Stanford

v1.5

Academic Innovation Translation Pathways

A guide for faculty, postdocs, and students seeking to translate their research into impact

Opening Statement

The Stanford Doerr School of Sustainability has a three-part mission: **create and deliver knowledge on Earth, climate, and society; innovate across disciplines; and drive policy and technology solutions in sustainability**. Stanford faculty are some of the most dynamic thinkers in the world and are well positioned to develop and launch policy and technology solutions. Many already do.

This guide was created through collaboration amongst faculty and staff from Stanford's Doerr School of Sustainability, Graduate School of Business, Law School, the Rock Center for Corporate Governance, and the Office of Technology Licensing to synthesize Stanford's institutional knowledge on translating innovation in its various forms. While our main focus is to support academic innovators working on policy and technology related to sustainability, we hope that this guide will benefit the broader Stanford community and the global entrepreneurship community, and it is our pleasure to offer it freely to any who may find it useful. We wish you the very best of luck with your endeavors.

Arun Majumdar
Dean, Stanford Doerr School of Sustainability

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01 Introduction and Purpose

Stanford University takes seriously the founding grant's charge to cultivate "direct usefulness in life" and "promote the public welfare by exercising an influence [on] behalf of humanity and civilization."[i] In its 2020 long-term vision statement, the university reaffirmed the founding grant: "Stanford has always been a wellspring of new ideas and innovative solutions, where curious people come to make a difference… [T]he scale and urgency of challenges facing us today require that Stanford amplify what has made us successful in the past and define new ways of making a difference… recogniz[ing] the need to forge deeper partnerships in our community and in the world to move ideas into action." The four themes of the long-term vision are (1) sustaining life on earth, (2) accelerating solutions for humanity, (3) catalyzing discovery in every field, and (4) preparing citizens and leaders." Woven throughout those themes is a commitment to ensuring equity and inclusion in our research and on our campus, embedding ethics across research and education and engaging with partners beyond our walls to learn from and give back to our local and global community."[ii]

Many faculty, staff, and students work on research or projects through labs, centers, accelerators, or classes with the express intent of making a significant positive impact.

When academic innovators' research or projects ripen sufficiently to grow beyond their initial scope and translate to applications, they face predictable questions: if/why to translate, what to translate, when, how, and with whom. In this context, "translation" refers to the process of taking a developed research or project idea and creating a structure for additional team members, funding, and scale, with the purpose of some broader impact. This may involve commercializing a new technology, starting a nonprofit, or scaling a current initiative. While Stanford has a reputation for an entrepreneurial culture and supporting academic innovators, it is not always easy to find important information, resources, advisors, funding, and potential collaborators, which are often scattered across schools and departments.

This resource carries on Stanford's long history of supporting academic innovators who are interested in creating projects beyond their academic work, which can both inform their research and drive direct positive change in the world. We synthesize institutional knowledge regarding various pathways for innovation translation and summarize key issues, questions, learnings, and resources to assist academic innovators considering launching their venture. We also explain various pathways with detailed case studies of successful projects, technologies, and organizations created by Stanford faculty.

i *The Founding Grant with Amendments, Legislation, and Court Decrees*. (1987). Stanford University.

ii *Long Term Vision*. Stanford University. Retrieved Aug. 12, 2024.

02 Steps for Translation

We summarize the steps required for a successful translation of academic innovation, each of which is discussed in more detail in the subsequent chapters:

1

CONSIDER THE KEY QUESTIONS

Chapter 3 outlines the key questions academic innovators should consider when deciding what type of pathway to pursue and how to proceed. Addressing these questions will help academics weigh the pros and cons of each option and anticipate potential challenges and issues that may need to be addressed.

2

PICK A PATHWAY

After reviewing the questions, one of the five common translation pathways in Chapter 4 will likely emerge as the best fit:

Stanford Initiative (Center, Lab, Group, Project, Etc.)

Launching an initiative within Stanford allows academics to continue their research and publish their findings, rely on Stanford for administrative support and funding, and use Stanford's research facilities, personnel, and brand. Stanford faculty remain in charge. Work is aligned with a mission-driven academic focus.

Nonprofit 501(c)(3)

Starting a nonprofit provides greater operational autonomy compared to a Stanford initiative, for which decisions are subject to university policies and administrative oversight. Academics may still lead long-term strategy but will delegate day-to-day operations to the executive director and faculty can spend no more than 13 days per quarter working on their nonprofit, as outlined by Stanford's Conflict of Interest policy. Founding an independent nonprofit may inhibit the academic's ability to continue research and publication in this area in their Stanford capacity.

License to a Third Party

By licensing their technology, academics can partner with an outside company to quickly develop and distribute their technology for maximum impact while creating passive income for Stanford, their department, and themselves. Academic innovators can remain dedicated to their academic pursuits without the need to spend time or energy starting a new venture.

2

PICK A PATHWAY (CONTINUED)

For-Profit Delaware C Corporation

When dealing with new technology or concepts with significant commercial potential, a for-profit entity is typically the best structure to attract funding, recruit top talent, and scale quickly. If academics wish to continue working full-time at Stanford, they must delegate daily operations to an executive team and a chief executive officer. However, they can still be involved and faculty can spend up to 13 days per quarter working for their startup, as outlined by Stanford's Conflict of Interest policy. As with an independent nonprofit, founding a C corporation may inhibit the academic's ability to continue research and publication in this area in their Stanford capacity.

For-Profit Delaware Public Benefit Corporation (PBC)

A public benefit corporation is ideal for academics who want to start a for-profit organization while also integrating a mission statement that focuses on achieving social and environmental objectives. Other considerations are identical to those for a C corporation. PBCs have an easier time attracting mission-driven investors and talent.

3

TALK TO THE OFFICE OF TECHNOLOGY LICENSING

For all pathways, academics must speak with the Office of Technology Licensing to discuss whether or not Stanford has a claim to any intellectual property and how to acquire the rights necessary for usage. Academics should understand Stanford's intellectual property policies. See Chapter 6.

4

TALK TO THE CONFLICT OF INTEREST TEAM

Regardless of pathway, it is important to contact the conflict of interest team in the office of the vice provost and dean of research. Conflicts may arise in any of the launch paths, whether through collaboration with Stanford personnel, use of Stanford resources or technology, or the 's additional role in the new startup or initiative. For more details, refer to Chapters 7 and 8.

5

HIRE A CEO OR ED

All pathways other than licensing technology to a third party also require a management team. The most important member is the chief executive officer or executive director. Academics should interview as many qualified candidates as possible and select someone who shares their vision, has relevant experience, works tirelessly, and who is excited by the opportunity. In rare cases, academics may take a leave of absence to take on the lead role themselves. We discuss this critical role in Chapter 10.

6

FUNDRAISE

All pathways other than licensing technology to a third party require funding. It is important to consider fundraising as early as possible. Beyond basic strategy (timing, amount, structure), successful fundraising depends upon the management team's narrative and network. Chapter 9 offers more detail.

7

RETURN TO THE KEY QUESTIONS

After completing steps 1 - 6, revisit the questions in step 1. Your answers may have shifted. We also highly recommend seeking advice from other academics who have launched ventures, including those featured in the case studies below. We are happy to assist and connect you as needed.

03 Key Questions to Consider When Choosing a Pathway

The following questions will help guide academic innovators in brainstorming and narrowing focus before choosing the type of project to pursue among the main pathways outlined in Chapter 4 (Stanford Initiative, Nonprofit 501(c)(3), License to a Third Party, For-Profit C Corporation, For-Profit Public Benefit Corporation), as well as identify potential challenges and opportunities and align strategy and goals.

Opportunity

- What is the problem or opportunity to be addressed?
- Who experiences the problem and who benefits from the status quo?
- What are the driving causes and what are the current available solutions?

Impact

- Who are the stakeholders?
- How is impact defined? What is the theory of change?
- How will impact be measured? What are the drivers?
- What are the long-term impact goals (type, speed, depth, scale)?
- Will measures of impact be reported? To whom?
- Are there foreseeable negative consequences? Can they be avoided?
- Who will guide the mission? How will they exert control?

Economics

- Is it possible to earn revenue?
- What is the total addressable market?
- What is the serviceable available market?
- What are the unit economics (revenue vs. cost per customer)? How do they change at scale?
- Can breakeven be achieved?
- Are revenue and impact directly and positively correlated? If not, what will be the balance between revenue and impact as the venture grows?
- Is there a potential exit (e.g., sale to a large company)?

Fundraising

- How much outside funding will be needed? When?
- Can this project attract initial investment or donations from family and friends or other close contacts?
- Can this project attract seed investment from family and friends or other close contacts?
- Can this project attract venture capital? (Delaware C and PBC only)

Control

- Who will oversee day-to-day management (chief executive officer or executive director)?
- Which person or group of people is in charge of long-term strategy?
- Which person or group of people has hiring/firing power over the management team?
- How will control be exerted? What rights and preferences do the various stakeholders have?
- What is the balance between centralized control (easy and efficient) and decentralized control (more accountability)?

Technology and IP Development

- Is the venture based on technology or information or other intellectual property that was developed at Stanford, or to which Stanford has a claim?
- Will the IP continue to be developed by the venture?

Continued Research and Publication

- Is continued research and publication in this area a priority for the ?
- Will the venture result in new technology (or methods, data, etc.) that will be useful for research?

Faculty Involvement

- How much time will this venture require?
- Does the faculty member need to gain new expertise? In what areas?
- Will the faculty member take a leave of absence to be a full-time manager?
- Will the faculty member remain in control?

Recruiting

- Who will serve as chief executive officer or executive director?
- What other core team members are needed?

Compensation

- How will the team be compensated? What is the market rate?
- How will faculty be compensated? What is the market rate?
- How can faculty compensation (money and/or equity) be balanced with team compensation to enable long-term success? What is typical?

Conflicts of Interest and Incentive Misalignment

- How will the team address the potential for conflicts of interest or incentive misalignment between:

  > Faculty and Stanford?
  >
  > Faculty and the chief executive officer or executive director?
  >
  > Graduate students and faculty, or Stanford?
  >
  > The founders, the management team, and investors or funders?

04 Translation Pathways: Overview

The chart below shows the level of inherent alignment between the five most common innovation translation pathways (shown as columns), and various priorities that academic innovators consider when choosing which pathway to pursue for their innovation (listed as rows).

Level of Inherent Alignment

None — High

N · Low · Med · High

Key Priorities of the Innovator	Stanford Initiative	Nonprofit 501(c)(3)	Licensing to Third Party	C Corporation	Public Benefit Corporation
MAINTAINING FOCUS ON MISSION & IMPACT	Med	High	Low	Low	Med
MAXIMIZING SPEED TO DEPLOY AT SCALE	Low	Med	Med	High	High
MAXIMIZING FINANCIAL RETURNS	N	N	Low	High	Med
MINIMIZING TIME COMMITMENT OF INNOVATOR	N	Low	High	Low	Low
MAINTAINING CONTROL	High	Med	N	Med	Med
MAXIMIZING ABILITY TO ATTRACT CAPITAL	Low	Med	N	High	High
MAXIMIZING ABILITY TO RECRUIT & RETAIN TALENT	Low	Low	N	High	High
MINIMIZING ONGOING STANFORD INSTITIUTIONAL CONSTRAINTS	N	High	High	High	High
AVOIDING CONFLICTS OF INTEREST WITH STANFORD	High	Med	High	Low	Low

Stanford Initiative

(Center, Lab, Group, Project, Etc.)

