

Impact: Stanford University's Economic Impact via Innovation and Entrepreneurship

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Contents

1	Executive Summary	2
1.1	Regional and Local Impact	3
1.2	Stanford's Approach	4
1.3	Nonprofits and Social Innovation	8
1.4	Alumni Founders and Leaders	9
2	Creating an Entrepreneurial Ecosystem	12
2.1	History of Stanford and Silicon Valley	12
3	Analyzing Stanford's Entrepreneurial Footprint	17
3.1	Case Study: Google Inc., the Global Reach of One Stanford Startup	20
3.2	The Types of Companies Stanford Graduates Create	22
3.3	The BASES Study	30
4	Funding Startup Businesses	33
4.1	Study of Investors	38
4.2	Alumni Initiatives: Stanford Angels & Entrepreneurs Alumni Group	44
4.3	Case Example: Clint Korver	44
5	How Stanford's Academic Experience Creates Entrepreneurs	46

6	Changing Patterns in Entrepreneurial Career Paths	52
7	Social Innovation, Non-Profits, and Social Entrepreneurs	57
7.1	Case Example: Eric Krock	58
7.2	Stanford Centers and Programs for Social Entrepreneurs	59
7.3	Case Example: Miriam Rivera	61
7.4	Creating Non-Profit Organizations	63
8	The Lean Startup	68
9	How Stanford Supports Entrepreneurship—Programs, Centers, Projects	77
9.1	Stanford Technology Ventures Program	78
9.2	Mayfield Fellows Program	78
9.3	Entrepreneurship Corner	81
9.4	EpiCenter—National Center for Engineering Pathways to Innovation	84
9.5	Other Stanford Programs Supporting Entrepreneurship	85
9.6	Clubs and Student Groups	92
10	Stanford Faculty and Research Staff	99
10.1	Academic Publications	101
10.2	Stanford Research	102
10.3	Stanford's Academic Organization	103
10.4	From Scientific Research to Commercial Products	105
10.5	Success of Funded Research	108
11	Stanford Internal Entrepreneurial Ecosystem: The Office of Technology Licensing	110
11.1	Company Formation: technology transfer	110
11.2	OTL Staffing and Operating Budget	112
11.3	Funding for Technology Startups	113
11.4	Impact of Technology Transfer on Tenure Review at Stanford	114
11.5	Best Practices Related to Stanford's Technology Transfer Process ¹	114
11.6	Results of Stanford's Technology Transfer Process	118

11.7 Business Expansion/Attraction/Partnerships	121
11.8 Incentives Supporting Existing Businesses	126
11.9 Best practices in creating collaborations and partnerships ²	128
11.10 Growth of Businesses as a Result of Collaboration	129
11.11 Business Relocation as a Result of Collaboration	130
12 Conclusions: Enhancing the Role of Research/Technology Universities in Innovation and Entrepreneurship	132
Acknowledgments	133
Appendices	134
A Appendix: Sources of Information	135
A.1 Stanford University 2011 Innovation Survey	135
A.2 Estimation Methods	137
A.3 Benchmark Comparison of Stanford Alumni Firms to Other Universities	141
A.4 An Explanation of Scale Factors Used	144
References	146

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ABSTRACT

This report focuses on data gathered from a large-scale, systematic survey of Stanford alumni, faculty and selected staff in 2011 to assess the university's economic impact based on its involvement in entrepreneurship. The report describes Stanford's role in fostering entrepreneurship, discusses how the Stanford environment encourages creativity and entrepreneurship and details best practices for creating an entrepreneurial ecosystem. The report on the 2011 survey, estimates that 39,900 active companies can trace their roots to Stanford. If these companies collectively formed an independent nation, its estimated economy would be the world's 10th largest. Extrapolating from survey results, those companies have created an estimated 5.4 million jobs and generate annual world revenues of \$2.7 trillion.

*The views expressed herein are those of the authors and do not necessarily reflect the views of the Ewing Marion Kauffman Foundation, Sequoia Capital or Stanford.

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1

Executive Summary

Stanford University has a deep history in entrepreneurship and technological innovation. For more than a century, the university has incubated ideas, educated entrepreneurs and fostered breakthrough technologies that have been instrumental in the rise and constant regeneration of Silicon Valley, and at the same time, contributed to the broader global economy.

