- driven, 'learn-while-you-earn' model that combines on-the-job training, provided by the employer that hires the apprentice, with job-related instruction in curricula tied to the attainment of national skills standards. A Registered Apprenticeship must meet certain standards, including progressive increases in an apprentice's skills and wages. It is approved either by the US Department of Labor's Office of Apprenticeship, or by the California Department of Industrial Relations' Division of Apprenticeship Standards."[25]

A federally registered apprenticeship requires at least 144 hours of related technical instructional (RTI) hours per year.[26] These hours can be done in a classroom, online, or by an individual plan. Apprenticeships are either time or competency based, or some combination of both.

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[22] Gallagher, James, "State of the Bootcamp Market Report 2020," Career Karma, 2/20.
[23] "Coding Bootcamps in 2020: Your Complete Guide to the World of Bootcamps," Course Report, accessed 2/11/20.
[24] Ibid
[25] Koller, Vinz, "The Future of Apprenticeship in California," Jobs for the Future & Social Policy Research Associates, Dec. 2018
[26] Understanding Apprenticeship Basics, Dept. of Labor, accessed 4/10/20

The Bureau of Labor Statistics reported there to be "585,000 active apprentices in more than 23,000 registered apprenticeship programs across the country" in 2018.[27] Despite a decades-long decrease in public investment in traditional workforce development programs, the U.S. has added more than 200,000 new apprentices since 2014, including new apprenticeships in the tech industry.[28] Most apprentices are still heavily concentrated in a handful of occupations, including construction, electrician and plumbing, carpentry, sheet metal workers, electrical power line installation, and heavy and tractor trailer trucking.[29] The chart below shows how few registered apprenticeships are in so-called "new collar" industries including finance, entertainment, and tech.

Federal Data: Active Apprentices by Industry, 2018	
Total, All Industries	585,026
(not listed)	3,262 (0.5%)
Information	1,152 (0.2%)
Professional, Scientific, and Technical Services	493 (<0.1%)
Finance and Insurance	145 (<0.1%)
Arts, Entertainment, and Recreation	47 (<0.1%)
Source: U.S. Bureau of Labor Statistics	

2018 data from the California Division of Apprenticeship Standards reported there to be 179 apprentices in the information technology sector in California.[30] 74% of apprenticeships in the state are in building and construction trades. The average age of a California apprentice is 29.

Apprenticeships have benefitted from bipartisan support in recent years. The Obama administration invested $90 million in apprenticeship expansion in 2016.[31] President Trump signed an executive order in 2017 expanding apprenticeships further, granting more power to companies to run programs and increasing grant funding to $200 million.[32]

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[27] "Apprenticeships: Outlook and wages in selected occupations," Bureau of Labor Statistics, Ryan Farrell, November 2019.
[28] "The Future of Apprenticeship in California," Jobs for the Future
[29] "Apprenticeships: Outlook and wages in selected occupations," Bureau of Labor Statistics, Ryan Farrell, November 2019.
[30] "The Future of Apprenticeship in California," Jobs for the Future
[31] "Fact Sheet: Investing $90 Million Through ApprenticeshipUSA to Expand Proven Pathways to the Middle Class," Dept. of Labor, 4/21/16.
[32] "Technology companies turn to apprenticeships in tight labor market," Washington Post, Cat Zakrzewski, 1/8/19

Nationally, over 17 companies pledged to expand tech apprenticeships in cybersecurity, IT, and software engineering in 2019, coordinated by the Consumer Technology Association.[33] IBM reported in 2019 that over 30% of their apprentices were diverse hires and 13% were veterans.[34] Existing tech apprenticeships employ various models. Techtonica and Catalyte use client-project based apprenticeship models that aim for apprentices being hired by their network of client partners. Apprenti acts as a training and recruitment intermediary with a handful of companies across fifteen locations.[35]

Companies are continuously creating new apprenticeship roles in tech occupations. A list of DOL-registered tech apprenticeship occupations can be found in Appendix F.

TechHire and City-Led Tech Workforce Programs

Silicon Valley is notorious as the epicenter of technological innovation, but the San Francisco Bay Area is not the only tech cluster in the U.S. Other clusters include Boston, Dallas, New York City, Seattle, Los Angeles, San Diego, Austin, TX, Salt Lake City, U.T., Provo, U.T., Raleigh-Durham, N.C.,and Washington, D.C.[36] Jobs at tech firms account for at least 8% of all jobs in these cities, with the exception of New York City, where they're estimated to comprise between 6% and 8%.[37]

In San Francisco, information technology accounted for 13% of private employment in 2017 and 24% of private wages and salaries.[38] By another measure, tech workers make up 73 of every 1,000 jobs in San Francisco. [39]

A handful of these cities are designated TechHire cities, which was an initiative launched in 2016 by the U.S. Department of Labor. The DOL awarded $150 million in H-1B job training grants to 39 locations. The program had a goal of reaching 18,000 participants, with a focus on young adults ages 17-29 who face barriers to employment, as well as veterans, individuals with disabilities, individuals with criminal records, those with limited English skills, and the long-term unemployed. The program focused on advanced manufacturing and healthcare as well as information technology.[40] Opportunity@Work, a 501(c)3 non-profit, was launched in 2015 to foster and build the TechHire network which now includes over 70 cities including many of the original grantee cities.[41]

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[33] Ibid
[34] Ibid
[35] Apprenti, accessed 4/7/20
[36] "Tech Cities 2.0," Cushman & Wakefield, 9/27/18.
[37] Ibid
[38] "Twitter Tax Break in San Francisco Ends Amid Push for New Funds," Bloomberg Tax, Joyce E. Cutler, 5/15/19.
[39] "Bridging the Los Angeles Tech Talent Gap," Deloitte, September 2018.
[40] "US Department of Labor TechHire Grants: Summary of Awards, released 26 June 2016," Obama White House Archives, accessed 2/11/20.
[41] TechHire, accessed 2/11/20; About Us, Our History, Opportunity@Work, accessed 2/11/20.

In addition to San Francisco, the cities of New York City and Los Angeles have two of the most sophisticated and well-developed tech workforce initiatives.

New York City

The New York City Economic Development Corporation runs a handful of sector-based initiatives focused on emerging technology including blockchain, cybersecurity, and augmented reality (VR/AR).[42] On the workforce side, their CyberNYC program focuses on closing the skills gap in the city's growing cybersecurity sector. CyberNYC includes an Applied Learning Initiative in partnership with four local universities including the City University of New York (CUNY), New York University, Columbia University and Cornell Tech.[43] They also offer an accelerated Cyber Bootcamp in partnership with LaGuardia Community College and Fullstack Academy that specifically targets underserved communities.[44] Their AR/VR efforts, launched in 2018, include a workforce training partnership with CUNY Lehman in the Bronx.[45]

NYCEDC also runs the NYC Tech Talent Pipeline.[46]

New York City benefits from the presence of the CUNY system, which ranks among the top U.S. public colleges with the best track records of helping low-income students move into the middle class.[47] This ranking is based on a 2017 study on the role of college in economic mobility led by current Harvard University Professor Raj Chetty.[48]

The New York City Economic Development Corporation is structured as a non-profit corporation, which impacts their funding structure and the depth and breadth of programming they're able to offer.

Los Angeles

L.A. is the third largest tech ecosystem in the U.S. behind New York and San Francisco and is also anticipating significant growth in the number of IT, software engineering, and digital media jobs.

Bixel Exchange at the Center for Innovation and Technology at the L.A. Area Chamber of Commerce oversees L.A.'s Tech Talent Pipeline and does so in their capacity as a convener and intermediary for 19 community colleges, 30 area high schools, nonprofits serving

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[42] New York City Economic Development Corporation, accessed 2/7/20.
[43] "Industry Programs 2019," New York City Economic Development Corporation, accessed 2/7/20.
[44] CyberNYC Bridge Program, Fullstack Academy, accessed 2/7/20.
[45] Business Programs, R Lab, New York City Economic Development Corporation, accessed 2/7/20.
[46] NYC Tech Talent Pipeline, New York City Economic Development Corporation, accessed 2/8/20.
[47] "CUNY Again Dominates Chronicle's Public College Social Mobility Rankings," CUNY, August 2018.
[48] Chetty, Raj, John Friedman, Emmanuel Saez, Nicholas Turner, Danny Yagan, "Mobility Report Cards: The Role of Colleges in Intergenerational Mobility," July 2017.

opportunity youth, and over 60 L.A. employers. The program operates in partnership with the City of Los Angeles, and facilitates tech internships and apprenticeship opportunities for diverse, underrepresented L.A. high school and community college students. Their programs focus on Information Services and Support, Software Systems and Development, and Design, Visual, and Media Arts.

California

Support for creating tech talent pipelines and apprenticeships extends statewide in California. California Gov. Gavin Newsom announced the formation of a Future of Work Commission in August 2019 featuring labor and business leaders, tech executives, and academic leaders. The Commission's primary focus is on the rise of app-driven gig jobs and the use of independent contractors, but they will focus on shifts in the state's economic development outlook and workforce needs.[49] The Commission is scheduled to issue a preliminary report in May 2020.