MISSION AND IMPACT	An initiative can tackle a broad range of missions and achieve significant impact, particularly when leveraging Stanford's brand and connections.
SPEED AND SCALE	Scaling an initiative and moving fast can be challenging within the Stanford ecosystem due to administrative requirements.
FINANCIAL RETURNS	Academic innovators can pursue their mission without the expectation of significant financial returns.
TIME COMMITMENT	Starting an initiative can be time-consuming, particularly during the startup phase and when managing administrative responsibilities as a faculty director, but faculty can pursue their research alongside the initiative, allowing the initiative to complement and enhance their academic work.
CONTROL	Academic innovators maintain control and can stay deeply involved in both the day-to-day operations and strategic direction.
FUNDRAISING	Stanford initiatives can earn revenue for mission-aligned activities. Faculty can leverage the university's resources and connections to secure funding directly from the university or through grant processes. However, external funding may still be necessary, depending on the size of the initiative. It is important to note that grant funding directed to the university is subject to administrative fees.
RECRUITING & TALENT	Although Stanford initiatives may be limited in the compensation they can offer, the Stanford brand provides a significant advantage in attracting highly capable talent, and the benefits and lifestyle are superior to most for-profit companies.
STANFORD INSTITUTIONAL CONSTRAINTS	Stanford initiatives may face institutional constraints with regard to governance, operations, partnerships, and revenue models.
CONFLICTS OF INTEREST WITH STANFORD	Academic innovators can continue using Stanford's research facilities and personnel. Stanford owns all IP generated. If the Stanford Initiative is to be affiliated with any outside organizations or companies, it will be important to ensure compliance with Stanford's Industrial Affiliate Program.

Chapter 11 features case studies of faculty who launched initiatives at Stanford, including The Natural Capital Project, DeepSolar, and the Golub Capital Social Impact Lab.

Nonprofit 501(c)(3)

MISSION AND IMPACT	A nonprofit[iii] can pursue its mission without needing to make a profit, but its impact will be constrained by its ability to earn revenue or secure substantial funding.
SPEED AND SCALE	Achieving larger scale and faster progress may be easier as compared to a Stanford initiative, as independent nonprofits are not bound by Stanford's institutional restrictions.
FINANCIAL RETURNS	Like Stanford initiatives, nonprofits are not driven by financial gains, so founders can focus on impact without the pressure of achieving financial returns. Nonprofits can still earn revenue for mission-aligned activities.
TIME COMMITMENT	Starting a nonprofit requires significant effort. If academic innovators choose to remain full-time at Stanford, they are limited by the conflicts of interest rules regarding outside consulting and faculty may spend no more than 13 days per quarter on the nonprofit.
CONTROL	A nonprofit is required to have a board of directors, which controls the nonprofit's long-term strategy and has 'hire and fire' power over the executive team. Typically the academic innovator is on the board, but they can be outvoted by a majority of directors.
FUNDRAISING	While for-profit startup companies rely on equity investment and scalable revenue generation, nonprofits can access funding through earned revenue, grants, and donations. However, while donors are often eager to fund projects that are new and innovative, they are often less interested in providing operating expenses thereafter. So, early on, nonprofits must consider their long-term fundraising and revenue model.
RECRUITING & TALENT	It is often cheaper to hire the same person to a nonprofit than to a for-profit because they are usually willing to accept some discount for mission-aligned work. The trade-off is that nonprofits may not be able to compete for the best talent or be able to retain them long-term.
STANFORD INSTITUTIONAL CONSTRAINTS	Nonprofits are not limited to the university's environment and offer agility and flexibility in terms of governance and operations, fundraising, partnerships, and revenue models.
CONFLICTS OF INTEREST WITH STANFORD	Academic innovators are limited by Stanford's conflicts of interest policies and must delegate non-Stanford activities to an executive team. Academic innovators cannot utilize Stanford's research facilities and personnel for their nonprofit activities.

Chapter 11 features two faculty nonprofit case studies: Digital Inquiry Group and 1 Grain to 1000 Grains.

iii An alternative to forming a tax-exempt 501(c)(3) is "fiscal sponsorship," where an existing nonprofit organization provides its legal and tax-exempt status to support a project or initiative that does not have its own structure. It may also offer administrative support. Most fiscal sponsor relationships require a percentage fee of money raised. However, for Stanford academic innovators who prefer not to establish an independent entity, starting a Stanford initiative may be a more practical option, as it offers similar benefits within the university framework.

License to a Third Party

MISSION AND IMPACT	When licensing to a third party, the mission and impact will mostly depend on the priorities of the licensee. Inventors and the Office of Technology Licensing may exert influence via the license negotiation process but are not involved in day-to-day management once the license is granted.
SPEED AND SCALE	Partnering with a third party offers the potential for achieving large-scale and relatively rapid progress, as the licensee may have the resources and capacity to quickly develop and implement the technology. However, if the licensee decides to move more slowly (or their priorities change entirely) then there is little the inventor member can do.
FINANCIAL RETURNS	Starting a new venture can be hard and involves raising funds, developing a product or service, and hiring and managing a team. By licensing to a third party, inventors may enhance their chances of achieving some financial return while avoiding the risks associated with starting a company. One drawback is that if the technology's value dramatically rises, the lion's share of the value will be retained by the licensee rather than the inventor.
TIME COMMITMENT	There is no time commitment required from inventors when licensing their technology apart from working with OTL on the licensing details.
CONTROL	The inventor has little to no control; the licensee controls the use, development, and distribution of the licensed technology within the parameters established by the license.
FUNDRAISING	Many technologies, particularly early-stage technologies, require substantial capital to transition from initial concept to a functional working product. By licensing to a third party, inventors can avoid the need to fundraise.
RECRUITING & TALENT	Not applicable.
STANFORD INSTITUTIONAL CONSTRAINTS	Once the inventor has completed the OTL licensing process, Stanford imposes no additional constraints.
CONFLICTS OF INTEREST WITH STANFORD	By licensing their technology, academic innovators can remain dedicated to their academic pursuits (research, publication, teaching, mentorship) without diverting their attention to starting a new organization. The academic innovator can continue to utilize Stanford's research facilities and personnel to develop new technology.

Stanford has granted many licenses for its technology. Fact patterns, technologies, and economic terms vary widely. Since negotiating a license is managed by OTL and inventors do not directly participate in this process, we have not included any case studies in this guide. For more information, contact the Office of Technology Licensing.

For-Profit: Delaware C Corporation

MISSION AND IMPACT	When starting a for-profit venture[iv], the primary focus is typically on achieving financial returns rather than pursuing a specific mission. As a result, academic innovators may not be able to prioritize the mission and impact they desire, particularly after the company takes on outside investors who are focused on profit.
SPEED AND SCALE	For-profit companies employ business models focused on efficiency and speed, enabling them to expand rapidly and achieve large scale.
FINANCIAL RETURNS	When the technology or concept has significant commercial value, a for-profit entity is best suited to attract investors, secure funding, scale, and ultimately exit via acquisition or initial public offering. Founders of for-profit companies have the opportunity to earn market-rate salaries or consulting fees and also have the potential to exit for a large lump sum payment for equity if the company is sold or goes public.
TIME COMMITMENT	Starting a for-profit venture can be challenging and requires fundraising, hiring a CEO, and assembling a team. Additionally, if faculty wish to remain full-time at Stanford, they are limited to spending no more than 13 days per quarter on their company.
CONTROL	A corporation is required to have a board of directors, which controls the company's long-term strategy and has hire and fire power over the executive team. In general, members of the board are elected by the holders of a majority of the company's outstanding shares, which means that the company is effectively controlled by the person or group that owns the majority of stock of a company. In addition, when VCs invest, they will have certain important veto rights that allow them to exert powerful influence over a company despite being minority shareholders. VCs and other investors may also demand representation on the company's board of directors.
FUNDRAISING	A new for-profit company requires significant investment to successfully launch and scale. Academic innovators will be required to build a compelling business case and should learn how to pitch investors, which can require significant time and effort. An experienced chief executive officer may lead fundraising, depending on how early they join the company.
RECRUITING & TALENT	Compared to nonprofits and initiatives, C corporations can more easily attract and retain outstanding talent because they can offer higher compensation packages and other incentives.

iv Other common for-profit corporate forms include the LLC and the S corporation. These structures may have some tax advantages over the C corporation, but these advantages are moot for startups, and C corporations (or public benefit corporations) are the only entity type that can accommodate the number and type of equity holders typical of a high-growth technology company. Venture capitalists almost exclusively invest in C corporations and public benefit corporations and other types of equity financing. For a full consideration of the benefits and costs of choosing between corporate entity types, you should consult legal, tax, and financial advisors.

STANFORD INSTITUTIONAL CONSTRAINTS	A for-profit company offers greater operational freedom and flexibility than an initiative within the university environment, allowing founders to move and make decisions more swiftly. Academic innovators must abide by OTL and COI policies.
CONFLICTS OF INTEREST WITH STANFORD	Academic innovators are limited by Stanford's conflicts of interest policies and must delegate non-Stanford activities to an executive team. Academic innovators cannot utilize Stanford's research facilities and personnel for their company activities.

Why Delaware?

Establishing a for-profit company requires legally forming the corporate entity in a particular state. A business is eligible to incorporate in any state (and may register as a "foreign" corporation where its headquarters is located). Almost all technology companies incorporate in Delaware for the following reasons:

Court Expertise
Delaware's specialized Chancery Court is renowned for its expertise in handling corporate disputes and interpreting corporate law, providing businesses with a stable and predictable legal environment and clear legal precedent.

Liability Protection
Delaware offers the most generous personal liability limitations for directors and officers of Delaware corporations.

Market Standard
Lawyers, investors, and other businesspeople understand Delaware law and template agreements are drafted for Delaware law. This significantly reduces transaction costs, which leads to more Delaware incorporations, creating a natural feedback loop. The overwhelming majority of VC-backed companies are incorporated in Delaware.[v]

Filing Processes
Delaware has a well-developed and efficient system for processing business filings. The Delaware Division of Corporations is known for its responsiveness and offering online services that simplify business incorporation and maintenance.

Overall, incorporation in Delaware offers businesses advantages that are conducive to growth, investor confidence, and long-term sustainability. While Delaware C corporations are a popular choice, a founder should consult with legal, tax, and financial advisors prior to incorporation.

For further discussion see Chapter 11, which contains case studies detailing Amprius Technologies, Impossible Foods, and Mitra Chem and key considerations to launching as Delaware C corporation.

v Bartlett, R. P. (2023). *Standardization and Innovation in Venture Capital Contracting: Evidence From Startup Company Charters*. Rock Center for Corporate Governance at Stanford University. Working Paper No. 253.

For-Profit (+ Mission): Delaware Public Benefit Corporation

MISSION AND IMPACT	The distinguishing feature of a public benefit corporation is its public benefit statement, a commitment to pursue a positive impact on society and/or the environment in addition to generating profits for shareholders. PBC must produce regular impact reports for shareholders, and its directors and officers have a fiduciary duty to adhere to the mission.
SPEED AND SCALE	Not materially different from a C corporation.
FINANCIAL RETURNS	A PBC — while still a for-profit entity that must generate returns — must also deliver on its mission. This may distract from financial returns (or drive even higher financial returns).
TIME COMMITMENT	Not materially different from a C corporation.
CONTROL	Not materially different from a C corporation.
FUNDRAISING	PBCs have an easier time attracting mission-driven capital, e.g., non-dilutive grants from foundations and the government. On the other hand, PBCs might have a harder time raising traditional venture capital funding, as some investors may be concerned that the emphasis on public benefit could detract from a focus on profits.
RECRUITING & TALENT	In some cases, PBCs might be even more competitive than C corporations in attracting and retaining talent if the talent is aligned with the mission.
STANFORD INSTITUTIONAL CONSTRAINTS	Not materially different from a C corporation.
CONFLICTS OF INTEREST WITH STANFORD	Not materially different from a C corporation.

