



STANFORD TECH
HISTORY PROJECT

Executive Summary

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Stanford's large and complex technology ecosystem has greatly transformed since 2010. While the full report aims to cover many of these changes in detail, this executive summary highlights the overarching trends that we believe are the most significant.

Student interest in computer science and tech grew rapidly

Now the largest major at Stanford University, Computer Science experienced significant growth in the last decade. Major declarations started rising in 2007, and by 2010, Stanford had conferred 86 CS bachelor's degrees, comprising 5% of the senior class. Ten years later, that number had more than tripled to 307 CS bachelor's degrees, comprising 17% of the senior class. This rate of growth outpaced the national average rate of growth for CS programs, as well as the rate of growth for most other Stanford majors. The total number of conferred M.S. degrees in CS also doubled during the past decade, while the number of conferred Ph.D degrees in CS increased slightly.

Tech-related courses outside of CS degree programs also grew in number and popularity, as data science and computational methods began to be integrated into departments across the University. The number of tech-related classes across all departments grew by 76% over the decade, and total enrollment in tech-related classes grew by 55%.

Meanwhile, the number of non-tech related classes increased by just 24%, and the total enrollment in non-tech classes decreased by 0.2%. Outside of the classroom, ideas and opportunities from tech fields now shape other fields as well; hackathons sought solutions for nontechnical problems and career fairs increasingly focused on connecting nontechnical students to opportunities at tech companies.

Recruitment for tech-related jobs increased, and career fairs became more accessible to smaller tech companies

As tech jobs increased nationally, so did recruiting for them on Stanford's campus. We found that the Stanford Computer Forum's affiliates grew from 62 in FY 2010 to 132 at its peak in FY 2017; and the number of partner companies in tech industries listed on the general career services website grew from 6 to 15 in the last decade. Recruiting for Financial Technology (FinTech) and machine learning (ML) jobs enjoyed an especially pronounced growth relative to other areas, reflecting both national trends and Stanford's specific strengths.

In 2015, BEAM, Stanford's career center, witnessed the greatest increase in participation from companies, after BEAM transitioned to a pricing model for companies that adjusted the cost of participation based on the size of the company. This new entry bar rendered career fairs more accessible to smaller companies and startups, whereas previously high costs had long prohibited all but the big tech companies and consulting firms. While these larger companies still maintained a strong presence, a majority of BEAM's partners became companies with fewer than 250 employees. However, the Computer Forum maintained a fixed price for all corporate members and thus remains inaccessible to many small companies and nonprofits.

Also around 2015, BEAM underwent a framework shift and name change, shifting from the Center for Career Development (CDC) to Bridging Education, Ambition and Meaningful Work. This change emphasized fulfilling and impactful work, rather than merely finding a job. However, students still criticize the tech focus in recruiting at Stanford, which creates a perception of non-tech jobs as undervalued. BEAM has responded in part by creating more pathways for humanities students into non-technical jobs at tech companies. Community concern increased for integrating students' identities and ethical values into the recruitment process, as well as opening career networks to students from all backgrounds. BEAM made progress on this front over the decade, but there is still room for improvement.

Research, curricula, and applications around artificial intelligence skyrocketed

Stanford occupies the academic forefront of a global explosion in interest around AI. Fei-Fei Li, who created the ImageNet dataset in 2009 — a key milestone in the AI subdiscipline of computer vision — joined Stanford's CS faculty in 2009. In 2010, Stanford's Chris Manning developed CoreNLP, a set of AI-powered natural language analysis tools, which is now used by over 900 companies. In addition to leading AI scholarship, there has been an expansion in AI curricula, with enrollment in AI classes quadrupling over the decade, attracting fewer than 2,000 students in 2010 to more than 8,000 students by 2020. The number of AI-related classes in the CS Department also tripled, increasing from 25 to 77 classes.