Gov. Newsom has also been a vocal advocate for expanding apprenticeships throughout the state. During his 2018 campaign for governor he laid out a goal of creating 500,000 new apprenticeships by 2029 as part of his "Economic Growth and Competitiveness Agenda."[50] The 500,000 goal represented a 500% increase in apprenticeships over 2018 levels.[51] California had previously been growing the number of apprenticeships by roughly 50% annually in preceding years, and apprentices made up 5% of the state's workforce.[52] California apprentices currently make up 15% of all apprentices in the U.S.[53] The 500,000 goal was perceived by some, including Jobs for the Future, as too ambitious without a major structural overhaul to the state's apprenticeship system.[54] In their 2018 report, "The Future of Apprenticeship in California," JFF noted that increasing the number of apprenticeships "is not just a change in scale. It will require a change in the way apprenticeships are designed, launched, and implemented."[55]

The report (The Future of Apprenticeship in California) provides a roundup of additional federal and state apprenticeship funding streams that have been created over the past ten years benefitting California, including the American Apprenticeship Initiative at the federal level and funding available through the Workforce Investment and Opportunities Act (WIOA). At the state level, sources include California's Employment Training Panel, the California Apprenticeship Initiative, the California Clean Energy Jobs Act, the California Workforce Board's Workforce Accelerator Fund, the 2018-2019 Omnibus Education Trailer Bill, Assembly Bill 235,

[49] "Newsom unveils Future of Work panel - with one notable omission," Politico, Jeremy White, 8/31/19.
[50] Newsom, Gavin, "Here's How We Grow California's Economy for Everyone," Medium, 2/8/18.
[51] "California's Proposal for Apprenticeship Growth Requires New Approach," Jobs for the Future, 12/17/18.
[52] Ibid
[53] Ibid
[54] Ibid
[55] Ibid

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the Career Pathways Trust, Career Technical Education Incentive Grants, the Strong Workforce Program, and the California Workforce Board's Slingshot Initiative, as well as the James Irvine Foundation's Linked Learning initiative.[56]

Despite the abundance of programs working on apprenticeship expansion and diverse tech pathways promotion in California, JFF concludes that coordination among these programs is weak, causing their collective impact to be diluted. [57]

TechSF was one of six California-based recipients of federal American Apprenticeship Initiative funding. They received a $2.9 million grant.[58] They are also a recipient of a California Workforce Development Board Slingshot grant, which was awarded to promote regional industry and sector-specific employment strategies.[59]

Community College Career Pathways

California's public high schools and community college system are one avenue through which apprenticeships could be expanded, particularly youth apprenticeships. In 2002 the California Community Colleges Board of Governors founded the nonprofit, Career Ladders Project, which operates under the Foundation for California Community Colleges.[60] The organization has been instrumental in building up a career pathway curriculum in tech, manufacturing, auto-motive, nursing, etc. that has been used as a building block for students to gain prevailing employment. One example is highlighted below to highlight a career trajectory map for someone looking to go into Advanced Manufacturing and Welding at College of the Canyons in California.

Career Ladders has worked to incorporate vocational training into basic skill requirements for students looking to obtain their associates degree, or transfer to a 4-year university. They use a stackable certificate model for each level of training completed. It allows students who may not be able to commit long-term to the program due to life circumstances but allows them to pick up right where they left off and earn more certifications to further their training and higher pay.

Gov. Newsom's proposed 2020-2021 budget included a significant investment in building up apprenticeship and work-based learning programs within California Community Colleges to the tune of $83.2 million.[61] The funds would "create and support programs in such fields as advanced manufacturing, hospitality and life sciences" and potentially others across California.[62]

[56] Ibid
[57] Ibid
[58] American Apprenticeship Grant Award Summaries, Dept. of Labor
[59] SlingShot, California Workforce Development Board, accessed 4/7/20
[60] Career Ladders Project, About, accessed 4/7/20
[61] "Calif. Governor's Proposed Higher Ed Budget," Inside Higher Ed, Paul Fain, 1/13/20
[62] Gordon, Larry. "Newsom Proposes Funding Boost for Colleges and Universities but Education Leaders Wanted More." *EdSource*, 15 Jan. 2020

MAPPING CLP | Career Ladders Project

Pathway(s): Advanced Manufacturing and Welding
Community College(s): College of the Canyons

LEGEND
⭐ Early College Credit Opportunities
*Aspirational

COLLEGE OF THE CANYONS

DRAFT: 2/17/2017
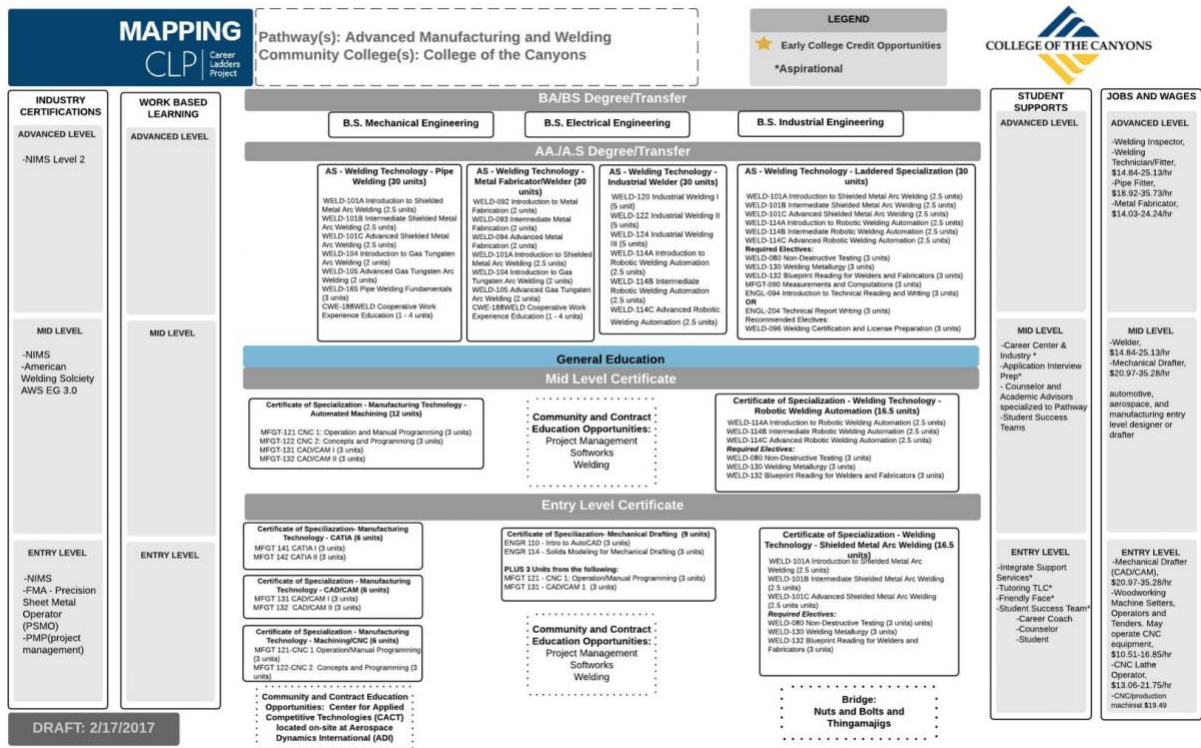
San Francisco Bay Area

Local Skills Gap

In the Bay Area demand most exceeds supply for highly specialized occupations including machine learning specialists and blockchain developers. [63] According to reporting from Brightline Defense, "within the San Francisco Bay Area, LinkedIn search shows 1,354 results for open 'machine learning engineer'' jobs." [64] The Bay Area Council, a premier industry alliance and lobbying organization for many of the area's major tech companies, estimates that despite the region's status as one of the U.S.'s primary tech hubs, there is still has an undersupply of more entry-level tech roles, including web developers. They estimate that for every 1,244 openings for web developers, there is an average undersupply of 450 qualified applicants. [65] For computer network support specialists, the Bay Area Council estimates an undersupply of 383 qualified applicants for 848 open positions. [66]

[63] Brightline Defense "High Tech Diversity in the San Francisco Bay Area, Task Two: Occupational Analysis," October 2019.

[64] Brightline Defense "High Tech Diversity in the San Francisco Bay Area, Task Two: Occupational Analysis," October 2019.

[65] Our Future Workforce: Web Developers, Bay Area Council, accessed 4/10/20

[66] "Our Future Workforce: Computer Network Support Specialists," Bay Area Council, accessed 4/10/20

The best-known brands don't suffer from a lack of applicants for entry-level positions but do cite a lack of qualified applicants. An article in Hackermoon made this point regarding software engineers, comparing knowing how to program to learning Spanish, in that many people know the basics but few are truly proficient. [67] Small to mid-size firms, and firms in other sectors hiring for tech roles also struggle to compete against big-brand tech firms for talent. [68]

Competition Remains for Tech Internships, Apprenticeships and Jobs

TechSF is one of three umbrella workforce initiatives focused on the tech sector in the San Francisco Bay Area, along with TechHire Oakland, an initiative run by the Kapor Center focused on the East Bay, and NOVA, a workforce development agency located in the South Bay. These initiatives are all committed to creating opportunities for underserved people to gain the skills necessary to compete for jobs in the tech sector. They work with different sets of non-profit training providers specific to their region (San Francisco, East Bay, South Bay), but the graduates of those programs are all competing for a limited number of apprenticeship placements within the same companies, as well as competing with applicants from other local tuition-based programs and applicants from across the country.

AirBnB, as one example, launched a software engineering apprenticeship program that welcomed its first cohort of 10 apprentices in January 2020. While the program was praised for focusing on candidates without bachelor's degrees who came out of local TechSF and TechHire Oakland-funded boot camp programs, two of the spots went to Holberton School graduates.[69] Among Code for America's first three apprentices to date, none of them came from TechSF funded programs, and one came from New York.

Groups Competing for Convener Power

In addition to the Kapor Center and NOVA, TechSF is also competing with other organizations for status as a central convener for apprenticeship advocates and tech employers in the Bay Area.

ApprenticeSIP Network: ApprenticeSIP is a [Meetup group](#) with 144 members based in the Bay Area. They host a monthly happy hour that serves as an informal networking and brainstorming opportunity for those interested in expanding apprenticeships in the Bay Area and nationally for underserved people. Members are primarily workforce, education, hiring, training, and policy professionals. OEWD staff member Orrian Willis is a founding member.

Bay Area Council: The Bay Area Council is a regional economic development organization founded in 1945. It has over 300 member companies, including most of the area's big tech

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[67] Brightline Defense "High Tech Diversity in the San Francisco Bay Area, Task Two: Occupational Analysis," October 2019.
[68] Ibid
[69] Interview with Charles Bathel, Holberton School, 1/15/20.

firms. They primarily serve as a lobbying organization, but they also have a workforce initiative called Our Future Workforce focused on helping employers meet hiring needs for in-demand roles, including web developers.[70]

TechSF: Breaking Down the Challenges

Libertarian Bias of Tech Industry

As a city government-led initiative, San Francisco's TechSF project faces an existential hurdle given the environment in which this project is operating. Silicon Valley has historically had a strong libertarian bias that fosters a reflexive distrust of government among staff and company leaders who are more likely to view government programs as cumbersome rather than helpful, regardless of the topic or the issue at hand. TechSF staff and other Bay Area tech workforce advocates report encountering this mindset among tech employers. Employers are often skeptical of launching programs that would be required to meet competency and organizational standards set by the U.S. Department of Labor, and would often prefer to design their own recruitment, hiring, and training programs, including their own unregistered apprenticeship programs, free from outside requirements.