Chapter 11 features a faculty public benefit corporation: Atlas AI.

05 Defining Impact

Before beginning an innovation translation journey, academic innovators should clearly define the impact they seek. This section provides an overview of impact-focused frameworks and definitions commonly used at Stanford.

BACKGROUND

The term "impact" is ubiquitous and at risk of becoming generic. It is a value-neutral term, but generally is taken to mean "creating positive effects" or "reducing negative effects." Leland and Jane Stanford defined what we would now call "impact" as "promot[ing] the public welfare by exercising an influence [on] behalf of humanity and civilization." They explicitly prioritized public welfare as opposed to private gain and implicitly emphasized the "good." The university's "good impact" was to be achieved by "teaching the blessings of liberty regulated by law, and inculcating love and reverence for the great principles of government as derived from the inalienable rights of man to life, liberty, and the pursuit of happiness."[vi] Academic research and training will always be Stanford's main purpose and impact.

Broadly speaking, there are several fundamental problems when it comes to defining, measuring, and attributing "impact": First, causality is impossible to prove deterministically. It may be the case that actions correlate with outcomes but do not cause them. The current state of metaphysics and epistemology demands humility on this count, as scientific knowledge rests upon likelihoods, not certainties. This makes it difficult to claim credit and attribute impact to any particular cause or set of causes. Second, timeframes are long. The effects of any action, such as a technology or policy, may not be truly understood for many years, or even generations. In particular the field of sustainability is focused on impacts that stretch far beyond the timescale of a human life. Third, there may be unintended consequences that reduce the target impact or overshadow it completely. Last but not least, a question of normative ethics: Presuming that we aim for "good" impact, what is "good"? Here, we have seen a general trend away from a dogmatic past and toward a relativistic future. This is a more accepting world, and a more complicated one.

We will not attempt a unified definition of impact. We simply offer a gentle reminder that impact is difficult to define, hard to measure, not amenable to deterministic causal analysis, and that any idea of "good" must admit some degree of ethical relativism. Nevertheless, doing good is worth striving for with vigor, curiosity, and humility.

In our conversations with faculty founders, most see impact through the worldview of their discipline and also think critically about the depth, scale, and speed of impact. Their ideas and definitions of impact are woven into the case studies in Chapter 11.

vi *The Founding Grant with Amendments, Legislation, and Court Decrees*. (1987). Stanford University.

Clearly the grant traces its lineage to the founding principles of a young nation that had just celebrated its centennial. It is also worth noting that both the Stanford family and the university have an uneven history of impact and more than a few blemishes.

IMPACT FRAMEWORKS

Despite healthy and reasonable skepticism with measuring impact, we offer a few frameworks that may prove helpful as a starting place for inquiry:

Theory of Change

Theory of Change is a comprehensive framework that outlines how and why a desired change is expected to happen in a particular context. It maps out the steps, activities, and interventions needed to achieve long-term goals, linking them to intermediate outcomes and underlying assumptions. For innovators creating their first Theory of Change, *here is a workbook* to get started.

Environmental, Social, and Governance

Environmental, Social, and Governance (ESG) is a set of criteria used to evaluate a company's impact and practices in sustainability, social responsibility, and corporate governance. ESG is meant to help managers, shareholders, and investors assess how well a company manages risks and opportunities related to these areas.

Triple Bottom Line

Triple Bottom Line (TBL) is a sustainability framework that evaluates a company's performance based on three dimensions: social, environmental, and economic. TBL encourages businesses to focus not only on profit (economic) but also on people (social) and the planet (environmental) to achieve long-term sustainability

Effective Altruism

Effective Altruism sits at the intersection of philosophy and economics. It suggests that once a problem is scoped and defined in terms of variable outputs, such as human quality-adjusted life years, impact may be calculated based on: (1) importance — scale and severity of the problem in terms of the defined outputs, (2) tractability — ease and feasibility of making progress, and (3) neglectedness — how underfunded or overlooked the area is. This "ITN" framework helps allocate resources effectively to maximize positive impact.

DEFINING IMPACT AT STANFORD

Stanford Doerr School of Sustainability

The Doerr School's vision for impact is to create a sustainable society by advancing knowledge critical to sustaining life on Earth, preparing students to lead, and catalyzing informed action to generate local, national, and global solutions. The school's three-part structure is designed to amplify global impact: (1) departments and programs to generate knowledge, (2) institutes to innovate across disciplines, and (3) the accelerator to drive policy and technology solutions.[vii]

Stanford Impact Labs

Stanford Impact Labs measures impact by considering the extent to which changes to policy, practice, or markets ultimately improve people's lives. When considering whether something has improved lives, SIL considers the breadth of impact (how many people benefit and who benefits), depth of impact (by how much do people benefit), the contribution of the team, and any associated impact risks. As a funder uniquely positioned within the university, SIL runs a competitive investment selection process each year for partnerships between faculty and leaders in the public, private, or social sectors. Funded teams receive financial capital, professional training, thought partnership, and individualized coaching. SIL also trains faculty, scholars, policymakers, and community leaders to leverage data and evidence for the public good.[viii]

vii Doerr School of Sustainability. *About the School*. Stanford University. Retrieved Aug. 12, 2024.

viii Stanford Impact Labs. *Accelerating Impact*. Stanford University. Retrieved Aug. 12, 2024.

Stanford Graduate School of Business Center for Social Innovation

The Stanford Center for Social Innovation defines impact as the positive and negative effects that an organization or innovation has on people and the planet. CSI created the Impact Compass, a visual tool that helps people assess the relative social impact potential of different organizations, programs, and ventures. The tool uses a scoring system to represent the six key dimensions of impact.[ix]

ix Center for Social Innovation. *Impact Compass*. Stanford University. Retrieved Aug. 12, 2024.

06 Office of Technology Licensing

For any pathway, it is necessary to work with Stanford's Office of Technology Licensing before launching.[x] As a general rule, Stanford owns inventions conceived or reduced to practice in whole or in part by members of the faculty or staff (including student employees) of the university in the course of their university responsibilities or with more than incidental use of university resources. Additionally, Stanford's Inventions, Patents, and Licensing Policy requires that potentially patentable inventions be disclosed in a timely manner to OTL.

BACKGROUND

Stanford's OTL, established in 1970, manages the university's intellectual property. OTL's mission is to facilitate technology transfer for public benefit and to generate royalty income to support research and education.[xi] OTL receives technology disclosures, evaluates technology, decides if and when to file patents, markets technology, and negotiates technology licenses with third-party organizations, third-party startups, and Stanford startups.

Academic innovators must understand this ecosystem and Stanford's policies in order to successfully launch their ventures, particularly as these policies relate to IP. Types of IP include patent, copyright, trademark, and tangible research property.[xii] Innovators should keep in mind that the technology licensing process (more details below) can require significant time and effort from both OTL and the faculty.

"Since its inception, OTL has prioritized the good of society. This has led to successful outcomes for all stakeholders, including Stanford. Some other university technology licensing offices have a mandate to generate revenue, which may distort incentives and lead to short-term thinking."

- **Jim Plummer**, Dean of the School of Engineering from 1999 to 2014

x Policies are subject to change and may be updated periodically. For the most current version of any policy, refer to the Stanford Research Policy Handbook and the Office of Technology Licensing website.

xi Office of Technology Licensing. *About OTL*. Stanford University. Retrieved Aug. 12, 2024.

xii Office of Technology Licensing, *Intellectual Property Basics*, Stanford University. Retrieved Aug. 12, 2024.

OTL is one of the country's most active offices in university-industry technology transfer. In 2023, OTL generated $59 million in licensing revenue, disclosed 568 new technologies, granted 115 licenses (including 27 to startups), and issued 173 new U.S. patents. OTL manages over 4,000 active dockets and receives invention disclosures from faculty, staff, and students. In addition to patents, OTL has processes for copyright (including software) and tangible research property.

The majority of technology disclosures — about 60% — are potentially patentable innovations originating from Stanford's laboratories.[xiii] These disclosures encompass a wide range of advancements across various fields, reflecting the university's commitment to fostering groundbreaking research and innovation. OTL's process is outlined below.[xiv] It begins with disclosure, proceeds to OTL's decision to patent (if applicable), and concludes with a license.

xiii "Potentially patentable" refers to inventions for which OTL files provisional patent applications because they believe there may be potential for licensing opportunities.

xiv Office of Technology Licensing. *OTL's Process*. Stanford University. Retrieved Aug. 12, 2024.

Technology Licensing Process Overview

1 DISCLOSURE

When developing technology, inventors must disclose any inventions that are conceived or at least partially developed within the scope of their university responsibilities or through non-incidental use of university resources. (Practically speaking, this means that Stanford owns any IP related to research and any IP created using Stanford lab space or special equipment.)

A disclosure should be made as soon as a academic innovator believes they have discovered something unique with commercial value and far in advance of publications or presentations related to the discovery. The disclosure is made via an Invention and Technology Disclosure Form. This submission establishes a record including the invention's description, the inventors, sponsorship details, and information on public disclosures and publications. Authorization from the principal investigator of the research is necessary for inventions originating from their lab or research, regardless of whether or not the PI themself was an inventor.

2 MANAGER ASSIGNMENT[xv]

OTL assigns a docket number to each disclosure and allocates a designated licensing manager. This manager assumes responsibility for all subsequent actions related to the disclosed invention.

3 EVALUATION

The licensing manager meets with the inventor(s) to discuss the invention and evaluates its patentability, novelty, potential applications, manufacturing feasibility and market potential. It may be the case that there is existing technology that will preclude a patent. Furthermore, due to the costs of patenting a new technology, the licensing manager may decide against pursuing the commercialization of the invention (in 2024, it cost between $30,000–$60,000 to apply receive a U.S. patent, including attorney time and filing fees).

xv In instances an invention is co-owned with other institutions or where a research sponsor is entitled by contractual agreement to manage inventions resulting from the sponsorship, the primary responsibility for marketing, negotiation and licensing may be managed by the other institution or research sponsor.

4 PUBLIC DOMAIN

Faculty have the freedom to place their inventions in the public domain if it benefits technology transfer, provided that the transfer complies with any U.S. federal government grants or other relevant agreements. When inventors choose this option, Stanford waives its intellectual property rights over these inventions. However, faculty are encouraged to think critically and discuss with OTL and patent attorneys before placing their invention in the public domain as doing so may not always result in the widest possible use of the invention. (There is little incentive for a third party to develop and commercialize a technology when its competitors can freely copy and compete. Patents protect against this).

5 PATENT APPLICATION[xvi]

OTL evaluates each invention disclosure to determine if patent protection and licensing are viable before investing in a costly application. Factors such as prior publications (which affect the novelty and non-obviousness of an invention), market potential, and development costs influence this decision. If pursuing patent protection is deemed worthwhile, the licensing manager collaborates with inventors and a patent attorney to prepare the application.

Inventors play a crucial role in the patenting process, providing expertise that ensures the application accurately reflects the invention's novelty and utility. The patent attorney, while knowledgeable in the field, relies on inventor input to craft effective patent applications and responses to patent office inquiries. Clear inventor contributions are essential for determining patent inventorship.

6 MARKETING THE INVENTION TO THIRD PARTIES

OTL ensures fair and unbiased technology transfer decisions for public benefit, free from undue influence of Stanford stakeholders. Hence, OTL markets all Stanford technologies openly to potential licensees prior to licensing to a Stanford inventor's startup. Inventors' insights on technical feasibility, market potential, and company leads are crucial.