The increased academic focus mirrors growth in industry applications. A number of AI-based startups have recently come out of Stanford, such as Viralspace, Sambanoa, Ambient.ai and Uhana. Stanford's administration has also leaned into the University's current and prospective leadership in AI, overseeing the 2019 creation of the Institute for Human-Centered AI (HAI) that aims to play a key role around the development and application of AI.

Diversity increased among CS students, especially for women, but these gains were less pronounced among CS faculty

The percentage of undergraduate CS degrees awarded to women increased from 8% to 29% from 2010 to 2018, exceeding the national female representation among B.S. CS degree recipients almost every year. This increase was primarily driven by Asian women, who went from comprising 29% of all female CS B.S. recipients in 2010 to 52% of all female CS B.S. recipients in 2018. The CS Department also increased racial diversity among its students. The percentage of degrees conferred to underrepresented racial minorities in tech (i.e. not white or Asian) rose from 13% to 23% for B.S. degrees, from 1% to 7% for M.S. degrees, and from 0% to 4% for Ph.D. degrees. The improvement still falls short of racial parity with Stanford's demographics: in 2018, 25% of undergraduate students and 10% of graduate students were underrepresented racial minorities. Students' backgrounds also affect their success within the major; for example, our survey of current undergraduate students in CS found that those from higher-income brackets have a far easier time in CS 106A than their lower-income counterparts.

The increase in representation is less prominent in instruction and research, as CS faculty remained largely male and white. The percentage of female CS tenure-track professors increased from 12% in 2010 to 15% in 2018, but consistently fell below the national average for female CS tenure-track professors. The percentage of nonwhite CS tenure-track teaching faculty increased from 12% in 2010 to 17% in 2018, driven by an increase in Asian representation. According to our surveys and interviews of undergraduates studying CS, a lack of diverse faculty consistently contributed to feelings of disbelonging in the major, but positive interactions with the few professors who shared their identities helped students from minoritized backgrounds.

Stanford's grassroots startup culture became more institutionalized

As many Stanford alumni and dropouts made it rich in Silicon Valley, some of them brought their expertise back to campus to fuel the next generation of tech startups at Stanford. Entrepreneurs and/or venture capitalists such as Peter Thiel '89 J.D. '92, Sam Altman (Stanford dropout), and Reid Hoffman '90 returned to teach classes at Stanford. Several courses are designed such that students will start companies in them, including How to Start a Startup, Lean Launchpad, LaunchPad, Startup, and Startup Garage — all offered between 2010 and 2014. LaunchPad launched more than 100 companies, and Startup Garage was the birthplace of over 130 companies including DoorDash. A robust ecosystem of entrepreneurship groups like BASES and StartX developed to support Stanford entrepreneurs with funding, community, and connections. VCs also embraced new ways to provide resources directly to Stanford students, such as by sending "scouts" to Stanford with the funds to invest in students' pre-seed and seed stage companies.

The institutionalization of startup culture over the past decade broadened its reach to more students. Today, more than 1 in 3 seniors have taken a class in entrepreneurship, though not all of these classes are tech-focused. However, exposure to startup culture and resources also remains unevenly distributed. For example, students across all levels of financial aid status share a similar desire for starting a startup, but undergraduates with no financial aid are 44% more likely to have a friend who has started a startup than undergraduates on full financial aid. There are also signs that “scrappier” startup culture on campus — students working on side projects for fun that might “accidentally” turn into large companies, Facebook-style — may be on the decline.

The ethical and societal implications of tech became a larger focus across Stanford

The 2010s saw a significant increase in work surrounding the ethical and societal implications of technology. At the start of the decade, much of this work focused on directly building tech for seemingly good purposes; the prominent student organization CS + Social Good began in the 2014-15 academic year and the popular class Hacking for Defense started in 2015-16. While this type of work still continues, the late 2010s saw a growing focus on preventing tech being used for bad purposes, driven by a national reckoning with tech’s impact and power. More emphasis was placed on interdisciplinary work and applying pressure from outside the tech industry. This manifested through the creation of the interdisciplinary tech ethics curricula in CS 182: Ethics, Public Policy and Technological Change and Embedded EthiCS, the establishment of the Cyber Policy Center (CPC), and student protests about companies that build tech for Immigration and Customs Enforcement.