Lack of Diversity in Tech & No Real Commitment to Change

Apprenticeships are one route by which tech companies could diversify their employee base. The lack of diversity within tech companies has been widely reported. In 2014, companies including Apple, Google, Facebook, and Microsoft began self-reporting diversity numbers, revealing a workforce that was overwhelmingly made up of white and Asian men.[71] The lack of diversity is particularly stark among technical employees including coders, software engineers, and data scientists.[72] In the five years since these companies began reporting on their own diversity metrics, barely anything has changed.[73] This lack of change comes despite over $1.2 billion invested in diversity-focused recruitment initiatives during that time, and the disparities extend upward into senior leadership.[74] Over 83% of tech executives are white and roughly 80% are men.[75]

Nationally, hiring for software and IT services has increased by 6.7% since 2018.[76] However, Black and Latinx workers and women remain underrepresented in technical occupations.[77] Data

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[70] Bay Area Council, bayareacouncil.org, accessed 2/13/20.
[71] Harrison, Sarah, "Five Years of Tech Diversity Reports - And Little Progress," WIRED, 10/1/19.
[72] Ibid
[73] Ibid
[74] "Tech still struggles with diversity, despite $1.2B in investments, report says," Silicon Valley Business Journal, Luke Strangel, 2/13/17
[75] "High Tech Diversity in the San Francisco Bay Area, Task One: Industry Analysis," Brightline Defense, July 2019
[76] Ibid
[77] Ibid

from the U.S. Census in 2016 stated Black, Latinx, and Native Americans hold 21% of degrees in computer science, yet only 10% of them hold high tech jobs. In Silicon Valley, this composition is even lower with Black and Latinx employees making up only 3-6% of the tech workforce, and women of color comprising 1% or less.

U.S. and Silicon Valley Workforce by Race/Ethnicity[78]
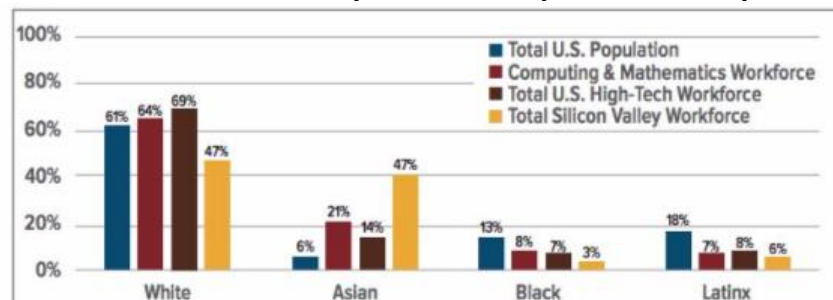
Sources: U.S. Census Bureau (2016), Bureau of Labor Statistics (2016), EEOC (2016).

An analysis done by Brightline Defense for TechSF found that compared to other large metropolitan tech hubs, Silicon Valley fares noticeably worse on tech workforce diversity. Houston, Miami, Atlanta, New York, New Jersey, Los Angeles, and D.C. all employ 1.5 to 3.3 times the number of Black and Latinx employees in tech occupations as the Bay Area.[79] Research from the Kapor Center, a tech equity non-profit based in Oakland found "these disparities exist due to inequitable pay, non-inclusive work environments, and bias in recruitment and promotion. Even after overcoming these challenges, retention remains challenging."

Share of Racial and Gender Groups in High Tech vs. All Private Industry[80]

[78] Ibid
[79] Ibid
[80] Ibid

	All Private Industry	High Tech	Percentage Difference
White	63.5%	68.5%	+5%
Asian	5.8%	14%	+8.2%
Hispanic	13.9%	8%	-5.9%
Black	14.4%	7.4%	-7%
Men	52%	64%	+12%
Women	48%	36%	-12%

Source: Brightline Defense analysis of the Equal Employment Opportunity Commission's Employer Information Numbers

In response to these gaps, many firms have created Diversity & Inclusion, Corporate Social Responsibility, or philanthropic branches that pay heed to the need for more equitable training and employment opportunities in tech. However, many workforce development specialists are skeptical of these efforts since many are heavy on glossy marketing campaigns to boost company brands and win favorable press coverage, or invest in high school extracurriculars to spark interest in tech, without making changes to recruitment, hiring, and training protocols that would boost workforce diversity, including apprenticeships.

D&I and CSR efforts within tech companies also suffer from a lack of consensus around how to define what a "diverse" hire is. Diversity can focus on gender, race, geography, or level of educational attainment. In light of the #MeToo movement, diversity discussions have gravitated around gender in recent years.

The programs funded by TechSF have strong diversity metrics compared to industry norms. As seen in Appendix B, in FY 2018-2019, women made up 40% of all 308 enrollments in TechSF funded community training programs. 71% of enrollees were San Francisco residents, 9% of enrollees were African-American, 34% were Latinx, 22% were Asian American, and 24% of participants were white.

Ageism in Tech

Navigating tech is even more difficult as you get older. Based on data from the California Department of Fair Employment and Housing from 2008 through 2015, 150 top tech companies within Silicon Valley were sued 226 times because of age discrimination.[81] "The median age of an American worker is 42. At Facebook it's 29, Google 30, Apple 31, Amazon 30 and Microsoft 33.[82] To further illustrate the point of age discrimination in tech, the following chart was pulled

81 Swartz, Jon. "Silicon Valley's Not-so-Secret Bias: Ageism." *USA Today*, Gannett Satellite Information Network, 16 Sept. 2016, www.usatoday.com/story/tech/columnist/2016/09/15/silicon-valleys-not-so-secret-bias-ageism/90120616/.
82 *Bloomberg.com*, Bloomberg, www.bloomberg.com/news/articles/2016-09-08/silicon-valley-s-job-hungry-say-we-re-not-to-old-for-this.

from the US Budget website that maps out the age distribution of workers in software development, computer or math, and all other jobs.[83]
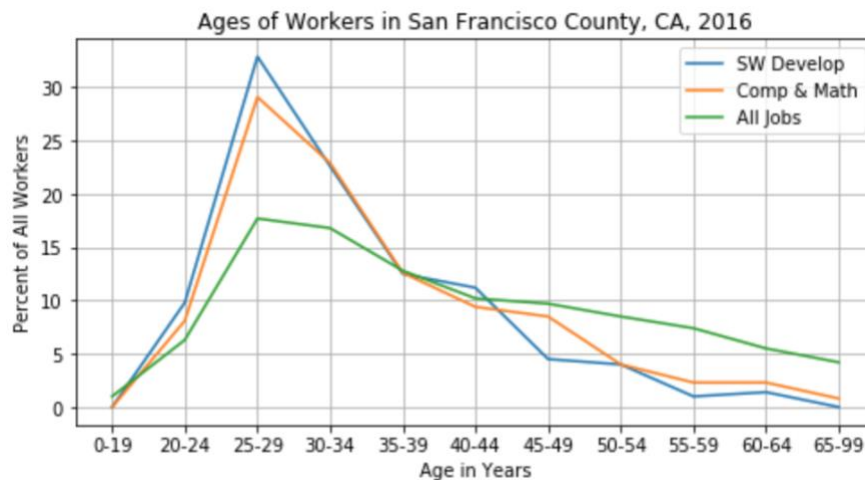
Current Hiring Practices

In general, tech companies spend hundreds of thousands of dollars on finding the best talent and hiring them. Signing bonuses are common for entry-level software engineers at Silicon Valley companies. Many invest a considerable amount of money on converting summer interns into full-time employees. On average, tech companies provide summer interns a monthly salary of $6,000—with Facebook paying the most at an average of $8,000 a month. [84]

According to a 2016 report from the Society for Human Resource Management, it typically costs $4,129 to fill a vacant position that takes about 42 days to fill.[85] The costs are significantly higher for smaller businesses, in which managers spend on average 40% of their time "on tasks that do not generate income, such as hiring."[86]

Degree Inflation: Hiring Favors Bachelor's Degree Holders

The Public Policy Institute of California put out a report that states "California will fall about 1.1 million college graduates short of economic demand if current trends persist—a problem we call the workforce skills gap." They predicted the number of college graduates will no longer be able to meet employer demand by 2030, and jobs will need to be filled by other mechanisms.[87]

[83] "U.S. Budget and Economy." *U.S. Budget and Economy/ Ageism*, Econdataus, econdataus.com/ageism.htm.

[84] Information provided by Orrian Willis, OEWD, TechSF
[85] "2016 Human Capital Benchmarking Report," Society for Human Resource Management, November 2016
[86] Zivkovic, Mile. "The True Cost of Hiring an Employee in 2020." *Toggl Blog*, 24 Mar. 2020
[87] "Will California Run Out of College Graduates?" Public Policy Institute of California, Hans Johnson, Marisol Cuellar Mejia, Sarah Bohn, October 2015.