Inventors themselves are usually the most promising licensees because of their expertise and willingness to shepherd a new technology in its infancy. When other companies express interest and seek detailed technical information, OTL typically involves inventors, sometimes under confidentiality agreements, to provide necessary details.

7 NEGOTIATIONS

If a company is interested in licensing the technology, OTL licensing manager initiates and leads negotiations. These negotiations begin with a license proposal from either party and often require flexibility and creativity to reach a mutually beneficial agreement. Terms vary based on technology, market, and company; for instance, startups may offer equity or deferred payments rather than fees upfront.

xvi In some cases, such as with copyrightable works, a patent may not be feasible. Instead, OTL might seek copyright protection.

It is important to note that only 20-25% of Stanford invention disclosures are licensed, largely due to their early-stage nature. If a license is granted, there are two potential outcomes:

1. **Licensing to a Non-Affiliated Inventor Company**: In such a scenario, if OTL decides to license the technology to a company unrelated to the inventor, the licensing manager will inform the inventor. The inventor may also participate in assessing the licensee's ability to develop products, but if the licensing goes through, the licensing manager handles the financial and contractual negotiation with the third party company.

2. **Licensing to an Inventor-Affiliated Company**: If the licensee is an inventor-affiliated venture (nonprofit, Delaware C corporation, or PBC), the inventor will need to engage in a conflict-of-interest review to resolve any academic and professional conflicts.[xvii]

A license can either be exclusive (one licensee) or non-exclusive (multiple licensees). The license may be granted to both a non-affiliated entity and the Stanford entrepreneur's venture; such a license can be non-exclusive for both parties in all fields of use, or exclusive within a particular field of use.

In addition, the licensee may choose an option, allowing them the option to license the invention over a period of time — typically six months initially — with extensions possible up to one year. Options agreements can be valuable to reserve technology rights for faculty ventures that are still seeking funding and do not want to pay for a full license immediately.

MONITORING PROGRESS

Signing a license agreement initiates a lasting partnership between Stanford and the licensee. The licensing manager oversees the licensee's performance throughout the license period, typically through regular financial or development reports mandated by the agreement. Both the terms of the license and the company's progress reports are typically treated as confidential business information.

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xvii Stanford /employees are not allowed to represent the potential licensee and must not negotiate directly with OTL. While Stanford does not provide preferential treatment to Stanford inventors, as a practical matter inventors are well positioned to license technology due to their intimate knowledge of the invention and their passion to shepherd the technology from early research and development to commercialization, a passion that is not often shared by third party organizations. So, in practice, inventor-led startups have often demonstrated their capability as the best licensee and have been granted exclusive licenses despite an open licensing process.

9 PATENT INCOME (ROYALTY & EQUITY SHARING)

Following the end of each fiscal year, Stanford distributes patent income received by OTL.[xviii] After deducting operational and direct expenses like patent and legal costs not covered by licensees, distributable patent income is divided as follows:

For the first $3,000,000 of cumulative distributable patent income from a single license:

- 33.34% to the inventor
- 24.66% to the inventor's designated department
- 21.0% to the inventor's school
- 21.0% to the Office of the Vice Provost and Dean of Research

For cumulative patent income exceeding $3,000,000 from a single license:

- 33.34% to the inventor
- 14.66% to the inventor's designated department
- 26.0% to the inventor's school
- 26.0% to the Office of the Vice Provost and Dean of Research

Royalties to departments and schools must be used exclusively for research or educational purposes, providing valuable unrestricted funds. In cases involving multiple inventors, OTL divides the inventor's 33.34% share equally unless an alternative allocation is agreed upon. When licensing multiple technologies as a portfolio, OTL determines relative values in good faith, often consulting with licensees, to allocate royalties appropriately.[xix]

10 AMENDING LICENSES

Licensing relationships may need periodic reevaluation as technologies, companies, and markets evolve. Amendments to the agreement can be requested by either party at any time and initiate renewed negotiations.

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xviii Some inventions are co-developed by inventors at multiple institutions with shared ownership of the intellectual property. In these situations, patent income will be shared between the institutions. In addition, some university research is sponsored and funded by entities that are entitled to receive a share of patent income in exchange for their research support.

xix In the case of copyright, royalties will normally be allocated in accordance with the university's policy on Inventions, Patents, and Licensing, with the "inventor's share" allocated among individuals identified by the inventor (or department head if not under a sponsored agreement), based on their relative contributions to the work.

Research Policy Handbook. (1999). *9.3 Administration of Copyright Policy*. Stanford University.

07 Conflicts of Interest: Faculty and Stanford University

The Conflicts of Interest Office (COI) was established to manage the issues that inevitably arise in a contemporary research university. Stanford empowers its faculty to engage directly with the world in myriad ways — public service, consulting, speaking engagements, technology transfer, joint ventures and partnerships, company formation, etc. — but balancing university responsibilities with external activities can lead to conflicts, usually involving time and money. As a nonprofit institution that commands public trust, and relies upon it, Stanford takes seriously potential conflicts of interest and integrity among its personnel, including faculty, staff, and postdoctoral scholars. Faculty should avoid both impropriety and the appearance of impropriety.

Conflicts of interest occur when personal interests diverge from professional obligations to the university, potentially influencing decisions for personal gain or distracting a faculty member from giving full effort to their Stanford duties. This includes holding a management position in another company, consulting more than is permissible, or using Stanford resources or personnel (e.g., graduate students) for personal gain.

In 2012, the U.S. government updated the reporting and audit requirements for universities receiving federal grant funding and included expanded guidance on conflicts of interest. At that time, Stanford formalized its disclosure and management system. COI requires all faculty to disclose "Outside Professional Activities," ensures faculty understand the rules and limits, and guides faculty as needed to mitigate potential conflicts of interest. Prior to undertaking a serious and sustained outside commitment such as starting a company, faculty should speak with COI and also notify the head of their department for advice and support.

Conflict of Interest Disclosure Process

1 DISCLOSURE SUBMISSION

Subject to limited exceptions, personnel must seek prior approval for both paid and unpaid outside professional activities through the Outside Professional Activities Certification System.[xx] Requests for approval must provide information about the proposed outside professional activity and outline steps to ensure that it will not negatively affect the individual's responsibilities at Stanford or pose financial or reputational risks to the university. Requests are routed through supervisors or principal investigators initially, then to department chairs, deans, or directors.

2 DISCLOSURE REVIEW

Designated officials evaluate disclosures to determine whether an outside professional activity or financial interest conflicts with the personnel's Stanford responsibilities or poses a conflict of interest or commitment. They review all current projects that the academic innovator is involved in at Stanford and assess how each project relates to the new outside activity.

3 MITIGATION PLAN

If approval is granted, personnel and the designated official may develop an appropriate management plan outlining the details of the relationship, providing an analysis of how the activity relates to personnel's Stanford responsibilities and specifying the appropriate steps to implement and maintain the plan. For example, other faculty might take on some of the responsibilities of the conflicted faculty or perform research oversight.

Management plans assist faculty and the COI Office in finding ways for faculty to engage in outside work while adhering to university rules. Management plans were less common in the past and sometimes carried a stigma suggesting wrongdoing, but this is not the case today. They are designed to ensure transparency, allowing faculty to engage in outside activities while having confidence that they are acting appropriately.

xx Research Policy Handbook. (2023). *4.1 Policy on Conflict of Interest and Conflict of Commitment*. Stanford University.

TIME ALLOWED FOR OUTSIDE PROFESSIONAL ACTIVITIES

Faculty may participate in external activities as long as they meet their Stanford obligations and stay within the time limits delineated by COI policy.[xxi]

Full-time faculty with a 12-month appointment

Full-time faculty with a 12-month appointment are restricted to 13 days per quarter, or 52 days for four quarters of active duty, for outside activities. Stanford university assumes a 10-hour workday for faculty, so this totals 520 hours per year. This time includes all outside activities combined. For instance, if a faculty member is involved with a startup, consults for another company, and serves on a board of a third company, the total must not exceed 52 days for all activities in any given 12-month period. Averaging days across quarters is generally permitted to account for ebbs and flows, but faculty who expect to consult for more than 13 days in any one academic quarter should consult their department chairperson or dean.

Full-time faculty with a 9-month appointment[xxii]

Full-time faculty on nine-month appointments with no salary supplement for the fourth quarter (usually, but not always, the Summer Quarter) are not subject to the 13-day limit during that quarter.

Faculty with a 75% appointment and a 12-month appointment

The 13-day limit is prorated for faculty holding part-time appointments, using the following formula: [13 x F] + [(1 - F) x 6 x 13], where F is the fraction of full-time duty, 13 represents the average number of weeks per quarter, and 6 represents the maximum number of days per week that are likely to be devoted to professional activities during the period of off-duty time. Thus, a faculty member holding a 75% appointment is permitted up to 29.25 days of consulting per quarter.

Faculty with a 50% appointment and a 12-month appointment

Using the same formula from above, a faculty holding a 50% appointment is permitted up to 45.5 days of consulting per quarter.

TITLES AND ROLES

Full-time faculty may not hold a “line management” title as an executive or officer of another organization. Therefore the faculty member may not be executive director, chief executive officer, chief science officer, chief technology officer, chief medical officer, vice president of engineering, etc. Faculty should instead indicate their part-time capacity with an “advisor” title or qualifier: advisor, chief science advisor, advisor to the chief executive officer, etc. Faculty may sit on an organization’s board of directors and may have the title of director.

xxi Research Policy Handbook. (2023). *4.3 Consulting and Other Outside Professional Activities by Members of the Academic Council and University Medical Line*. Stanford University.

xxii For non-full-time faculty with a 9-month appointment, the limit varies based on their status and pay during the quarter when they are not actively teaching. Refer to RPH 4.3 for additional details.

STARTUPS AND TENURE

Faculty who have not yet achieved tenure may be reluctant to engage in significant outside professional activities (such as starting a company), fearing that these activities might be a demerit on their academic resume. This is a valid consideration. In general this has not been the experience of Stanford faculty in the case studies below, but the authors recognize these case studies have selection bias. As long as faculty continue to deliver outstanding academic work, the policies and culture at Stanford provide significant latitude to engage in other projects. That said, academic work is very time-consuming, and many pre-tenure faculty may choose to focus on academia and defer other activities until tenured.

SABBATICALS

Faculty on paid sabbatical are subject to the same outside professional activities restrictions they face while working as faculty. Stanford's view is that a paid sabbatical is intended to be a time for rest and creative exploration, not an opportunity to receive double pay by working for another organization while still on Stanford salary.

LEAVES OF ABSENCE

Faculty may negotiate an unpaid leave of absence with the dean of their department. Unpaid leaves release faculty from all university obligations and enable the faculty to work freely on any projects they would like, with no time or compensation restrictions. Additionally, the faculty is no longer subject to the Stanford IP assignment policy, meaning that any technology or invention developed while on leave is the sole property of the faculty, not Stanford.

Faculty will need to complete forms detailing their reasons for the leave, its duration, and their planned activities during that time. Additionally, they must create a plan for managing their responsibilities while on leave. For instance, if they have students or lab staff, someone else will need to oversee their work. This ensures that, although the faculty is on leave, their students and staff are supported, and their academic or graduate progress is not negatively affected.

LIMITS TO LEAVE: "TWO IN SEVEN"

The ironclad rule with regard to faculty leaves is that faculty must not be absent from Stanford for more than two years in any seven-year period. "Stanford wants full-time faculty. If Stanford made exceptions to the 'two in seven' rule, then word would spread," says Jim Plummer. "Soon it would not be a rule at all." It is worth noting that Stanford may rehire departed faculty, but most faculty who leave are on a different journey and do not return to Stanford.