Stanford graduates have founded, built or led thousands of businesses, including some of the world's most recognized companies – Google, Nike, Cisco, Hewlett-Packard, Charles Schwab, Yahoo!, Gap, VMware, IDEO, Netflix and Tesla. In the area of social innovation, the Stanford community has created thousands of non-profit organizations over the decades, including such well-known organizations as Kiva, the Special Olympics and Acumen Fund.

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Other key findings of the survey include:

- 29 percent of respondents reported being entrepreneurs who founded an organization (for-profit or nonprofit)
- 32 percent of alumni described themselves as an investor, early employee or a board member in a startup at some point in their careers.
- 25 percent of faculty respondents (some of whom are also alumni) reported founding or incorporating a firm at some point in their careers.
- Among survey respondents who became entrepreneurs in the past decade, 55 percent reported choosing to study at Stanford because of its entrepreneurial environment.

The Stanford Innovation Survey went out to 143,482 alumni out of 191,332 total living Stanford degree-holders from the 1930s to 2011. There were 27,783 responses with proportional representation from all seven schools, for an overall response rate of 19 percent. In addition, a total of 1,903 faculty received surveys and we received 1,134 faculty responses for a 59.6 percent response rate. Unfortunately, founders from some of the largest companies founded by Stanford alumni – HP, Cisco, Google and others – were not able to respond to the survey, so the numbers stated above and throughout this report are conservative and may not represent the full impact of Stanford entrepreneurship.

1.1 Regional and Local Impact

Stanford alumni maintain their ties to the university, the Bay Area and the state. They return to campus to recruit, lecture, collaborate in

research and advise current students. Forty percent of Stanford students find jobs through some form of networking, and the men and women who lead Silicon Valley's most innovative companies interact regularly by visiting campus to lecture, collaborate with faculty, and share ideas with the next generation of entrepreneurs currently filling classrooms.

According to the survey:

- An estimated 18,000 firms created by alumni are headquartered in California, generating annual worldwide sales of \$1.27 trillion and employing more than 3 million people.
- Among those who graduated after 1990, 25 percent of the responding entrepreneurs formed their companies within 20 miles of the university. (For engineers whose companies populate Silicon Valley, that figure rises to 31 percent.) Thirty-nine percent of all alumni founded firms are located within 60 miles of Stanford—or roughly a one hour's drive.
- 15 percent of graduate students from outside the United States stayed in the Bay Area and contribute to the region's robust infrastructure and entrepreneurial spirit. Since 1984, almost 44 percent (17,265) of Stanford's graduate students have come from outside the United States. That percentage has increased in recent years to 56 percent in 2010.

1.2 Stanford's Approach

How does Stanford create this entrepreneurial ecosystem? No matter what their major, students in all schools receive their education in the context of a robust liberal arts environment that gives them the broad worldview they need to be the innovators and leaders of tomorrow. The university encourages networking and collaboration across disciplines and schools, offers opportunities for testing ideas and encourages students to become involved in research and prototype their ideas. In addition, Stanford has for many years provided education specifically designed to encourage and develop entrepreneurs. The university began offering classes in small business and entrepreneurship as enrollment

mushroomed after the Second World War. Today, it offers dozens of courses and programs that educate and support potential entrepreneurs, including:

- *LaunchPad*, offered through the School of Engineering's Hasso Plattner Institute of Design (widely known as the d.school), is a 10-week course in product design and development in which student teams imagine, prototype, build, market, distribute and sell a product or service.
- *Creating a Startup*, a two-quarter course offered by the Graduate School of Business (GSB), is team-taught by Stanford faculty, serial entrepreneurs in Silicon Valley and members of local venture capital firms.
- *The Spirit of Entrepreneurship*, a School of Engineering course offered to undergraduates and graduate students, brings in speakers for the Entrepreneurial Thought Leader seminars to discuss topics like venture financing and business models that influence a successful startup.
- *iPhone Application Development*, a 10-week course taught by Apple engineers. Offered as a Stanford course as well as a free, downloadable course through iTunes U (grades, credits and access to faculty are only available to Stanford students), it has proven enormously popular. Many of the apps created as a result of course assignments are now sold through Apple's App Store.