While much of this work remained bottom-up (i.e. driven by students and faculty with specific interests and concerns), there was an increasing level of interest from University leaders, which helped coordinate a number of initiatives in this space. The University’s long-range planning process, which started in 2017, fueled the creation of HAI and the Ethics, Society, and Technology Hub — both of which serve as key organizing and funding vehicles for work in this space. These high-level initiatives attracted lots of external attention and funding (at least \$100 million for HAI). However, the consolidation of leadership, resources, and power in these spaces replicated some of the same biases that tech ethics and tech policy aim to address. HAI was designed by a team that appears to be 70% male and 80% white, and CPC was initially led by a team that appears to be 78% male and 89% white; both groups seem to have lacked any Black scholars.

Our survey of over 900 randomly selected current undergraduates captured a number of current students’ sentiments on the ethical and societal implications of tech. About 55% of undergraduates believe that tech’s impact on the world became more positive over the past decade. Nearly 60% of undergraduates also believe that Stanford provides a large

number of opportunities and resources to grapple with issues at the intersection of tech and another discipline. Meanwhile, 87% of undergraduates believe that a tech ethics class should be required for all CS majors, which is not currently the case — though there is a Technology in Society requirement that students frequently fulfill through a tech ethics course. And, while 67% of undergraduates believe Facebook has a negative impact on the world, Facebook continues to be one of the top employers of recent Stanford graduates.

Stanford's close ties with Silicon Valley sparked concern, but a lack of transparency made it hard to investigate all potential conflicts of interest

While Stanford's close ties with Silicon Valley are not new to the 2010s, many of those ties continued to strengthen in the early 2010s. By 2012, the university was flooded with so much tech money that an article in *The New Yorker* famously gave Stanford the nickname of "Get Rich U."

These ties generated pockets of concern across the University. Some administrators were concerned that the "Get Rich U" image, coupled with the rapid growth of CS, might threaten Stanford's liberal arts mission. And, when Silicon Valley's public image soured between 2016 and 2018 during the national techlash, some administrators hoped to ensure that Stanford's reputation wasn't only harnessed to the reputation of Silicon Valley. Embracing work around interdisciplinary topics like tech ethics and tech policy served as one way to shore up Stanford's liberal arts efforts and establish a more disjoint image from Silicon Valley. However, many of our interviewees expressed concern about how work on these topics at Stanford continues to rely heavily on tech companies for money, data, and other resources.

At times, our efforts to investigate conflicts of interests were inhibited by a lack of transparency. HAI did not release an annual list of donors from either of its two years of operation, contrary to its stated policy that "a list of HAI corporate, institutional, and individual donors will be published annually." Stanford stopped reporting the identities of foreign donors starting in January 2011, two months after Stanford created the Center at Peking University — despite a federal law requiring that U.S. universities disclose foreign gifts and contracts of \$250,000 or more. Stanford maintains donation policies that prevent the University from disclosing all but a high-level overview of each year's fundraising; detailed information on where Stanford Management Company invests the University endowment was also limited. BEAM used to publish an annual aggregated report on students' first career destinations until 2017, at which point they took down that webpage and stopped publishing the data, because they found it skewed toward certain sectors and post-graduation plans. Collectively, a lack of data limited our ability to understand Stanford's motivations for certain decisions, analyze Stanford's progress on key metrics, and observe violations of Stanford's conflict of interest policies.

Recommendations

These topline findings provide a snapshot of the most significant trends we found over the last decade, but our analysis does not stop there. This report also aims to inform future decisions that will maintain Stanford's status as a top innovation and engineering hub, increase diversity and inclusion in tech at Stanford, and create more technology with ethics and the public interest in mind. Whenever our analysis lended itself to a proposal that would advance these goals, we made recommendations accordingly. All of these recommendations are consolidated in an appendix of the full report.