"Stanford wants full-time. If Stanford made exceptions to the 'two in seven' rule, then word would spread. Soon it would not be a rule at all."

– **Jim Plummer**, Dean of the School of Engineering from 1999 to 2014

OUT-LICENSING (STANFORD TO NEW VENTURE)

Faculty desiring to license technology from Stanford to their own nonprofit or for-profit company may not participate in OTL's licensing process because they are also Stanford employees, and this creates an automatic and insurmountable conflict of interest. Another non-Stanford member of the team must negotiate the license on behalf of the company.

Faculty should carefully evaluate the scope of their requested license to their new venture. On one hand, they might want a broad license to maximize their company's capabilities. On the other hand, if they intend to continue using the technology at Stanford for academic research, their venture will need to receive a license with a narrower field of use to avoid conflicts with that research.

IN-LICENSING (NEW VENTURE TO STANFORD)

If a faculty member receives cash or equity compensation from an outside company then the faculty may not license that company's technology into Stanford (e.g., for research in their lab). Stanford takes the position that this creates a conflict of interest.

This can create problems. Take the following real-world example (details changed for anonymity): A faculty member in the School of Medicine has an invention, starts a company as scientific advisor and 8% owner, recruits a management team, helps raise funds, and licenses the invention from Stanford to the company via OTL. The company develops new technology based on the original licensed IP and the new technology would be extremely valuable for the medical 's academic research, potentially opening up an entirely new area of scientific inquiry. Unfortunately, these new technologies may *not* be licensed back to the faculty's lab for research.

The faculty startup may, however, license technology to another faculty lab at Stanford. This arrangement requires careful work with the 's department and COI to ensure that there is no sharing of information, personnel, or resources between the two labs.

STANFORD RESOURCES

As a general matter, faculty may not use Stanford resources, including Stanford staff or student labor, for personal gain. This is obvious in the context of specialized lab equipment, but can become more nuanced if, for example, a PhD student that is near to graduating wants to join a faculty startup. Careful management is required. Further discussion below under Conflicts of Interest: Other Stakeholders.

08 Conflicts of Interest: Other Stakeholders

BETWEEN FACULTY AND THE CHIEF EXECUTIVE OFFICER OR EXECUTIVE DIRECTOR

Assuming the faculty member does not take a leave of absence to run the organization, the most important relationship is between the faculty member and the executive manager. In for-profits, this person is the chief executive officer. In nonprofits, this person is the executive director. A for-profit startup presents the most fulsome example of the potential for incentive misalignment, so we focus on that scenario.

The three dimensions where conflict is likely to arise are control, compensation, and effort. The classic fact pattern is as follows: A Stanford faculty member develops a new technology or concept and is critical in the ideation and launch phase of a company. The faculty member desires a very large equity stake of the company (30-50%), but remains on faculty at Stanford. They recruit a chief executive officer and then help raise funds. The chief executive officer has significant equity (5-20%), but substantially less than the faculty member. The rest is owned by investors or other team members. The faculty member, by remaining at Stanford full-time, is limited to part-time work at their startup by Stanford's COI rules.

The startup moves quickly and the chief executive officer works 60-hour weeks, much harder than the faculty member, who can only contribute one day per week. Over a period of months, then years, the faculty member's early involvement becomes less significant as a proportion of total effort and value created, and the faculty member's outsized ownership stake makes it difficult to attract talented team members and sophisticated investors. Furthermore, the faculty member's insistence on continued strategic control and high equity ownership actually holds the company back from moving in the direction it should, at the speed it could, with the team it needs. The team may begin to resent the faculty member. The company's progress slows; it will likely fail completely.

While some amount of tension between team members is inevitable, we recommend the following:

Experienced Chief Executive Officer

Recruit an experienced CEO who fully understands the short-term and long-term implications of the equity and governance structure — and someone to whom the faculty member is excited to delegate day-to-day and strategic responsibilities.

Open Communication

Regular (weekly) check-ins for focused meetings (at least 1 hour) plus frequent communication and open access to faculty outside of official meetings to keep the team "unblocked," in consideration that the rest of the team might be working around the clock.

Minority Equity and Sharing Credit

We encourage faculty members to have realistic (minority) equity expectations and humility with regard to titles and claiming credit, in recognition of the fact that the faculty member's commitment

will be severely limited by Stanford's COI rules, many stakeholders are needed for success, and high-level operation and execution over a long time is much more important than the initial idea or innovation.

More information and guidance is included in Chapter 10.

GRADUATE STUDENTS

Stanford goes to great lengths to protect the academic careers of its graduate students. As a general matter, PhD students may not work for their doctoral advisor in a non-academic capacity prior to graduation due to the conflict of interest presented by a faculty member overseeing a student's academic work while also managing them in another capacity.

As additional protection for PhD students, OTL will not grant a license to a Stanford startup if a PhD needs to continue to use and develop the technology to finish their graduate studies. The technology can be licensed only if a PhD needs to use the technology in a basic research manner (not continue development), their work is not within the field of use of the license, and their PhD research would not directly benefit the licensee.

Where there is the potential for conflict between a faculty entrepreneur's venture and continued academic research by the PhDs in their lab, the dean of the faculty member's school will appoint another faculty member with sufficient expertise to an oversight position to make sure that graduate students are not explicitly or implicitly encouraged to pursue research paths that are valuable to the new venture.

Faculty may employ Stanford students, and OTL may grant licenses if the student in question:

- Has graduated (this is obvious but is worth reiterating, as sometimes it is easier and better to simply wait),
- Is a non-PhD student (e.g., master's, MBA, JD, MD, etc.) for whom the faculty member is not an academic advisor, or current or future instructor (for example, a faculty member that teaches a single interdisciplinary class each Fall Quarter may hire an MBA student who took the class as an intern in Spring Quarter),
- Is a PhD student who drops out of the PhD program early of their own accord (we emphasize that the faculty should *not* exert any direct or indirect influence on this decision),
- Is a PhD student who has completed their research and is in the final months of writing their dissertation prior to defense. In this case a conflict of interest remains and a management plan must be discussed with COI, but Stanford takes the position that this is a transitory and manageable conflict of interest given the proximate completion of the PhD and the faculty's diminished role in academic oversight, or
- Is a postdoctoral scholar, although these individuals are usually focused on finding an academic job and are not interested in private sector work.

Unfortunately this means that PhD students who are not near completion of their degree who want to work with faculty in a private capacity are in a difficult position and usually may not do so. This can create tension if, for example, a 4th-year PhD student sees a master's student or recently-graduated PhD join a

faculty startup, while they are "stuck" in their PhD. These dynamics should be carefully managed.

If this seems overly restrictive, imagine the counterfactual: A 4th-year PhD student takes a leave of absence to co-found a faculty member's startup, receives significant equity, low cash compensation (as is standard for startup founders), and a senior executive title. The company does well for two years and then runs into an unforeseen roadblock (market, technology, competition, etc.). Another year goes by before the team gives up on what was once a promising project. The PhD student considers their options. While the experience was likely hugely informative, the equity is worthless and they have not earned much cash. Moreover, their PhD research has gone stale in the three years since they took their leave of absence. Do they return to the PhD program and "restart" with a new research direction? Do they go work in industry? This is a difficult position and one that PhDs and their faculty supervisors would do well to avoid.

BETWEEN THE TEAM AND INVESTORS OR FUNDERS

Misalignment may also arise with both non-dilutive and dilutive funding, each in slightly different ways.[xxiii] Non-dilutive funding may come slowly, over time, with milestone-based triggers and extensive reporting and audit requirements. While there are many situations in which non-dilutive funding is attractive, it may be the case that these requirements are too restrictive for a young organization, especially if the startup's strategy will change quickly and there is risk that the grant milestones become misaligned with the company's new strategic direction.

Furthermore, non-dilutive funding may come with requirements based on the funder's prerogatives. For example, a foundation might give a grant to a company working on a solar technology but require that the company offer its products in a certain region first. This might affect the price at which the products may be sold and, assuming the company is U.S. based, limit the company's ability to get fast and reliable product feedback from its customers.

With regard to dilutive funding — we focus on venture capital —one should be mindful of certain incentives that are set by the structure of their financial vehicles and portfolio construction. First, VC funds typically have a 7-10 year lifecycle. This means that they want businesses to grow very quickly and be sold (or go public) within that window. This may sound like a long time, but this motivates VCs and the founding teams they invest in to grow exponentially and secure new investment every 12-24 months. This puts significant pressure on management to build at breakneck speed and may be especially stressful for an academic innovator that takes a leave of absence to be a first-time CEO. The goals of VC may not align with the nature of the technology and the preferred timeline of research and development of the company.

Second, importantly, VCs make investments in many companies and hope that a few of them are huge successes, recognizing that most will fail. This means that if there are strategic risks that will result in either total failure or huge success, the VC is incentivized to advise founders to take those risks. The VC is diversified, but the founder is not — and may prefer a more cautious approach in order to protect their downside. This is why VC, for all of its benefits, is understood to be "impatient" capital and why non-dilutive capital or slower growth funded by revenue may be preferable.

xxiii For more information on the difference between dilutive and non-dilutive funding, see Chapter 9.

09 Fundraising

All pathways other than a technology license to a third party require some amount of outside funding, unless the venture can finance all operations and growth with earned revenue. This is exceedingly rare. In all cases, is important to consider how much money will be needed, by when, and from whom. Beyond that, fundraising largely comes down to the management team's narrative and network. Academic innovators are encouraged to speak with fundraising coaches, like those offered through *Stanford Venture Studio*, as well as peers, friends, or advisors who have successfully navigated this process in order to understand how to convey their story in a way that appeals to the audience they are approaching and to meet many investors. The fundraising process (like any application process) is a valuable opportunity for feedback, reflection, and improvement, and it may be wise for first-time founders to partner with an experienced business person (e.g., CEO) during fundraising pitches in order to ensure that all feedback is understood and metabolized.

SOURCES OF FUNDING

There are two types of funding: "dilutive" and "non-dilutive." Dilution occurs in the for-profit startup context (Delaware C corporation or public benefit corporation) when a company sells part of its equity ownership to investors in exchange for capital that does not ever need to be repaid — the team's equity is "diluted" by the investors' ownership. Venture capitalists are a common source of dilutive funding for for-profit startups. VCs achieve a return when the company exits, by being sold or going public, and lose their money if the company fails. VCs are one of the few sources of risk capital for early-stage companies, as startups usually cannot secure loans from a bank. VCs also provide social proof, expertise building companies, and a large network that can be useful for executive recruiting and future fundraising. For legal structural reasons, almost all VCs are limited to investing in Delaware C corporations or public benefit corporations.

Many ventures are initially financed through friends and family or experienced individual investors, often referred to as "angel investors." In some cases, Stanford University might also make an equity investment in a for-profit startup company, e.g., through the portion of the Stanford endowment that is reserved for high-risk startup investments. Most startups receive initial capital from friends and family, angel investors, and accelerators, using a Simple Agreement for Future Equity (more widely known as a "SAFE"). Then once early milestones have been reached, the company will be ready to pursue VC, at which time the company will issue equity (preferred stock) to the VC. The SAFEs convert into preferred stock substantially identical to the stock purchased by the VC.[xxiv]

Non-dilutive funding usually comes via grants by a university (Stanford), nonprofit, foundation, family office, donor-advised fund, mission and program related investment, and government. For Stanford initiatives and nonprofits, this is the only type of funding available, as there is no return on capital that would attract equity investors like VCs. Some for-profit companies may be eligible for grant funding in limited circumstances, e.g., via the U.S. government's

xxiv A Simple Agreement for Future Equity is a type of investment contract used in venture capital. It allows investors to fund early-stage startups in exchange for the right to receive equity in the company at a future date, typically during a subsequent, much larger financing round. SAFEs do not carry interest or maturity dates like convertible notes. They are designed to be simpler and more flexible than equity financing contracts, making them popular among early-stage startups and investors.