Public Policy Institute of California Workforce Projections 2030[88]

SOURCE: Authors' projections.
NOTE: See the technical appendices for data and methods.
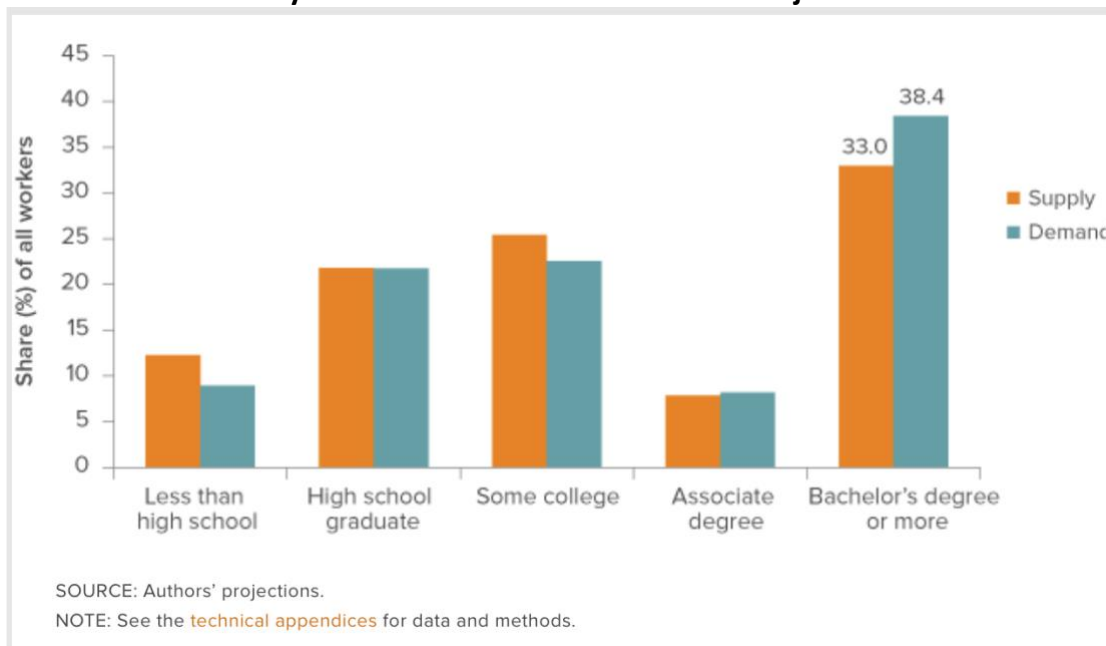
California is not alone. The Harvard Business School report "Dismissed by Degrees" reviews how "degree inflation - the rising demand for a four year college degree for jobs that previously did not require one - is a substantive and widespread phenomenon that is making the U.S. labor market more inefficient."[89] The trend is driven by employer's need for candidates with mastery over technical programs like Microsoft Excel and "soft-skills,'' who have come to rely on a bachelor's degree as a proxy for those skills. [90] This artificially inflates the cost of entry to a range of middle-skills jobs.

This trend includes tech employers who primarily recruit from four-year college universities, especially top ranked schools. According to data from PAYSA, a significant number of employees at the top 100 tech firms come from a select number of colleges, including the University of Washington, Carnegie Mellon, Sanford, and UC Berkeley.[91] Stanford serves as a major pipeline into several Silicon Valley companies including Google and Apple. The report found "major tech companies may be hiring graduates across the world, but small and midsize companies are still snatching up alumni from some of the most popular colleges." This is a serious concern for individuals who don't have the privilege to attend top tech colleges and learn non-traditionally."

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88 "Will California Run Out of College Graduates?" Public Policy Institute of California, Hans Johnson, Marisol Cuellar Mejia, Sarah Bohn, October 2015.
89 Fuller, J., Raman, M., et al. (October 2017). *Dismissed By Degrees*. Published by Accenture, Grads of Life, Harvard Business School.
90 Ibid
91 "Top Colleges in Tech," PAYSA, 6/5/17.

Many companies seem to be taking a wait-and-see approach to see if colleges and universities will produce more computer science graduates who are female and people of color, rather than focusing on hiring from bootcamps or launching apprenticeship programs. Recruiting tactics often focus on partnerships with Historically Black Colleges and Universities or non-profits generating interest in computer science degrees among high schoolers, including Girls Who Code. Companies remain reluctant to hire candidates without bachelor's degrees who have successfully completed coding and programming bootcamps or vocational training programs, even though those candidates tend to be more diverse by all metrics.

Reskilling Initiatives Favor Current Employees

Many hard-to-fill positions in tech are not entry level positions, but rather, middle or senior level roles. This is a problem to which apprenticeships are not a solution. To confront this, companies have undertaken initiatives to restructure or reskill their existing workforce in addition to efforts to recruit or train new employees. For some companies these programs have been a much bigger focus than entry level recruiting. These corporate programs are often referred to as "corporate universities" or "corporate colleges."[92]

To meet these demands, private for-profit training providers including General Assembly, Udacity, and Degreed have launched consulting businesses with customizable learning platforms and custom curriculum that companies can use to re-train and upskill existing employees. Moving forward, these in-house efforts may reduce the need for independent bootcamp programs or act as direct competitors.

AT&T[93]

AT&T launched their Workforce 2020 initiative in 2016. The company set out with a goal to retrain 100,000 employees by 2020, as part of a long-term organizational shift toward continuous learning to keep up with the pace of change of technology. The company estimated that in 2012 50% of their employees had a background in STEM and by 2020 that threshold would need to be 95%. A central component of the plan involved partnerships with digital education providers to create curriculum for in-demand, technical skills that they offered to employees in-house through their AT&T University platform. They partnered with Udacity to build an online master's program at the Georgia Institute of Technology in computer science and worked with Udacity and Coursera to develop new classes and "nanodegrees" in data science, agile project management, front-end web development, full stack web development, and IOS development. Employees chart career progression plans and

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[92] "Amazon upskilling 100,000 employees. Here's what that means for the future of work," Fast Company, Scott F. Latham, 7/23/19.
[93] "AT&T, Retraining, and the Workforce of Tomorrow," William Kerr, Joseph Fuller, and Carl Kreitzberg, Harvard Business School, July 9, 2019.

log coursework through the platform. They also offer apprenticeships to existing employees who want to take on a new position.[94]

Vodafone[95]

Vodafone estimates they receive 100,000 applications for every 1,000 job postings. They don't struggle with entry-level hires but do struggle to recruit senior-level staff. In an interview for a Harvard Business School case on the company, Chief Human Resources Officer Ronald Schellekens said "in the analytics areas, it's tough to hire the super experienced people, but the reality is that we need to also figure out how to build it ourselves internally."

Amazon

Amazon announced an ambitious goal in 2019 to retrain 100,000 existing employees, representing a third of their current workforce as part of their Upskilling 2025 program, based on internal projections.[96] The company projected that even "non-tech" jobs at the company would require more STEM expertise, including work in business analyst units, marketing, and program management.[97]

A workforce development survey conducted by Salesforce in 2017 soliciting responses from 750 hiring managers about the future of work showed broad interest in new employee training programs. The survey indicated that 88% of hiring managers felt formalized retraining programs, "to evolve existing employee skill sets will be crucial in the years ahead."[98] As seen in the figure below from the report, interest in apprenticeships ranked third as a strategy of interest, while retraining programs for existing employees garnered the most interest, though tech managers showed more interest than average across sectors.

[94] "Technology Transformation, AT&T, 2016.
[95] "Vodafone: Managing Advanced Technologies and Artificial Intelligence," William Kerr and Emer Moloney, Harvard Business School, February 20, 2018.
[96] "Amazon upskilling 100,000 employees. Here's what that means for the future of work," Fast Company, Scott F. Latham, 7/23/19.
[97] "A look at our changing workforce," Amazon, accessed 4/3/20.
[98] "The Future of Workforce Development," Salesforce, accessed 4/6/20.

Industries Disagree on How to Drive Workforce Development

Percentage Difference Between Hiring Managers Who Currently Do or Highly Prioritize the Following Work Development Practices/Investments

INDUSTRY COMPARED TO ALL-INDUSTRY AVERAGE

● Financial Services ● Healthcare and Life Sciences ● Technology ● Manufacturing ● Consumer Products and Retail

Practice/Investment	All-Industry Average
Formalized retraining programs for employees (e.g., to evolve skills as demands change)	46%
Comprehensive training programs for college-educated entry-level talent (e.g., soft skills, coding, etc.)	41%
Apprenticeships (i.e., practical on-the-job training, not a traditional internship)	40%
Engaging underrepresented groups (e.g., minority groups)	40%
Online training/educational resources (e.g., Coursera, Khan Academy)	35%
Engaging individuals with nontraditional backgrounds (e.g., noncollege educated)	35%
Employee volunteer incentives for workforce dev programs (e.g., paid volunteer policy, mentor/mentee match)	35%
Comprehensive training programs for noncollege-educated entry-level talent (e.g., soft skills, coding, etc.)	33%
Partnering with workforce dev organizations (e.g., Year Up, Code2040) to engage program participants	30%

Salesforce Research

Apprenticeships: A Misunderstood Opportunity

Employers find the process of creating and launching a registered apprenticeship program to be daunting. Many don't know how much it would cost or may not feel confident they have the support staff necessary to ensure an apprenticeship placement goes smoothly. They may also simply not know how such a placement could be structured. Some employers, including Salesforce, already have existing relationships with youth job non-profits including YearUp, and host interns for 6 months in IT and business operations, and expressed wariness over setting up a new program. Apprenticeship programs that do exist are often small. Airbnb, which has over 12,000 employees, took 10 apprentices in their first software engineering cohort in 2020. [99]

TechSF prospects for employers in the tech sector that they think could be hosts for apprenticeship program and offers one-on-one support throughout the process of registering and setting up an apprenticeship. They simultaneously encourage employers to take advantage of LaborX as a source of diverse hires, and graduates of the network of tech skills programs they help fund.

[99] Interview with Charles Bathel, Holberton School, Jan. 15, 2020

However, apprenticeship advocates we spoke said employers often remained confused and unconvinced of the benefits of these programs – both because there's such a heavy cultural emphasis on college as the main pathway for career exploration in the U.S. and apprenticeships remain relatively uncommon. [100]

Employers would benefit from more specific guidance on program creation. Ally Lee, one of the apprenticeship program managers at Twilio described the stress that can come from business units and departments having to find the budget for an apprentice on their own, rather than companies creating a general designated funding pot for the roles. [101]

Apprenticeship advocates most common refrain was that it was helpful to approach new employers through their staff who held positions being targeted for apprentice roles (like software engineers) and would be directly supervising and mentoring apprentices, rather than focusing outreach efforts on human resources directors, diversity and inclusion teams, or other operations support staff. [102]

Apprenticeship Return on Investment

The return on investment for apprentices is a calculation each employer would need to track individually, but the evidence suggests the return is consistently positive, which is widely misunderstood by employers. Apprentices have high rates of conversion to full-time employees, unlike interns, reducing recruiting and training costs.