More broadly, both the Graduate School of Business and the School of Engineering offer entrepreneurship curricula. The business school does this through its Center for Entrepreneurial Studies (CES) and the Stanford Venture Studio, a workspace for students exploring startups and entrepreneurial skills. The engineering school's classes are through the Stanford Technology Ventures Program (STVP) and the Hasso Plattner Institute of Design. All of these programs are open to students throughout the university.

Stanford's approach to entrepreneurship education is to bring together cutting-edge theory and real-world expertise in the classroom.

Classes may be taught by tenure-track faculty as well as seasoned entrepreneurs, veterans of the startup process who share their experiences and insights and may even provide key introductions to funders. Consulting faculty at the Business School and the School of Engineering—many from local firms—collaborate in teaching highly popular courses such as:

- Google chairman Eric Schmidt, venture capitalist Peter Wendell, and Stanford alumnus Andy Rachleff—respective co-founders of Sierra Ventures and Benchmark Capital—have team-taught *Entrepreneurship and Venture Capital*.
- Entrepreneur and venture capitalist Peter Thiel recently taught a class in the Computer Science Department about startups.
- Irv Grousbeck, co-founder of Continental Cablevision (later Media One) and a co-owner of the Boston Celtics, has taught entrepreneurship at the business school since 1985.
- Debra Dunn, formerly a senior executive at Hewlett-Packard, teaches in the School of Engineering's Hasso Plattner Institute of Design, including the course, *Designing for Sustainable Abundance*.
- IDEO partner Christopher Flink co-teaches *Brands, Experience and Social Technology*—an interdisciplinary experiment in teaching innovation—with Graduate School of Business professor Jennifer Aaker at the Hasso Plattner Institute of Design.
- Steve Blank, a serial entrepreneur and founder of Epiphany, and venture capitalists Ann Miura-Ko and Jon Fieber teach *Technology Entrepreneurship and Lean Startups* in the Stanford Technology Ventures Program.

According to the 2011 Stanford Innovation Survey, technical innovators—those who created new products, production processes or business models—and entrepreneurs were more likely than other alumni to have participated in entrepreneurship courses and programs. Approximately 25 percent of the technical innovators and founders reported taking an

entrepreneurship course at Stanford, including 60 percent of the “quick founders”—those who received venture capital funding within three years of graduation.

Competitions and programs for students also attract future entrepreneurs. The survey showed that 35 percent of technical innovators, 40 percent of founders and more than 50 percent of quick founders participated in E-Challenge, STVP, the Center for Entrepreneurial Studies, d.school or other entrepreneurship programs. All three categories of innovators were also much more likely to have used the alumni network, particularly for identifying funding, co-founders, early hires and mentors.

Mentorship at Stanford happens through formal relationships, such as those between adviser and student, and more informally through networking and proximity. The university extensively involves visiting entrepreneurs, consulting faculty, lecturers and fellows, and office hours for these individuals can quickly move from suggesting specific assignments to relaying war stories or providing real-time strategy sessions.

Many faculty members extend their mentoring to local companies by serving on boards. For example, Stanford professors Terry Winograd, Jeff Ullman and Rajeev Motwani moved from informal roles advising two graduate students—Larry Page and Sergey Brin, who became the founders of Google—to formal roles on the company’s technical advisory board in its early years.

The Stanford President Marc Tessier-Lavigne is a member of non-profit and corporate boards including Agios Pharmaceuticals, Regeneron Pharmaceuticals, Juno Therapeutics and Denali Therapeutics. The Former Stanford President John Hennessy is a member of boards of Google and Cisco Systems. School of Engineering Dean James Plummer serves on the boards of Intel, International Rectifier and Cadence Design Systems. Former Graduate School of Business Dean Garth Saloner serves on the boards of Quick Response Services, Brilliant Digital Entertainment, NextStage Entertainment and Tradeweave Inc.

The faculty brings domain expertise to the companies related to new technologies. This service, in return, gives academicians insights into industry challenges and consumer opportunities that often help to define long-term research.