Small Business Innovation Research (SBIR) program, or in the case where the company is a Delaware public benefit corporation whose mission aligns with the goals of the grantmaker. But for the most part, for-profit companies raise dilutive funding while Stanford initiatives and nonprofits are usually limited to non-dilutive funding.

Stanford University — and its many centers, labs, and accelerators — offers two sources of non-dilutive funding to new university initiatives. The first source is a traditional lump sum or staged grants for early-stage research and development. This process is familiar to many researchers who already rely on such funding for their academic work. The funding may come from the university itself or a related entity such as the Doerr Sustainability Accelerator, Stanford Medicine Catalyst, the Office of Technology Licensing's High Impact Technology Fund, or Stanford Impact Labs. At the end of this guide of this guide we provide a list of Stanford funding opportunities.

Second, the university may choose to add the initiative to its operating budget and fund it on an ongoing basis provided it meets Stanford's goals. In this case the Stanford initiative will survive as long as Stanford deems it to be a worthwhile use of its resources.

Funding sources are too numerous to provide a full discussion here, and we again recommend connecting with others who have successfully navigated the fundraising process in a given translation pathway and domain area. It is also worth repeating that many non-dilutive funders are more interested in helping build something new than in sustaining or growing something over a long period of time; academic innovators who seek non-dilutive funding in the early stages should be thoughtful about how they can build long-term partnerships and/or earn sufficient revenue to cover the cost of operations over the medium and long term.

FUNDING AMOUNT

Early-stage fundraising needs are driven by research and development, product, sales and marketing, and team compensation. Revenue projections also play an important role, as revenue offsets funding required.

Circumstances differ widely and fundraising needs may differ by orders of magnitude. Generalized advice is difficult. Consider two examples at opposite ends of the spectrum:

1. A small nonprofit community organization with part-time leadership and volunteers who all receive modest stipends, with minimal overhead as far as branding, materials, office space, etc., may only need to raise $50,000 to cover operations for its first two years. This funding might come primarily from other nonprofits, foundations, family offices, donor-advised funds, mission and program related investments, and governments.
2. A battery company with a world-class executive team and significant research and development costs, laboratory space, and a desire to scale very quickly might initially raise $5,000,000 through a combination of venture capital and federal government grant funding, with $25,000,000 in follow-on funding two years later.

The enormous difference in size and source of fundraising illustrates the diversity of needs between ventures.

FUNDING STAGES

All investors or funders "stage" their investments to mitigate risk, meaning they provide small amounts of money early, when risks are high, and will provide more and more funding as the venture achieves its milestones and reduces its market and technology risk. With dilutive funding, VCs do this through staged preferred stock financings (Series Seed, A, B, C, etc.).[xxv] These stages come with explicit and implicit requirements for product development, recruiting, and revenue growth depending on the sector. A Series A for a biotechnology company will be of a different size and will require different milestones than a Series A for a consumer software company.

For non-dilutive funding, many grantmakers require performance milestones before additional funds are triggered. Others offer tailored funding opportunities based on a project's status. Stanford Impact Labs is an excellent example; SIL makes staged and sequenced investments in solutions-focused, partnership-based research teams at three levels:

Stanford Impact Labs Funding by Stage

- Stage 1: Seed Partnership: Up to $350,000 for a maximum of two years to conduct research, explore partnerships, and test possible solutions. Some Stage 1 teams will likely pursue Stage 2 funding.
- Stage 2: Test Solutions: Up to $800,000 for a maximum of three years to develop and deploy a specific solution with a partner organization. Some Stage 2 teams will likely pursue Stage 3 funding.
- Stage 3: Amplify Impact: Up to $5,000,000 for a maximum of five years to scale solutions that have proven to be effective and to improve upon alternative approaches.

As far as the major pathways, the first fundraise will likely be:

Initial Fundraising Timing by Translation Pathway

- Stanford Initiative: Prior to launch.
- License to a Third Party: No funding needed.
- For-profit: Shortly after incorporation (although conversations may begin before).
- Nonprofit: Shortly after incorporation or 501(c)(3) status is granted (although conversations may begin before).

Typically an organization should raise enough money to operate for 18 to 24 months — this allows for at least a year of building before the executive team needs to consider raising more money.

xxv Series Seed: This is often the first round of significant financing for a startup, aimed at helping the company get off the ground. Typical Series Seed rounds are between $2-5 million in funding. Prior to raising Series Seed, a for-profit company will typically seek financing through "Pre-Seed" or "angel" financing, such as friends and family, high net worth individuals, and incubators/accelerators such as Y-Combinator, TechStars, and many others.

Series A: This round is usually the first significant round of venture capital funding, intended to help the company scale its operations and grow. Typical Series A rounds are between $10-15 million in funding.

Series B, C, etc.: Subsequent rounds of funding are used to further expand the company, develop new products, or enter new markets.

10 Recruiting a Chief Executive

Unless the academic innovator takes a leave of absence to run the new venture full-time, recruiting a chief executive officer or executive director is the most important task for successful launch. We assume in this section that the academic innovators will remain in their academic roles and that an executive manager is needed. We will refer to this person as the CEO although they might instead be an ED in the context of a nonprofit or Stanford initiative; we note differences where applicable.

DAY-TO-DAY OPERATIONS

The CEO or ED should manage day-to-day operations. Given the academic innovator's restrictions under Stanford's conflict of interest policies, they are simply not well positioned to manage ongoing operations on a part-time basis in the way a full-time executive can and should.

COMPENSATION AND CONTROL

Decisions about compensation and control usually hinge on when the CEO joins and the particular relationship between the academic innovator and the CEO. A high-quality CEO will require salary and equity compensation commensurate with their experience and the opportunity cost of forgoing other positions. If the venture has not raised money, then the CEO should have fundraising experience because this will be a key component of the organization's success.

CEO / ED Profile and Compensation

	Example	Joins Pre-Fundraise	Joins Post-Fundraise
FIRST-TIME CEO	Recent MBA graduate who spent three years in consulting and one year at a small technology startup prior to business school. Some fundraising and management experience.	**Equity**: 5-30%. **Salary**: After fundraising, salary is $125,000-$175,000 / year. **Control**: Manages day-to-day, co-leads long-term strategy with academic innovator.	**Equity**: 5-10%. **Salary**: $125,000-$175,000 / year. **Control**: Manages day-to-day, defers to academic innovator on long-term strategy.
SEASONED CEO	Mid-career executive who has been a CEO at two prior companies that grew from dozens to hundreds of employees. Significant fundraising and management experience.	**Equity**: 20-40%. **Salary**: After fundraising, salary is $200,000-$300,000 / year. **Control**: Manages day-to-day, leads long-term strategy.	**Equity**: 5-15%. **Salary**: $200,000-$350,000 / year. **Control**: Manages day-to-day, co-leads long-term strategy with academic innovator.
FIRST-TIME ED	Recent PhD graduate who spent two years at an NGO prior to graduate school. Little fundraising or management experience.	**Salary**: After fundraising, salary is $100,000-$175,000 / year. **Control**: Manages day-to-day, co-leads long-term strategy with academic innovator.	**Salary**: $100,000-$175,000 / year. **Control**: Manages day-to-day, defers to academic innovator on long-term strategy.
SEASONED ED	Mid-career executive who has been an ED at multiple NGOs or university centers. Significant fundraising and management experience.	**Salary**: After fundraising, salary is $150,000-$250,000 / year. **Control**: Manages day-to-day, leads long-term strategy.	**Salary**: $150,000-$250,000 / year. **Control**: Manages day-to-day, co-leads long-term strategy with academic innovator.

EQUITY VESTING

In the for-profit context, it is important to note that any equity granted to the CEO (or any employee or consultant) should vest over time. Often employee vesting is "over four years with a one-year cliff," meaning that vesting occurs in equal increments over 48 months, with no vesting until the first anniversary of vesting commencement. If an employee is granted 8% of a startup vesting "over four years with a one-year cliff" departs or is fired in month 10, they would lose all of their equity. At the end of month 12, they vest in 2% of the company (25% of their grant). If they stay until the end of year 3, then they will own 6% of the company (75% of their grant).[xxvi]

FINDING CANDIDATES

Finding good CEO candidates can be a challenge for many. Typically, candidates are Stanford students (recently graduated or graduating soon), executives in the academic innovator's personal network (friends and family) or extended professional network, or are sourced by professional recruiting firms that perform these services for a fixed upfront fee or variable commission.

VETTING

Another challenge is understanding how to assess the abilities of a CEO or ED candidate. We suggest making sure that they have:

- Management experience
- Fundraising experience
- Startup or small company experience
- Domain or industry expertise
- Impact and economic goals that align with the academic innovator and the translation pathway
- Enthusiasm to work tirelessly whenever needed, regardless of the entrepreneurship pathway
- Agreed to the governance structure and understand the short- and long-term implications
- Fully understood their salary and equity compensation and any expected changes over time
- Positive reviews from those who have managed them and been managed by them

TERMINATION

While ideally the recruiting process finds an excellent match, sometimes a CEO or ED does not work out. This could be for a range of reasons, many benign, including medical issues, change of strategic vision, personal conflict, unexpected market conditions, etc. Intentionality in the recruiting process should help reduce mismatches. However, the academic innovator should be aware that terminating a CEO or ED might be necessary, and that it should be done thoughtfully but swiftly to avoid loss of momentum.

xxvi These figures do not factor in dilution of equity grants and sales, e.g., to subsequent employees or investors.

11 Case Studies

We spoke with faculty who had followed each pathway and compiled case studies based on their experiences. We highlighted their progress to date, their thought process throughout the venture, and what has been easy or difficult. We highlight lessons learned.

We grouped case studies by pathway and began with a summary of key takeaways for each section.

Stanford Initiative

These case studies of Stanford faculty who have opted to establish their initiatives within the university ecosystem underscore the trade-offs between staying within Stanford versus launching an independent venture.

Key Takeaways

BUILDING AND RUNNING AN INITIATIVE

- Evaluate the university's existing resources and capabilities to support the initiative, including infrastructure, expertise, and technology.
- Set up a governance structure and assign leadership roles to manage and oversee the initiative effectively.
- Develop strategies for the long-term sustainability of the initiative, including potential for scalability and continued funding.

Jim Leape, co-director of the Center for Ocean Solutions and the William and Eva Price Senior Fellow in the Stanford Woods Institute for the Environment, adds: "Stanford initiatives can have a hard time partnering with outside organizations due to Stanford's demanding administrative requirements. Navigating sub-agreements and securing approval for a memorandum of understanding or similar documents can be cumbersome. Managing the administrative aspects is one hurdle, but maintaining a successful partnership also requires genuine engagement. Sustaining the partnership involves addressing the inherent difficulties of collaborating between two organizations that operate in different spheres, each with its own set of priorities and challenges."

"Managing the administrative aspects is one hurdle, but maintaining a successful partnership between Stanford and another organization also requires genuine engagement."

– **Jim Leape**, Co-Director of the Center for Ocean Solutions

BALANCING PRIORITIES

- Initiatives often build on existing Stanford work but require significant additional time and effort.
- Large-scale programs involve substantial administrative responsibilities, including approving budgets and overseeing operations.
- Collaborating with colleagues and hiring non-professionals to handle some administrative tasks can help faculty focus on research.