The U.S. Department of Labor estimates employers get a $1.47 return of investment for every dollar spent on apprenticeships, on average, through reduced waste, higher productivity, and more innovation. [103]

The CEO of Treehouse, Ryan Carson, estimated in an article for Harvard Business Review that for a company specifically hiring 10 software developers using "internal technical hiring team and an outside recruiter to fill those positions," given industry averages for signing bonuses, compensation and the time to activate a new hire, "it's going to cost you around $2 million to source, hire, onboard, and then compensate that cohort of developers for one year." He estimated that those same hires if done through an apprenticeship program would only amount to $723,000, saving roughly $1.3 million. [104]

[100] Interview with Annelies Goger, Brookings Institute, Jan. 27, 2020
[101] Interview with Ally Lee, Twilio, March 16, 2020.
[102] Interview with Orrian Willis, OEWD, Jan. 13, 2020
[103] "Fact Sheet: Investing $90 Million Through Apprenticeship USA to Expand Proven Pathways Into the Middle Class," Dept. of Labor, 4/21/16
[104] "How My Company Created an Apprenticeship Program to Diversify Tech," Harvard Business Review, Ryan Carson, 11/2/18.

Apprentices are typically not paid a full salary equivalent to that of an entry-level employee, but follow incremental wage increases as they progress in skill development. TechSF advocates that apprentices earn at least 60% of average wages for their position. An example of how an apprentice hire could save an employer money relative to a regular hire, earning $100,000 as an entry-level employee, is below. [105] These projections are based on Society for Human Resource Management's costs per hire, $4,000 [106] (very conservative considering locality is not cross-compared), TechSF pays for $5,000 of any ongoing training needed, and a $10,000 conservative sign-on bonus

Legend:
- Salary Paid
- Savings
- Sign-on Bonus
- On-going Training
- Internal Recruiting Cost
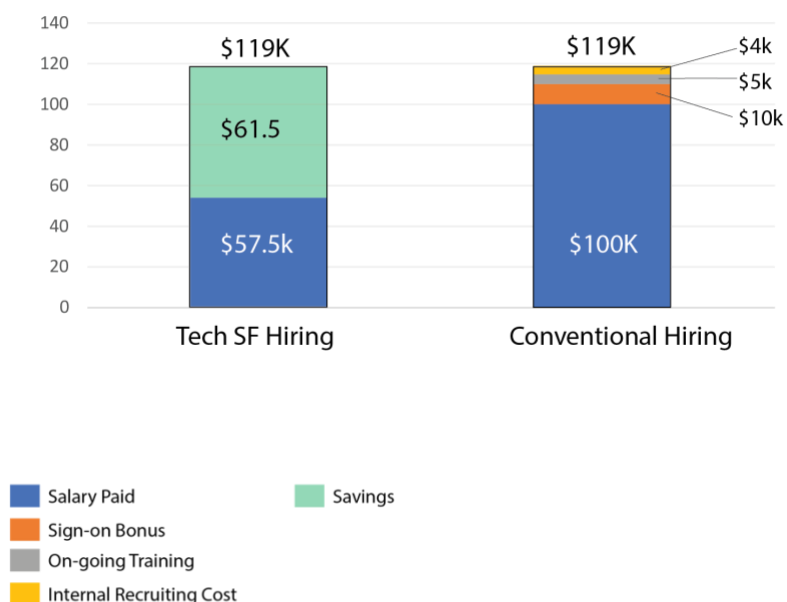
Economic Development Incentives

The City of San Francisco has experimented with various policies and programs to encourage equitable, diverse, and local hiring, but doesn't have any official tools to require apprenticeship expansion.

The city offered employers a payroll tax break for up to six years starting in 2011 (which expired in 2019) if they located their offices downtown. Formally known as the Central Market and Tenderloin Area Payroll Expense Tax Exclusion and more often referred to as the "Twitter tax break," the break cost the city $10 million a year in tax revenue on average over eight years.[107] The break was originally intended to keep companies with high-paying jobs in San Francisco

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[105] Estimate created by Joshua Baltodano, 4/10/20.

[106] Shrm. "Average Cost-per-Hire for Companies Is $4,129, SHRM Survey Finds." *SHRM*, SHRM, 19 May 2017, www.shrm.org/about-shrm/press-room/press-releases/pages/human-capital-benchmarking-report.aspx.

[107] "'Twitter' Tax Break in San Francisco Ends Amid Push for New Funds," Bloomberg Tax, Joyce E. Cutler, 5/15/19

that might otherwise locate in Silicon Valley or the East Bay to avoid the city's tax on stock options after they went public.[108]

The tax break was conditional on a handful of things, including participation in the city's First Source Hiring Program that requires companies to project how many entry-level roles they will hire for, post those jobs with First Source, and make a "good faith" effort to hire those who are referred to them through the city's workforce development system, though they are not actually required to do so.[109] Companies signed individual agreements with the city to receive the break, which often included extra investments in the Tenderloin and Market Street neighborhoods. The online dating platform, Zoosk, for example, provided internship opportunities, tutoring, and donated $10,000 to a local nonprofit in exchange for the tax break.[110]

Given recent blame placed on major tech firms over a handful of national issues – including data privacy, misinformation, and a lack of internal diversity, there's been less public appetite for giving firms tax breaks, which is part of why it wasn't renewed in 2019., despite the potential to encourage local hiring and investment.[111]

TechSF also offers employers a stipend of $2,500 for every apprentice they hire and pair with a mentor on the job site, along with an additional $2,500 to cover outside training costs to meet the DOL's requirements for instructional hours, totaling $5,000. However, for most large companies $5,000 is a drop in the bucket, and not enough to offset the perceived risk of an apprentice hire. As a result, TechSF has been prioritizing efforts to work more closely with small to midsize companies where these benefits could have a bigger impact.

Recommendations

1. Imagining TechSF 2030

One of the main questions TechSF faces is what will happen when two key grants run out in 2020 and 2021, and how they can create an apprenticeship ecosystem that's sustainable over the long run.

The most successful examples we've seen of scaled apprenticeship programs involved systems-level change at the regional or state level with a non-governmental intermediary at the center that had the capacity to build and follow long-term strategic plans. Appendix G features a brief case study of CareerWise Colorado, an example of a statewide youth apprenticeship initiative that operates in partnership with Colorado high schools, community colleges, and local

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[108] "Ibid
[109] "First Source Hiring Program," City and County of San Francisco, accessed 4/3/20.
[110] "'Twitter' Tax Break in San Francisco Ends Amid Push for New Funds," Bloomberg Tax, Joyce E. Cutler, 5/15/19
[111] Ibid

companies. They are aiming to enroll 20,000 apprentices per year by 2026, representing 10% of the state's high school juniors and seniors.[112] CareerWise Colorado is a 501(c)3 founded by Noel Ginsburg, the founder of a plastics manufacturing company. Other scaled apprenticeship programs include Apprenticeship Carolina and Apprenti.

Successful regional and state apprenticeship initiatives often share these features:

- **Programs are business-designed and business-led**. Apprenticeships work best for occupations in which employers are struggling to hire to meet demand – which is true for select tech occupations in the Bay Area. Pathways are smoothest when employers can weigh into the training programs (bootcamps or instructional hours curriculum) to meet their specific needs, and ensure curriculum is updated regularly. This is a core feature lacking in the TechSF model. TechSF has strong allies like Vivek Nair at Twilio, but there are no institutionalized leadership roles for these individuals outside the ICT Committee and working groups.

- **An independent player is at the center acting as a strategist and convener**. These independent actors are neutral and less reliant on government funds or shifting political interest. These entities can drive long term strategy and act as a public-private facilitator. The Kapor Center in Oakland is a great model, and the L.A. Area Chamber of Commerce plays this role in Los Angeles. CareerWise Colorado also acts in this role. Having a private entity, non-profit, or philanthropy play this role increases fundraising opportunities and doesn't limit staffing to the constraints of government budgets. [113]

- **A sustainable long-term funding model.** Rather than issuing stipends or tax credits to employers for hiring apprentices, apprenticeship programs are exploring financially self-sustaining models. Careerwise Colorado is working toward this by imposing employer fees per apprentice to be a part of the program, for example.

- **Formal partnerships with high schools and community colleges in addition to non-profits**. Given that so many TechSF programs target opportunity youth (if not exclusively) San Francisco Unified School District would appear to be a logical partner, as would other Bay Area community colleges including the City College of San Francisco and beyond. A patchwork of non-profit partners is a challenging model to scale for apprenticeships.

- **Formalized systems for employer prospecting.** Programs can only grow so much when relying on personal, one-on-one relationships and individual requests. Employer scoping

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[112] Abdelal, Rawi E., Joseph Fuller, Matthew G. Preble, "CareerWise Colorado Case Study," Bloomberg Harvard City Leadership Initiative, Harvard Kennedy School of Government.
[113] Presentation from Noel Ginsburg, CareerWise Colorado, Harvard Business School, 4/8/20.

needs to be systematic and replicable. CareerWise Colorado uses Salesforce to do this, for example, and a separate platform for tracking participant data. [114]

- **Targeted data collection.** TechSF collects data on TechSF funded non-profit training enrollments, enrollee demographics, and placement outcomes (in jobs, internships, or education), but has not tracked which graduates of the programs they fund have landed in specific apprenticeships, or the end result for those apprentices, beyond providing an overall number – 52 - of apprentice positions they helped coordinate. Better data collection is needed.

Given the upcoming discussions related to California's Future of Work Commission, and at least a dozen entities in the state concurrently working on addressing the tech skills gap and apprenticeship expansion, OEWD and TechSF would benefit from seeking state-level partnerships to create a broader regional or state umbrella, with more formal business and public school partnerships and an independent governing structure.

2. Capitalize on Tech Worker Activism

In addition to expanding the role of business leaders, education partners, and intermediaries, the cause of apprenticeship expansion would also benefit from the voices and participation of existing tech workers.

Most apprenticeship and workforce development programs focus on generating more buy-in and participation from senior leadership, including working with corporate offices, but worker-led initiatives could be a promising alternative route to generating changes in hiring practices.