Other programs for mentoring and networking include:

- The Stanford Technology Ventures Program's Mayfield Fellows Program provides mentoring and networking activities for gifted undergraduates or co-terminal master's students.
- The Hasso Plattner Institute of Design offers courses that focus on projects developed with industry partners. Classes involve teams of designers, engineers, social scientists and business students and often focus on identifying and solving problems or coming up with devices and innovations to satisfy real-world needs.
- The Stanford Institute for Innovation in Developing Economies (SEED) seeks to stimulate, develop and disseminate research and innovations that enable entrepreneurs, managers and leaders to alleviate poverty in developing economies.
- The Stanford Venture Studio is a workspace at the Graduate School of Business for students exploring startups and entrepreneurial skills.

Mentoring and career development programs also make it more likely graduates will remain near campus. Numerous entrepreneurship associations on campus, such as the Stanford Entrepreneurship Network (SEN) and the Business Association of Stanford Entrepreneurial Students (BASES), encourage this retention.

The continuing engagement with the university by graduates who have founded companies provides research, jobs and other opportunities for students. In 2011, for example, local businesses offering summer internships to Stanford students included Facebook with 35 interns, as well as LinkedIn and Palantir Technologies, with 25 each.

1.3 Nonprofits and Social Innovation

In addition to founding businesses, Stanford graduates created some 30,000 nonprofit organizations. These include such world-renowned organizations as The Special Olympics, founded by Eunice Kennedy Shriver, a Stanford sociology graduate; and Kiva, a microfinance organization

started by Jessica Jackley, a Stanford MBA, and Matt Flannery, with degrees in symbolic systems (BS) and philosophy (MS).

Other well-known nonprofits include the Acumen Fund, a global venture fund aimed at alleviating poverty co-founded by Stanford MBA Jacqueline Novogratz. Also, MentorNet which was created by Carol B. Muller, a Stanford engineering alumnus, to help university engineering and science students – especially women and minorities – achieve their career goals by matching them with mentors and guiding their one-on-one relationships over the Web.

But the majority of these nonprofits are small grassroots organizations that collectively have had an impact in education, global health or healthcare, the arts, economic development, human rights and many other areas.

At the same time, a growing number of graduates have pursued social innovation – the idea of doing well by doing good. Two of the best-known of these enterprises are Sally Ride Science, a science education company founded by astronaut Sally Ride, and Embrace, providers of an affordable infant warmer for the developing world that was created by four students enrolled in the university's *Design for Extreme Affordability* course.

1.4 Alumni Founders and Leaders

Below are just some of the Stanford alumni who have founded major companies (list is ordered by the year the company was founded):

- David Packard and Bill Hewlett, co-founders, Hewlett-Packard, Palo Alto, CA (1939)
- Russell H. and Sigurd F. Varian, William Webster Hansen, and Edward Ginzton, Varian Associates (1948) [Varian split into three companies in 1999. Varian Inc. is located in Palo Alto, CA.]
- Joe Coulombe, founder and former CEO, Trader Joe's, Monrovia, CA (founded as Pronto Markets, 1958)
- Ray Dolby, founder and chairman of Dolby Labs, San Francisco (1965)

- Doris Fisher, co-founder, Gap Inc., San Francisco, CA (1969)
- Charles Schwab, founder and chairman, Charles Schwab Corp., San Francisco, CA (founded in 1971 as First Commander Corp.)
- Phil Knight, founder and chairman, Nike, Beaverton, OR (1972)
- Andreas Bechtolsheim, Scott McNealy and Vinod Khosla, co-founders (with Bill Joy), Sun Microsystems, Santa Clara, CA (founded 1982; acquired by Oracle in 2010)
- Judy Estrin, serial entrepreneur (JLABS Inc, Precept Software, Bridge Communications (1981)
- Jim Clark, Silicon Graphics, Mountain View, CA (1981; acquired)
- Trip Hawkins, founder and CEO of Electronic Arts, Redwood City, CA (1982)
- T.J. Rodgers, Cypress Semiconductor, San Jose, CA (1982)
- Heidi Roizen, co-founder and CEO of T/Maker Company (1983)
- Leonard Bosack and Sandy Lerner, co-founders of Cisco Systems, San Jose, CA (1984)
- Morris Chang, founder and chairman, TSMC, Hsinchu, Taiwan (1987)
- Peter Thiel, Ken Howery, co-founders (with others), PayPal, San Jose, CA (founded 1988; acquired by eBay, 2002)
- David Kelley, founder of IDEO, Palo Alto, CA (1991)
- Jen-Hsun Huang, founder and CEO of Nvidia, Santa Clara, CA (1993)
- Jerry Yang and David Filo, founders of Yahoo!, Sunnyvale, CA (1994)
- Reed Hastings, founder and CEO of Netflix, Los Gatos, CA (1997)