FOCUSING ON PRACTICAL IMPACT

- Engaging end users and stakeholders throughout the project lifecycle, particularly at the beginning, provides insights, identifies challenges, and highlights areas for enhancement and higher impact.
- Foster collaborations with nonprofit institutions, government agencies, industry leaders, and the private sector to enhance research relevance and translate scientific advancements into real-world impact.

Leape adds: "We cannot rely on a model where we simply conduct research and expect others to adopt it without further effort. For research to truly make an impact, we must engage directly with those on the front lines. The problems as seen from Palo Alto often differ significantly from those experienced on the ground. Therefore, it is crucial to collaborate with community groups, companies, governments, or other stakeholders who are directly involved in addressing these issues."

"For research to truly make an impact, we must engage directly with those on the front lines."

– **Jim Leape**, Co-Director of the Center for Ocean Solutions

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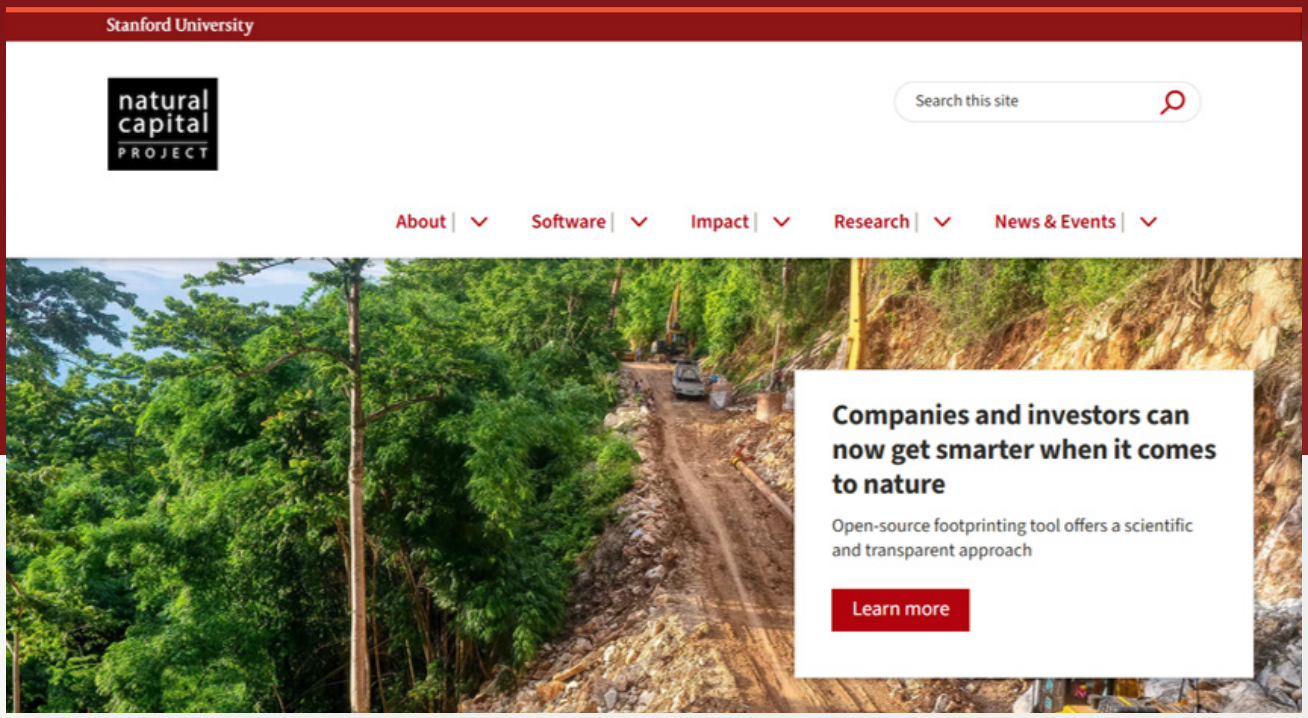
LEVERAGING DATA FOR GREATER IMPACT

- Accurate and extensive data is crucial for sound analysis and decision-making, enabling precise identification of trends, patterns, and correlations.
- Build a platform to share scientific findings that is comprehensible, actionable, and facilitates ongoing dialogue between researchers and practitioners.
- Establish clear protocols for data privacy and security to protect sensitive information and maintain public trust.

THE NATURAL CAPITAL PROJECT



FOUNDED

2005

MISSION

Transforming the way nature is viewed in society and valued in decision-making. Working with governments, financial institutions, business, communities, and civil society, the Natural Capital Poject has pioneered a systematic, science-based

FACULTY FOUNDER

Professor Gretchen Daily, the Bing Professor of Environmental Science in the Department of Biology at Stanford University

Current role:
Co-Founder & Faculty Director

Gretchen Daily is co-founder and faculty director of the Stanford Natural Capital Project. She is the Bing Professor of Environmental Science in the Department of Biology at Stanford University, the director of the Center for Conservation Biology at Stanford, and a senior fellow at the Stanford Woods

Institute for the Environment. Daily completed her undergraduate, master's, and PhD degrees at Stanford. Daily's work is focused on understanding human dependence and impacts on nature and the deep societal transformations needed to secure people and nature. Her work spans fundamental research and policy-oriented initiatives to open inclusive and green development pathways. Together with many colleagues, Daily has published about 400 scientific and popular articles and 13 books. She has received numerous international honors including the 2020 Tyler Prize for Environmental Achievement, 2017 Blue Planet Prize, 2019 BBVA Frontiers of Knowledge Award, 2012 Volvo Environment Prize, 2010 Midori Prize for Biodiversity, and the 2009 International Cosmos Prize.

BACKGROUND AND MOTIVATION

The Natural Capital Project (NatCap), founded in 2005, was born out of Daily's interdisciplinary research and wide-ranging social interactions. She came to see many environmental problems as symptomatic of a deeper issue. "Many sustainability solutions apply Band-Aids to deep structural problems rooted in how

our market economy values — or often undervalues — nature," she says. "To truly shift civilization toward a new direction, we need a suite of financial and policy mechanisms that can fundamentally alter how governments worldwide perceive and prioritize the value of nature."

At the time there was no scientific framework for assessing the value of nature; this was the domain of spirituality, philosophy, and art. Valuing nature in monetary terms created ethical backlash, including in Daily's own field of biology, as artists, philosophers, and naturalists were concerned that attributing market value to nature would devalue it and oversimplify its richness. Appreciating these perspectives, Daily nevertheless believed that unless nature was understood and recognized in economic terms it would be impossible to save in our financialized world.

Daily founded NatCap along with co-founders Taylor Ricketts, a former PhD student and director at World Wildlife Fund, and Peter Kareiva, the chief scientist at The Nature Conservancy. They chose to start small and start at Stanford. In later years, new core partners were added: the Chinese Academy of Sciences, the Royal Swedish Academy of Sciences, the Stockholm Resilience Centre, and the University of Minnesota. NatCap's structure will soon evolve further, with the launch of a global secretariat, in 2025, at the project's 20th anniversary.

STANFORD INITIATIVE VS. NONPROFIT

NatCap's theory of change was to save nature by directly integrating a science-based valuation of nature into decision-making processes in the public and private sectors. Daily and her partners needed to demonstrate the crucial role of nature in areas such as food security, climate resilience, and urban systems, and rigorous academic research was required as a first step. Stanford provided a plethora of resources and scholars with whom to partner. Similar efforts were attempted by independent nonprofits and governments, including the United Nations, but, by starting at Stanford, NatCap created neutral territory to engage both the private and public sectors, as the university's top-tier academic ranking, coupled with a reputation for practical problem-solving and its location in Silicon Valley,

provided a credible foundation for hosting and developing a wide array of tools that bridged the gap between research and practice. Furthermore, NatCap's mission centered on sharing lessons learned and building capacity through training, which parallels Stanford's educational mission.

The founders of NatCap also wanted to co-develop software and data solutions with real-world users to create accessible and actionable scientific information. Stanford was better suited for this than an independent nonprofit. Despite being housed at Stanford, and relying in large part on the enthusiasm and talent of Stanford graduate students and postdocs, Daily emphasizes that external partnerships with large, established nonprofits have been key to their success: "To access and engage government leaders in the deep ways required to drive change, NatCap often relied on preexisting relationships and trust established and held by our nonprofit partners," she says.

"To access and engage government leaders in the deep ways required to drive change, NatCap often relied on preexisting relationships and trust established and held by our nonprofit partners."

– **Gretchen Daily**, Bing Professor of Environmental Science in the Department of Biology at Stanford University

FUNDRAISING

At the outset, Daily and her partners had the backing of then-Stanford president John Hennessy and secured funding from two anchor donors who strongly supported their initiative. But rather than rest on their laurels, they continued fundraising. Having seen other centers and initiatives close down after spending their initial capital and failing to secure more funding, they treated this initial funding with care and only used it in extraordinary circumstances to bridge funding gaps and safeguard the core team. (One cannot help but draw parallels between NatCap's fiduciary stewardship and its underlying mission.)

NatCap also secured substantial funding from the MacArthur Foundation and the National Science Foundation and implemented a dues-paying structure, where Stanford, The Nature Conservancy, and World Wildlife Fund contributed to support the role of the faculty director. Finally, NatCap took the approach of fundraising separately for each demonstration project (a practical, real-world project advancing NatCap's methodology in research and implementation). These strategies have enabled NatCap to operate and scale successfully since its founding.

SCALING AND ACHIEVING IMPACT

Over time, NatCap has expanded its network to include 500 direct partners, each with their own extensive connections. Daily and her team have worked directly in 70 countries, with ongoing projects involving the Global Environment Facility and three major multilateral development banks: World Bank, Asian Development Bank, and Inter-American Development Bank. Recently, they have partnered with a new set of 15 countries through the United Nations Development Programme to pioneer and demonstrate innovative policy and financial mechanisms. These efforts aim to embed natural values into everyday practices, influencing sectors like energy, agriculture, water, mining, shipping, and infrastructure development.

"Our approach allows us to work closely with each partner country to make meaningful impact," Daily says. For instance, Chile has recently made significant strides as a result of Natural Capital's collaborative efforts. Chile has established a national-level super committee comprising key ministries of finance, economy, and environment, together with the central bank, with a primary focus on natural capital. This model is proving pivotal because it streamlines the decision-making process and empowers various ministries to collaborate routinely. Previously, NatCap would engage separately with a country's various ministries (such as infrastructure, agriculture, and finance), which sometimes required years of coordination. Now, Chile demonstrates a unified approach. The model can inspire similar transformations in other partner countries, with NatCap as a source of institutional knowledge.

> **"Our approach allows us to work closely with each partner country to drive meaningful impact."**
>
> – **Gretchen Daily,** Bing Professor of Environmental Science in the Department of Biology at Stanford University

Recently, NatCap hosted a symposium where representatives from 50 countries, along with development banks and entities like the U.S. Treasury, learned about government innovation, such as in Chile, and how they might be replicated around the world. NatCap has been widely recognized, receiving numerous awards, including the environmental science equivalents of the Nobel Prize.