Recent Rise in Tech Worker Activism

There's been an increase in the number of concerted collective action taken by tech employees among both white- and blue-collar workers in recent years challenging company policies. [115] In 2018, there was a major Google walkout in response to news that Google awarded generous severance packages to senior staff let go in response to credible accusations of sexual harassment.[116]

Some recent action has focused on broad, ethical appeals to the companies regarding climate change, company relationships with energy companies, or contracts with federal immigration enforcement agencies. In September 2019, employees at Google, Amazon, Microsoft, Twitter,

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[114] Presentation from Noel Ginsburg, CareerWise Colorado, Harvard Business School, 4/8/20.
[115] "What we learned from over a decade of tech activism," The Guardian, Nataliya Nedzhvetskaya and J.S. Tan, 12/23/19.
[116] Wakabayashi, Daisuke, Erin Griffith, Amie Tsang, Kate Conger, "Google Walkout: Employees Stage Protest Over Handling of Sexual Harassment," New York Times, 11/1/18.

Facebook, and Square participated in a walkout to protest company climate policies.[117] A few dozen workers at Accenture signed a petition in November 2018 that unsuccessfully called on the company to end their contract with Customs and Border Protection.[118]

However, these types of values-based appeals (on climate, immigration, etc.) are not considered protected by the National Labor Relations Act (NLRA). The NLRA is the U.S.'s bedrock labor law and along with the National Labor Relations Board (NLRB) governs labor unions in the U.S. It also expressly protects worker organizing efforts outside of unions that meet certain conditions. The act primarily only protects action taken over wages or terms of employment. [119]

Employee pressure has proven successful at pressuring companies through media coverage to change their practices. The consensus among labor activists and organizers is that these tactics are most successful when the company at stake cares about having a socially conscious brand.[120] Companies including Google, REI, and Starbucks have changed company practices in response to employee pressure and media campaigns. [121]

Coworker.org founder and co-director Michelle Miller said that to her knowledge, as of February 2020 there has not been a petition started on the platform by tech employees calling for apprenticeships or changes in recruitment, hiring, and training practices, but that such action would likely be protected by the NLRA since it relates to wages and employment conditions.[122] Coworker.org hosts petitions from blue collar tech workers (and other industries) on their platform. They also have experience working with tech employees, including those at Google, to help train them on their rights and win media coverage of issues. [123]

Employee Resource Groups

One avenue for cultivating worker interest could be through Employee Resource Groups. These are employee-led interest groups formed around shared identity, and they're often framed as outlets for employees to drive change within their company, essentially without taking their concerns public.

3.) Explore Tech Opportunities in Other Sectors

[117] Baca, Marie, Jay Greene, "Amazon, Google, and other tech employees protest in support of climate action," The Washington Post, 9/20/19.
[118] Menegus, Bryan, "Accenture Employees Demand Their Company Break Ties With U.S. Border Patrol," Gizmodo, 11/15/18
[119] Alvins, Jeremy, Megan Larcom, Jenny Weissbourd, "Coworker.org Case Study," Harvard Kennedy School of Government and MIT Sloan School of Management, Jan. 2018.
[120] Hegji, Alexandra, "Federal Labor Relations Statutes: An Overview," Congressional Research Service, 11/26/12
[121] Coworker.org Case Study
[122] Interview with Michelle Miller, Coworker.org, 2/11/20.
[123] Alvins, Jeremy, Megan Larcom, Jenny Weissbourd, "Coworker.org Case Study," Harvard Kennedy School of Government and MIT Sloan School of Management, Jan. 2018.

TechSF would benefit from additional landscape analysis to identify non-tech employers and mid-sized companies recruiting for technical positions in data science, web development, graphic design and video production, UX/UI research, and software engineering. Jobseekers would benefit from opportunities to pursue tech roles and occupations within healthcare, education, government, real estate, finance, legal fields, non-profits, media, and other industries. Exploring the creation of apprenticeship programs in tech occupations among a wider variety of employers could expand the number of employer partners and potential placements. TechSF currently places a heavy focus on building relationships with technology companies.

In Los Angeles, for example, a report commissioned by the city, drawing on data from LinkedIn, found that 4 out of 5 workers with tech roles did not work for a tech company focused on software or IT.[124] 80% of tech workers reported working in healthcare, education, manufacturing, and entertainment, among other sectors.

In Boston, the city's workforce intermediary, the Private Industry Council (PIC) runs a youth summer jobs program that hosts over 1,000 high school students each year. In 2019 this included 120 placements in tech roles, but most of those roles were with companies that weren't expressly "tech" companies, including Blue Cross Blue Shield, financial firms, design firms, law offices, and others.[125] The program has strong backing from the mayor, and the city runs a call-center style operation each year to reach out to employers, asking them to host at least five youth workers. They call on industry associations, like the Boston Bar Association, to help with outreach and make requests, and rely on employer directories, like the Boston Business Journal.[126]

4.) Strengthen Curriculum Ties Between CBOs and Employers

The non-profit training providers TechSF awards grants to would benefit from tighter relationships with employers for the purposes of curriculum design, in order to keep their graduates competitive for open apprenticeship positions.

Many competing Bay Area software engineering and data science bootcamps outside the TechSF ecosystem that send graduates to the same companies TechSF works with offer deeper curriculum on full stack and server-side development, rather than focusing on front-end web development, which is where the programming for <dev/Mission> and Code Tenderloin ends. Competing programs also offer programs in data science and UX/UI research. Appendix D offers a directory of other Bay Area tech bootcamps and their curriculum offerings.

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[124] "LA's Tech Talent Pipeline: Investing in a thriving Tech workforce pipeline for Los Angeles," City of Los Angeles, accessed 2/8/20.
[125] Presentation from Josh Bruno, Boston PIC, Harvard Graduate School of Education, 4/9/20
[126] Presentation from Josh Bruno, Boston PIC, Harvard Graduate School of Education, 4/9/20

Requests for new or different training curriculum could be worked into the next round of RFPs that will go out in 2020. The ICT Committee could also be a useful place to convene employers for curriculum reviews.

5.) Update TechSF Online Resources for Employers

It would be of value to employers if TechSF developed more comprehensive resources for companies and organizations considering hosting apprentices. [127] Additional resources could include:

- A step-by-step guide for registering a new program and any reporting requirements.
- Instructions for registering a position that's never previously been approved by the Dept. of Labor's Office of Apprenticeship or the California Department of Industrial Relations' Division of Apprenticeship Standards (a UX researcher position, for example.)
- Examples of existing registered occupation workflows and competency checklists
- Organizational charts offering examples of how to fit apprentices into workstreams
- One or two case studies of how companies have structured existing programs
- A list of best practices and pitfalls for employers when creating apprenticeships

[127] Interview with Laura Kogler, Code for America, 1/14/20

Methodology

Interviews

Last Mile Training Provider Staff
1. Leo Sosa, Founder and Executive Director, Dev/Mission
2. Annie Tahtinen, Strategic Technology Partnership Manager, Jewish Vocational Services
3. Donna Hilliard, Program Manager, Code Tenderloin
4. Olivia Herriford, Cybersecurity Apprenticeship Program Manager, City College of San Francisco
5. Stone Strickland, California Business Development Lead, Apprenti
6. Charles Bathel, Community Manager, Holberton School

OEWD Staff & TechSF Consultant Team
1. Orrian Willis, Senior Workforce Development Specialist, OEWD, TechSF
2. Krysti Specht, Workforce Developer and Program Officer, OEWD, TechSF
3. Katherine Daniel, Deputy Director, OEWD
4. Craig Dermody, Economic and Workforce Data Specialist, OEWD
5. Eddie Ahn, Executive Director, Brightline Defense

Apprenticeship & Future of Work Thought Leaders
1. Annelise Goger, Rubenstein Fellow, Metropolitan Policy Program, Brookings Institute
2. Joseph Fuller, Professor & Director, Managing the Future of Work Initiative, Harvard Business School
3. Rachel Lipson, Project Director, Weiner Center for Social Policy, Harvard Kennedy School
4. Kirsten Lundgren, Director, TechHire Oakland, Kapor Center
5. Michelle Miller, Co-Director, Coworker.org

6. Noel Ginsburg, Founder, CareerWise Colorado, presentation at Harvard Business School, 4/8/20
7. Josh Bruno, School-to-Career Director, Boston PIC, presentation at Harvard Graduate School of Education, 4/9/20

Bay Area Tech Company Staff
1. Nikki Tosiello, Workforce Development Director, Salesforce
2. Orlando White, Community Development Manager, LinkedIn
3. Vincent Bish, former Director of Operations, The Next Chapter @ Slack & The Last Mile
4. Nancy Chan, former Head of Social Impact, Catalyte
5. Laura Kogler, Engineering Director, Code for America
6. Jocelyn Maser, Associate Director of People Operations, Code for America
7. Ally Lee, Program Manager, Twilio

Data Analysis

As part of our methodology, we requested and reviewed enrollment and placement metrics for the eight community-based organizations that receive TechSF and OEWD grants that could potentially serve as direct feeders into apprenticeship programs. We also reviewed the request-for-proposal process for these eight CBOs, did a literature review (additional sources to footnotes included in bibliography) and reviewed two data analysis prepared for TechSF by Brightline Defense on tech industry diversity in the Bay Area and an analysis of projected occupational growth in the tech sector.

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Appendix

A. Chart: TechSF Funded Non-Profit Training Providers

	<dev/Mission>	Code Tenderloin	missionbit	Upwardly Global
Age Eligibility	Ages 16-24	Ages 18+	Ages 18+	Ages 18+
Length of Program	12 weeks	6 weeks	4 weeks (Javascript prep); 7 weeks (summer youth boot camps)	Varies
Area of Focus	Programming & Coding	Programming & Coding	Programming & Coding	Job Readiness
Specific Skills	Front end web development HTML, CSS, JavaScript	4-Week Job Readiness Training 6-Week Code Ramp (Basics of Javascript) 4-Week SOAR sales training (Pathway to Account Executive)	Javascript (Pre-bootcamp prep course) Web Development Unity Game Design Android App Design Bootcamp	Help work authorized immigrants rebuild their professional careers in the U.S., including in tech fields. Offer technical skills training in IT, network systems admin, software engineering, web development, project management, and graphic design.
Corporate Partners	Uber, Google	Galvanize, Microsoft, Google	Facebook, Hack Reactor	
2018-2019 Enrollment Data				
OEWD Grant Award Totals*	$150,000	$230,000	$264,000	$100,000
Total Enrollees	45	70	250	38
Continuing Education or Job Placement	36	58	N/A	30

Apprenticeship Placements	N/A	N/A	N/A	N/A

*Grant awards are a combination of OEWD general funds, WIOA funds, and American Apprenticeship Grant (AAG) funds.