1.4. *Alumni Founders and Leaders*

11

- Larry Page and Sergey Brin, founders of Google, Mountain View, CA (1998)
- Tim Westergren, Jon Kraft, co-founders (with Will Glaser), Pandora Radio, Oakland, CA (2000)
- Reid Hoffman, Konstantine Geuricke, Allen Blue, Eric Ly and Jean-Luc Vaillant, cofounders, LinkedIn, Mountain View, CA (2002)
- JB Straubel, co-founder, Tesla Motors, Palo Alto, CA (2003)
- Jeff Skoll, Participant Media, Los Angeles, CA (2004)
- Kevin Systrom and Mike Krieger, Instagram, San Francisco, CA (2010, acquired by Facebook in 2012)

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Author Biographies

Charles Eesley is an Associate Professor and W.M. Keck Foundation Faculty Scholar in the department of Management Science and Engineering at Stanford University. His research interests focus on strategy and technology entrepreneurship. His research seeks to uncover which individual attributes, strategies and institutional arrangements optimally drive high growth and high tech entrepreneurship. He is the recipient of the 2015 Richard Schulze Distinguished Professor Award, the 2011 National Natural Science Foundation Award in China, the 2010 Best Dissertation Award in the Business Policy and Strategy Division of the Academy of Management and of the 2007 Ewing Marion Kauffman Foundation Dissertation Fellowship Award for his work on entrepreneurship in China. His research appears in the *Strategic Management Journal*, *Organization Science*, *Research Policy* and the *Journal of Economics & Management Strategy*. Prior to receiving his PhD from the Sloan School of Management at MIT, he was an entrepreneur in the life sciences and worked at the Duke University Medical Center, publishing in medical journals and in textbooks on cognition in schizophrenia.

William F. Miller (1925–2017) spent about half of his professional life in business and half in academia. He served as vice president and provost of Stanford University (1971–1979) where he conducted research and directed many graduate students in computer science. Prior to

Stanford, he was Director of the Applied Mathematics Division at the Argonne National Laboratory where he actively engaged in developing computational science.

In 1968, Miller played a role in the founding of the first Mayfield Fund in venture capital as a special limited partner and advisor to the general partners along with four other Stanford faculty members. He became the Herbert Hoover Professor of Public and Private Management in the Stanford Graduate School of Business in 1979 and was a co-director of the Stanford Program on Regions of Innovation and Entrepreneurship (SPRIE).

As President and CEO of SRI International (1979–1990) Miller opened the think tank to the Pacific Region, establishing the spin-out and commercialization program at SRI and the David Sarnoff Research Center (now the Sarnoff Corp.) as a for-profit subsidiary of SRI. He has served on the board of directors of several major companies. Miller co-founded SmartValley, Inc. and helped create CommerceNet and served on its board of directors. He was a founding director of the Center for Excellence in Non-profits. He was a founder and chairman of Nanostellar Inc., and founder/chairman of Lumiette, Inc.

Miller was a Life Member of the National Academy of Engineering, Fellow of the American Academy of Arts and Science, Fellow of the American Association for the Advancement of Science, Life Fellow of IEEE and a member of the Silicon Valley Engineering Hall of Fame. He received Japan's Okawa Prize, the DongBaeg Medal from the Republic of Korea, the David Packard Civic Entrepreneur Award, and many other awards. In 2009, Konkuk University, Seoul Korea, established the William F. Miller School of Management of Technology and named Miller Honorary Dean.

Miller received the BS (1949), MS (1951), PhD (1956) and Honorary DSc (1972) from Purdue University.