	BAYCAT	Bay Area Video Coalition (BAVC)	Jewish Vocational Services	MEDA
Age Eligibility	Ages 18-25	Ages 18+	Ages 18+	Ages 16+
Length of Program & Schedule	Spring and fall internship cohorts, 18 weeks	12 weeks	14 weeks	7 weeks
Area of Focus	Digital Media, Production & Design	Digital Media, Production & Design	IT, Database Administration, or Network Security	IT, Database Administration, or Network Security
Specific Skills	Video production and editing, motion graphics; with a focus on telling stories featuring the perspectives of women and people of color	Graphic design, video production and editing, digital marketing	Salesforce administration	Front end web development HTML CSS JavaScript
Corporate Partners	Clients include Golden State Warriors, UCSF, and the National Park Service			
2018-2019 Enrollment Data				
OEWD Grant Award*	$150,000	$190,000	$395,000**	$100,000
Total Enrollees	55	120	95	50
Continuing Education or Job Placement	14	120	74	40
Apprenticeship Placements	N/A	N/A	N/A	N/A

B. TechSF Client Enrollment and Placement Demographics, Fiscal Year 2018-2019

TechSF Client Enrollment and Placement Demographics, FY18-19

Table 1: Number and Percentage of Clients by Race with Average Wage and Placement Rate

Race	Enrollments		Placements		Wage	Placement Rate
	Number	%	Number	%		
African American	29	9%	12	10%	$26.37	41%
American Indian/Alaskan Native	6	2%	1	1%	$15.00	17%
Asian/Pacific Islander	67	22%	22	18%	$40.22	33%
Latino/Hispanic	100	32%	50	41%	$24.70	50%
White	74	24%	24	20%	$40.74	32%
Other Race	12	4%	4	3%	$50.90	33%
Decline to Answer	20	6%	9	7%	$28.88	45%
Total Clients	308	100%	122	100%	$32.39	40%

Table 2: Number and Percentage of Clients by Gender and Age Group with Average Wage and Placement Rate

Gender and Age Group	Enrollments		Placements		Wage	Placement Rate
	Number	%*	Number	%*		

42

	Number	%	Number	%	Wage	Placement Rate
Female	120	100%	57	100%	$31.53	48%
Under 25	32	27%	13	23%	$19.80	41%
25 to 39	50	42%	25	44%	$31.49	50%
40 to 59	36	30%	17	30%	$36.56	47%
Over 60	2	2%	2	4%	$42.70	100%
Male	184	100%	63	100%	$31.39	34%
Under 25	62	34%	22	35%	$18.98	35%
25 to 39	69	38%	22	35%	$29.04	32%
40 to 59	48	26%	17	27%	$48.45	35%
Over 60	5	3%	2	3%	$26.50	40%
Transgender/Gender Non-Conforming	4	100%	2	100%	$100.00	50%
Under 25	4	100%	2	100%	$100.00	50%
25 to 39	-	-	-	-	-	-
40 to 59	-	-	-	-	-	-
Over 60	-	-	-	-	-	-
Total Clients	308		122		$32.39	40%

*Column reflects row percentage of each gender identity, not grand total

Table 3: Number and Percentage of Clients by Residency with Average Wage and Placement Rate

	Enrollments		Placements			
Residency	Number	%	Number	%	Wage	Placement Rate

	Number	Percentage	Number	Percentage	Wage	Placement Rate
San Francisco Resident	220	71%	85	70%	$30.35	39%
Lives Outside San Francisco	88	29%	37	30%	$36.57	42%
Total Clients	308	100%	122	100%	$32.39	40%

Table 4: Number and Percentage of Clients by Education with Average Wage and Placement Rate

	Enrollments		Placements			
Education	Number	Percentage	Number	Percentage	Wage	Placement Rate
Less than High School	15	5%	6	5%	$15.67	40%
High School Graduate	35	11%	18	15%	$16.33	51%
Some College or Associate's Degree	71	23%	29	24%	$36.90	41%
Bachelor's Degree or Higher	136	44%	57	47%	$35.20	42%
Unknown	51	17%	12	10%	$35.99	24%
Total Clients	308	100%	122	100%	$32.39	40%

C. Program Profiles: Code Tenderloin & <dev/mission>

Code Tenderloin

One TechSF affiliate partner, Code Tenderloin, is five years old and is located in the heart of the Tenderloin District of San Francisco. The area has the highest concentration of homelessness, along with drug addiction. Code TL was born out of a necessity to provide some of the city's most vulnerable job readiness skills and pathways to job placement. Since inception five years ago the program has provided 5,000 participants job readiness skills, and within the past two-years, a coding bootcamp with an 87% completion rate. The program has served people who have faced chronic homelessness for years, people who've come out of recovery, and countless others. The program provides the following to each applicant:

Case Management: Each participant is paired with a case manager to assess where the individual is in their job search. A case manager can also take participants to get their identification, clothing for an interview, and other means to ensure they have all the necessary resources to apply for employment. The program also provides follow-up case management upon completion to help assist their graduates find employment, or referrals.

Job Readiness Skills: This 4-week program offers workshops on resume writing, how to do a job search, mock-interviews. They teach participants soft skills to work on conflict resolution and how to work in different settings. Upon completion the participant can pursue one of the following two tracks.

Track 1: On-Ramp Coding: This involves a 6-week/72 hour course that "teaches the basics of JavaScript from expert software developers from local tech companies." If students complete the program successfully they can further their JavaScript skills with Code Ramp++ in partnership with another coding training provider, Galvanize. Two recent graduates recently gained acceptance into Airbnb's selective paid six month software engineering apprenticeship program.

Track 2: Paid Internship as a Case Manager: Using curriculum adopted from City College of San Francisco, along with their own methodology in relating to the community they serve, Code TL offers JRS graduates an eight week internship in which they serve as a case manager to homeless people in the Tenderloin while being paid $17/hour. After 8 weeks of training participants can apply to become a case manager for Code TL, or are provided further assistance to become case manager for another organization.

<dev/Mission>

Dev/Mission is located in the Mission District in San Francisco. They were founded in 2017 by Leo Sosa to provide diverse young adults in the city exposure to STEM and careers in tech. They focus on career exploration and skill-building, and offer two after school programs primarily targeting high school students, and a semester-long training bootcamp open to young adults ages 16-24.

- **Track 1: STEM Hub:** These are dedicated open-house days when young adults can come and explore workshops.
- **Track 2: Digital Music Lab:** This is an afterschool program offered in partnership with Adobe and KMEL 106.1 radio to teach young adults audio recording, production, and editing skills.
- **Track 3: 12 Week Bootcamp:** This in-person program is run at the <dev/mission> office on Valencia Street. Curriculum covers HTML, CSS, Javascript, and computer hardware repair and mechanical engineering skills. The program also includes site

visits to local employers and mentoring matches with employer partner staff. There are two cohorts per year, typically including 20 participants each.

Our PAE team with <dev/mission> founder Leo Sosa, Jan. 20,2020

D. Competing Bay Area Bootcamp Programs

Bay Area Last Mile Programs Outside TechSF Ecosystem					
Program Name, Location, Length	**Job Placement Focus**	**Admissions Requirement**	**Curriculum**	**Employer Engagement**	**Student Financing Available**
Program Type: Apprenticeship Service Provider					
Year Up San Francisco, CA San Jose, CA Pleasant Hill, CA Menlo Park, CA 6 months of classes, 6 months of internship	IT, digital marketing, financial operations, sales	Ages 18-24	Technical and professional skills	6 month internship placement, 1,300 employer partners nationwide	N/A
Program Type: Bootcamp - No Fee					

Hack the Hood Oakland, CA 8 weeks	Web development	Low-income minority youth in California			N/A
Hidden Genius Project Oakland, CA 18 months (during high school)	Software development, entrepreneurship	Black male high school students in Oakland	Software development, entrepreneurship; business skills; personal identity and community awareness	Mentorship, hiring partner network	N/A
Samaschool San Francisco, online	Gig economy platforms (TaskRabbit, Care.com, Handy.com, etc)		Digital skills, soft skills necessary to use platforms, freelancer training		N/A
Techtonica San Francisco 6 months	Software development	Women and nonbinary people	Software development	Corporate hiring partners provide mentors, sponsor students, and participate in diversity training	N/A
The Stride Center Oakland 6 months, + 2 month certification	IT		IT technical skills, general professional skills		N/A
Program Type: Bootcamp - Tuition Pay					
Academy X San Francisco, CA Timing varies	Web development		Web development		Yes (discounts, prepay credit)
Acclaim Education Silicon Valley 8 weeks	Mobile development		Black Box testing, HTML & CSS, JavaScript, PHP, Python	Career services	No
AlwaysHired San Francisco, CA 1-3 weeks	Tech sales		Sales skills, soft skills	Contract with employer partners for placements	No

App Academy San Francisco, CA 12 weeks	Web development		Web development in multiple languages with focus on Ruby, soft skills	None	Partial ISA available
Berkeley Boot Camps Berkeley and San Francisco 12 weeks full time, 24 weeks part time	Data science, UX/UI, coding, cybersecurity, digital marketing	Some technical skills required	Full stack development	Employer hiring partners	Yes (scholarships)
BrainStation San Jose 10 weeks full time	Web development, mobile development, UX/UI design, digital marketing		Combined online and in-person project based learning in web development/ design	Tours with employer partners, networking	No
Coding Dojo Berkeley Silicon Valley 14 weeks	Software development, data science		Ruby on Rails, LAMP, MEAN, Python, .NET Core and Swift/iOS		Yes (partner loan programs, scholarships)
Data Application Lab Silicon Valley 19 weeks	Web development, data science		Project-based data science development	Employer hiring partners, alumni network	No
Data Science Dojo Silicon Valley 5 days	Data science	Knowledge of at least one programming/scripting language or computing environment	Data science, professional skills	Networking opportunities with fellow attendees	
Developer Bootcamp San Jose 6-10 weeks	Web development		Web development		Yes (payment plans, scholarships)
Galvanize San Francisco 12 weeks	Software engineering, data science		Web development, data science	Partners with various tech companies and start ups.	Yes (partner loan programs)

General Assembly San Francisco 10-13 weeks full time	Web development, mobile development, data science, product management, business, digital marketing		Technical web and mobile development, product management, data science, business, marketing	Offer corporate training to Fortune 1000 companies, and use relationships to facilitate student hiring process	Yes (partner loan agreement)
GrowthX Academy Online, but based in San Francisco 12 weeks	UX/UI design, digital marketing, tech sales, business development		Technical skills, professional skills	Part of a coworking community at Galvanize, students work with companies to build to-market strategies	Yes (partner loan programs, scholarships
Hack Reactor San Francisco 12 weeks	Software development	Some coding background required	Web development, software development	Internal career development/placement services	Yes (loan partner programs)
Hackbright Academy San Francisco, San Jose 12 weeks	Software engineering	Specifically targets women	Coding, APIs, HTML, CSS, SQL, Javascript, project and team-based work	Job search support	Yes (Tuition refund with employment payment plans)
Interview Kickstart Sunnyvale, CA 8 weeks part time	Software development - technical interviews	At least one coding language, data structure experience	Technical interview preparation; job search skills		No
Metis San Francisco 12 weeks	Data science	Programming experience, statistics experience, tech assessment, data science project challenge, interview	Interactive project-centered data science curriculum	Employer hiring partners	Yes (Partner loan programs, scholarships)
Product School San Francisco	Product management		Product management,	Local hiring partners	Yes (Loan programs)

Silicon Valley 8 weeks			career development		
Rithm School San Francisco 18 weeks	Software engineering	Interview, program-specific case assignment	Web development: HTML, CSS, Javascript, Python	Work on client projects with venture-backed companies, 4 weeks of tech interview prep	6 month job guarantee or tuition reimbursed
Tradecraft San Francisco 12 weeks	Software development, product management, UX/UI design, sales, business development		Start-up focused technical skills, soft skills	Employer hiring partners	Yes (Partner loan programs)
Program Type: Bootcamp - Income Share Agreement					
Holberton School San Francisco 2 years	Software development		Web development; full-stack web development; AR/VR; machine learning	6 month internship included in the program, mentorship from industry professionals	Yes (ISAs)
Lambda School Online, SF-based 6 months	Web development		JavaScript-focused development		Yes (ISAs)
Make School San Francisco Oakland 2 years	Product management, mobile development, software development	Some coding background	Computer science theory, product development, soft skills	Corporate partners for 6 month internship and job placement (Lyft, LinkedIn, Dailymotion)	Yes (scholarships, ISAs)

E. Apprenticeship Profiles: Twilio & Code for America

Twilio

Twilio's Hatch apprenticeship is a six-month program in software engineering first launched in 2017. They've hired 4 cohorts with a total of 28 apprentices. They've pledged to expand each cohort to 8-10 people with a goal of training 100 by 2023. Internationally, Twilio employs over 3,000 people.

Twilio specifically recruits apprentices from diverse backgrounds who do not have a computer science degree and have completed a bootcamp or remote learning program. Twilio prioritizes local hires. By comparison, Twilio had 49 interns in 2019 alone, most of whom were full-time students at four-year colleges. Apprentices and interns work 40 hours a week and receive the same hourly wage of $51/hour.

Successes:
- Typically receive over 300 applications for 8 cohort positions
- 90% of the first 28 apprentices converted to full-time employees at the program's end
- At least 6 former apprentices have been promoted to software engineer II

Challenges:
- Budgeting for apprenticeship positions can be stressful when done by department or business unit. It's easier when the company has one general funding stream for these positions that departments can draw on.
- Staff time can be limited for mentoring and supervising, particularly on new projects with big deliverables. It typically works best to place apprentices on more established teams and product lines where the work is consistent.
- To further engrain a culture of supporting apprenticeships, the company could make apprenticeships part of their departmental evaluation metrics.

Code for America

Code for America is a 501(c)3 that first launched their [apprenticeship program](#) in 2018. It is a full-time, salaried, nine-month program. As of January 2020 they matriculated five apprentices total (4 software engineer apprentices and 1 data science apprentice) with plans to take on three more beginning in April 2020. Their program specifically recruits and hires people with non-traditional credentials, who are switching careers or are recent bootcamp graduates, and is committed to bringing on diverse hires. Code for America has 77 employees overall.

Successes:
- CfA does performance evaluations bi-annually and also does mini-evaluations, which staff felt improved case management and offered more opportunities to check-in with apprentices about their progress.
- CfA found being a mentor for an apprentice was a great opportunity for their mid-level staff to gain the management experience necessary to move up.
- Each apprentice is assigned a supervisor, a mentor, and an "ally." Mentors are peers within the same team. Allies are peers from a separate team who schedule biweekly coffee dates to more informally connect and build a sense of belonging. Former apprentices are assigned as allies to new apprentices.

> **Challenges:**
> - As a smaller company, they found they need to diversify the type of occupations they hire apprentices for, so their company-wide skill-set doesn't skew too heavily toward software engineers. They're hoping to hire more data science and UX/UI apprentices moving forward. However, it's not clear UX/UI apprenticeships have been registered with the DOL.
> - Registering a new role can take up to 12 months.
> - Like many high-profile players in the tech space, CfA has a large national following. Encouraging local-only apprentice hires would be challenging.

F. DOL Tech Apprenticeship Workflows & Competencies

The following occupations have already been registered with the Department of Labor as apprenticeship positions with recommended workflows and competency checklists, included at the links. Software engineering apprenticeships are typically amended and built off the application developer or computer programmer positions.

Application Developer
Additive 3D Printing Technician
Cloud Operations Specialist 1
Cloud Operations Specialist 2
Commercial Drone Pilot
Computer Programmer
Computer Support Specialist
Computer Systems Analyst
Cybersecurity Support Technician
Database Technician
Data Scientist
Digital Marketer
Digital Video Editor
E-Commerce Specialist
Health IT Specialist
Help Desk Technician
IT Generalist
IT Project Manager

G. Case Study: CareerWise Colorado

Where: Colorado, with recent pilots in New York City, D.C., and Elkhart, Indiana.
Founded: 2016
Org. Structure: 501(c)3
Education Partners: 10 community colleges and high schools across 8 school districts, including Denver Public Schools
Employer Partners: 88
Total Apprentices to Date: 204 apprentices across first two cohorts in 2016-2017 and 2017-2018 school years. Data not available for 2018-2019 or 2019-2020 school years.

Program Structure: Students participate in on-the-job training during their junior year (12-16 hours per week) and senior year (20-24 hours per week) of high school, with the option of working full time as an apprentice the year after they graduate. Apprentices then have the option of continuing on at a community college with coursework aligned with their pathway.

Industries and Occupations:
Indicates program is in development

IT	Financial Services
● Quality Assurance Technician	● Staff Accountant
● IT Support Technician	● Insurance Underwriter
● Database Administrator	● Retail Banker
● Junior Coder	● Commercial Loan Officer
● *Web Developer**	● *Investment Research Analyst**
Manufacturing	Business Operations
● Quality Control Technician	● Sales Coordinator
● Manufacturing Technician	● Project Coordinator
● Maintenance Technician	● Human Resources Associate
● Logistics Technician	● Business Operations Associate

● CNC Machinist ● CAD Drafter	● Graphic Designer
Hospitality ● Hospitality Management	Education ● Paraprofessional to Teacher ● Early Childhood Educator*
Healthcare ● CNA to LPN ● Medical Assistant, *Billing and Coding Assistant**	

Key Components Driving Success:

● The initiative was created and driven by members of the business community, then systematically worked to get buy-in from K-12 public schools, community colleges, local leaders, state agencies and elected officials.
● Their founder, Noel Ginsburg, CEO of Intertech Plastics, had previously founded the Colorado Advanced Manufacturing Association (CAMA) in 2013, and served on the Metro Denver Chamber of Commerce, Colorado Economic Development Commission and Colorado Workforce Development Council, making him a natural bridge between business and government.
● The program had early buy-in from senior leaders, including Governor Jared Polis, former Gov. John Hickenlooper and former Labor Secretary Tom Perez.
● CareerWise Colorado was born out of an effort to create a Colorado-based version of the Swiss VPET system. Gov. Hickenlooper appointed Ginsburg to chair a new entity, the Business Experiential Learning Commission in 2015. The planning discussions included representatives from Colorado's community college system, Denver Public Schools, and business leaders.
● The program focuses on jobs that are in-demand locally and have strong growth prospects.
● The program is open to all students within a partner high school and seeks to avoid tracking by avoiding entrance requirements based on socio-economic status or demographics. They wanted all parents to be on board.
● They estimate employers get a 5 to 10% ROI per apprentice.
● Each employer is assigned a CWC account manager to manage the onboarding process and provide ongoing support.
● They created a formalized system for employer prospecting in order to scale when it was time to move beyond relying on the founder's personal contacts that got the program off the ground. They partnered with CAMA, the Colorado Technology Association, and local chambers of commerce to scale partners.
● They also adopted analytical software to scrape online job postings for entry and middle skills positions.

- They use a Community Readiness Framework to evaluate expansion school districts and focus on quality over quantity of district partnerships.

Challenges:

- Earning the trust of teachers and school administrators
- When government-led initiatives lack a clearly articulated case demonstrating how participating businesses will benefit.
- Becoming financially self-sustaining through fees paid by employers, rather than relying on philanthropy and foundation grants.
- Finding employers large enough to sponsor apprentices in rural areas.
- Finding the right balance between keeping the program open to every student and ensuring those who might benefit most have access, without tracking.

Sources: CareerWiseColorado.org, "CareerWise Colorado" HBS Case Study, presentation from Noel Ginsburg at HBS 4/8/20