BALANCING PRIORITIES

Professor Daily has not experienced a conflict of interest with her academic responsibilities. "NatCap is another dimension of my research," she says. "I had already been researching, teaching, and writing about natural capital before starting the initiative." Her work has always been interdisciplinary and involved engagement with non-academic partners; NatCap is both informed by and benefits from her academic pursuits. Managing NatCap now requires most of her time, as the operation has grown large and

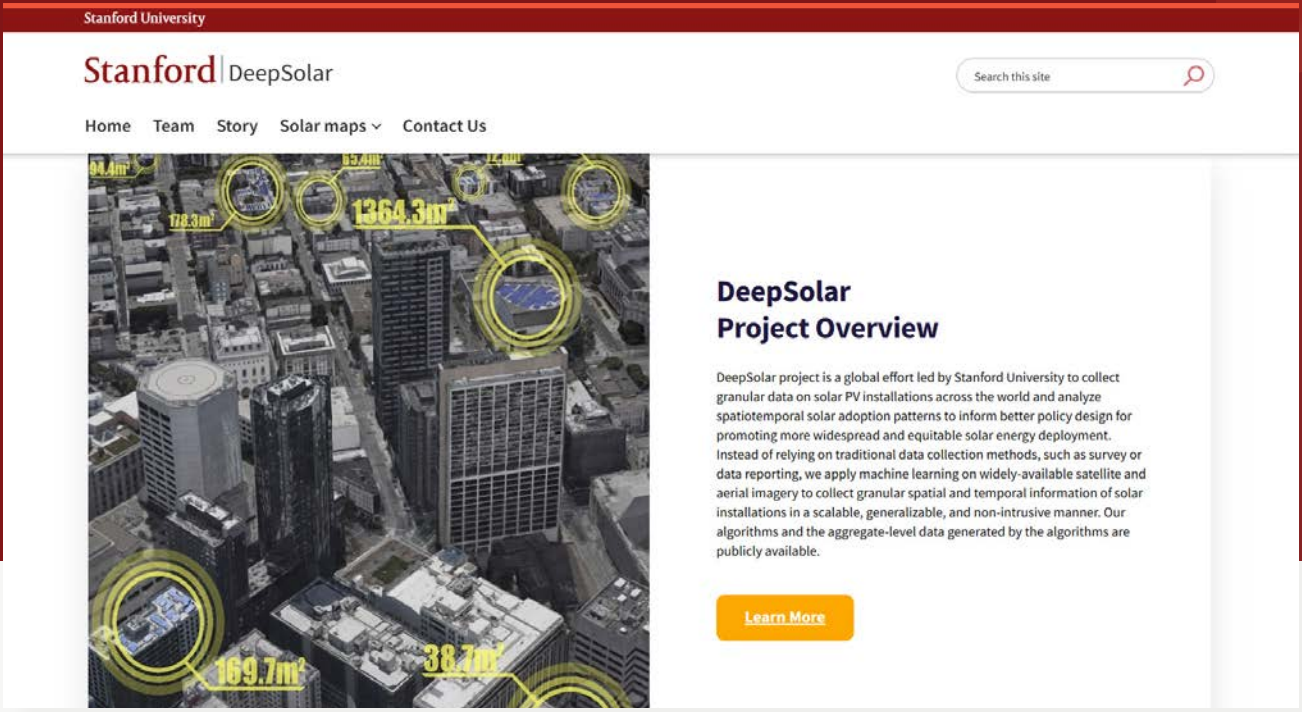
administratively complex and Daily is the sole person responsible for approving scores of administrative items daily. Thus, balancing tasks in both research and administration can be overwhelming at times and may not appeal to other faculty.

EXPANDING BEYOND STANFORD

Despite the immense success of The Natural Capital Project at Stanford, Daily is leading a spin-out into an independent nonprofit organization with a large off-campus center, enabling direct access to a broader base of funding sources and allowing NatCap to scale its team and create additional career opportunities for mid-career researchers. This will also reduce the operational overhead of working with Stanford, which was needed at the beginning but which now has become restrictive in some ways, especially with regard to partnerships and fundraising. Readers may benefit by revisiting Page 10 to see how the nonprofit pathway now aligns with the needs of the project at its current stage. This new entity will collaborate directly with another independent (and unrelated) nonprofit and will have more strategic flexibility to pursue consulting and other opportunities necessary to its mission. As a market for this work opens in the private sector, there may be revenue generating opportunities to support the Stanford-based effort.

The new center will train a larger cohort of future leaders and scale the solutions that NatCap has been validating at Stanford and in fieldwork with partner countries and development banks. Daily envisions a 10-year initiative for the center: collaborating with on-campus postdocs and graduate students and refining solutions needed for abstract science and practical implementation with decision-makers in the public and private sectors. Once validated, these solutions will be deployed through partnerships with governments, U.N. systems, multilateral development banks, and the private sector to catalyze transition to a more sustainable future.

DEEPSOLAR



FOUNDED

2018

MISSION

To facilitate consumer solar energy adoption via an open source data set that combines satellite imagery of current installations with key demographic and weather data.

FACULTY FOUNDER

Ram Rajagopal, Associate Professor of Civil and Environmental Engineering at Stanford University

Current role:
Co-Founder & Faculty Director

Ram Rajagopal is an associate professor of civil and environmental engineering at Stanford University where he directs the Stanford Sustainable Systems Lab focused on large-scale monitoring, data analytics, and stochastic control for infrastructure networks, in particular, power networks. His research interests in power systems are in the integration of renewables, smart distribution systems, and demand-side data analytics. He holds a PhD in electrical engineering and computer sciences and a master's in statistics, both from the University of California, Berkeley, as well as a master's in electrical and computer engineering from University of Texas, Austin, and a bachelor's in electrical engineering from the Federal

University of Rio de Janeiro. He is a recipient of the NSF CAREER Award, the Powell Foundation Fellowship, the Berkeley Regents Fellowship and the Makhoul Conjecture Challenge award. He holds more than 30 patents and has advised or founded various companies in the fields of sensor networks, power systems, and data analytics.

BACKGROUND AND MOTIVATION

When Rajagopal joined Stanford in 2011 he became deeply focused on the electric grid, particularly distributed energy, and identified it as a research opportunity with significant practical applications. His goal was to answer two key questions: What was the impact of distributed energy on the grid, and how could distributed energy be managed effectively to benefit end users.[xxvii]

To address these questions, Rajagopal and his team developed algorithms for energy management and authored numerous successful papers. However, they were eager to achieve real-world impact. They set out to test the effects of solar energy and battery management on the grid, using their control systems to manage electrical loads. They partnered with Google, the Navy, and the California Energy Commission to build a $10 million state-of-the-art lab at Stanford, conducting experiments that closely simulated real-world conditions, experiments that could not be done anywhere else.

Their first test system was installed in a residential area in Fremont, but challenges arose, not least of which was that the homeowners came to view Rajagopal and his graduate students as customer service representatives for their power needs. The Stanford team soon had "a constant stream of phone calls from these homes thinking that Stanford was responsible for providing customer service," says Rajagopal. As a result, Rajagopal and his team pivoted away from residential to the commercial sector, specifically farms.

Farms consume much more energy than residential homes so there is less relationship management per unit of energy provided. Nevertheless, challenges with servicing persisted, and it became clear that Stanford, as a research institution, was not equipped to manage even small-scale commercial partnerships over a long period. Ultimately, one of the farm owners decided to take over the project, using the knowledge gained from the Stanford experiments to launch an independent venture, and Stanford's role in the project came to an end. During this time Rajagopal's team explored the more abstract problem of data-driven solar energy deployment, leading to the creation of DeepSolar.

STARTING DEEPSOLAR

When Rajagopal and his team evaluated the impact of distributed solar systems, they approached utilities like PG&E for data. They discovered that PG&E lacked high-quality data on solar panel locations and struggled to pinpoint the exact location of solar panels. "Even though PG&E is supposed to have records of people with solar panels, they still had trouble understanding where the panels were and who had them," says Rajagopal. "In other words, even if they had the data, it was not easily accessible."

xxvii Distributed energy refers to the generation of electricity from sources that are decentralized and located close to the point of use, rather than being generated at a large, centralized power plant. Distributed energy systems often include renewable energy sources such as solar panels, wind turbines, and small-scale hydropower, as well as other technologies like combined heat and power systems and battery storage.

To address this issue, in 2017 one of Rajagopal's students used Google Maps to access satellite images of solar installations across California. Rajagopal and his team developed a machine learning algorithm to effectively track and map these installations. The promising results led to an expansion of their mapping efforts nationwide and continued optimization of their algorithm. They created a high-fidelity solar deployment database for the contiguous United States and called it DeepSolar.

Under DeepSolar, the team combined solar installation data with other key information, such as population density, household income, and solar radiation. They found that solar deployment density peaks at a population density of 1,000 people per square mile, increases with annual household income up to about $150,000 per year, and is inversely correlated with the Gini index, which measures income inequality. Additionally, they discovered a solar radiation threshold of 4.5 kWh/m^2 per day. This led them to develop a precise machine-learning model to predict solar deployment density at the census tract level. The outcome was not merely to verify that wealthier people in sunnier places tended to adopt solar more, but rather the precise financial and climate thresholds at which solar adoption begins, scales, and ultimately becomes ubiquitous.

INTELLECTUAL PROPERTY

After paper publication, Rajagopal's team had received substantial interest from policymakers, researchers, and business professionals and could have considered offering the data for a paid subscription fee. But Rajagopal wanted DeepSolar's data to be public. Much of the data was already publicly available; DeepSolar's innovation was to combine it in a useful way and layer their satellite image machine learning algorithm on top. Since DeepSolar was released as open source, no OTL license was ultimately needed, but technology disclosure and legal consultations were still required and proved time-consuming. As a result, Rajagopal recommends starting the process with OTL as early as possible regardless of translation pathway.

Another concern was data privacy, specifically with regard to the publication of GPS locations of solar installations. To address this, DeepSolar opted to use a data-sharing framework within Stanford's medical school, which has strict guidelines regarding personally identifiable data. While their heat map interface was made public, specific GPS locations were kept private.

A last hurdle: while Google Maps initially allowed unlimited image downloads — and Rajagopal's team was even invited to present their findings to Google executives — changes to Google's service agreement later restricted image downloads. This made updating the DeepSolar database difficult. So Rajagopal and his team expanded their efforts beyond visible satellite data. They included other renewable energy systems, such as wind, and extended their coverage to transmission and distribution, pivoting again, and naming this expanded project EnergyAtlas.

BIGGEST CHALLENGE

According to Rajagopal, "finding the right people is the most challenging aspect. Faculty can raise money or secure grants; finding individuals who are both committed and capable is very difficult. You need

people who are mature, experienced, and have the qualities of a CEO — someone who can drive progress while also being willing to take risks." Depending on the size and scope of the project, it might be necessary to bring in a seasoned CEO or ED even while the faculty maintains a leadership role in the Stanford initiative.

Sometimes it is not possible to bring a seasoned executive, especially if the project is early and lacks financial upside. At the same time, it is often not feasible to promote PhD students or postdocs to leadership roles due to conflicts of interest (they may not be able to be involved in any capacity). This dilemma creates a paradox: Stanford has a wealth of exceptional talent but this talent often cannot be utilized for new ventures. This limitation often explains why many initiatives fail to progress beyond the research phase — the initial Stanford team is unwilling or unable to take it further, and hiring outside management is difficult and expensive.

ACHIEVING IMPACT

Rajagopal considers the impact of his work in three key areas: academic, policy, and commercial. First, Rajagopal and his team have managed to publish numerous papers in leading journals, including *Nature*, which is a significant achievement and rare for someone with an electrical engineering background. Second, by providing valuable insights into solar energy potential and deployment, their work has helped shape policies that determine where and how cities invest in new renewable energy projects, including by the Public Utility Commission and the California Energy Commission. Third, with regard to commercialization, their data has proven valuable to solar energy installers and business professionals aiming to optimize deployment strategies.

"Science can actually be better when it responds to the real world. It creates a natural feedback loop of impact and inquiry."

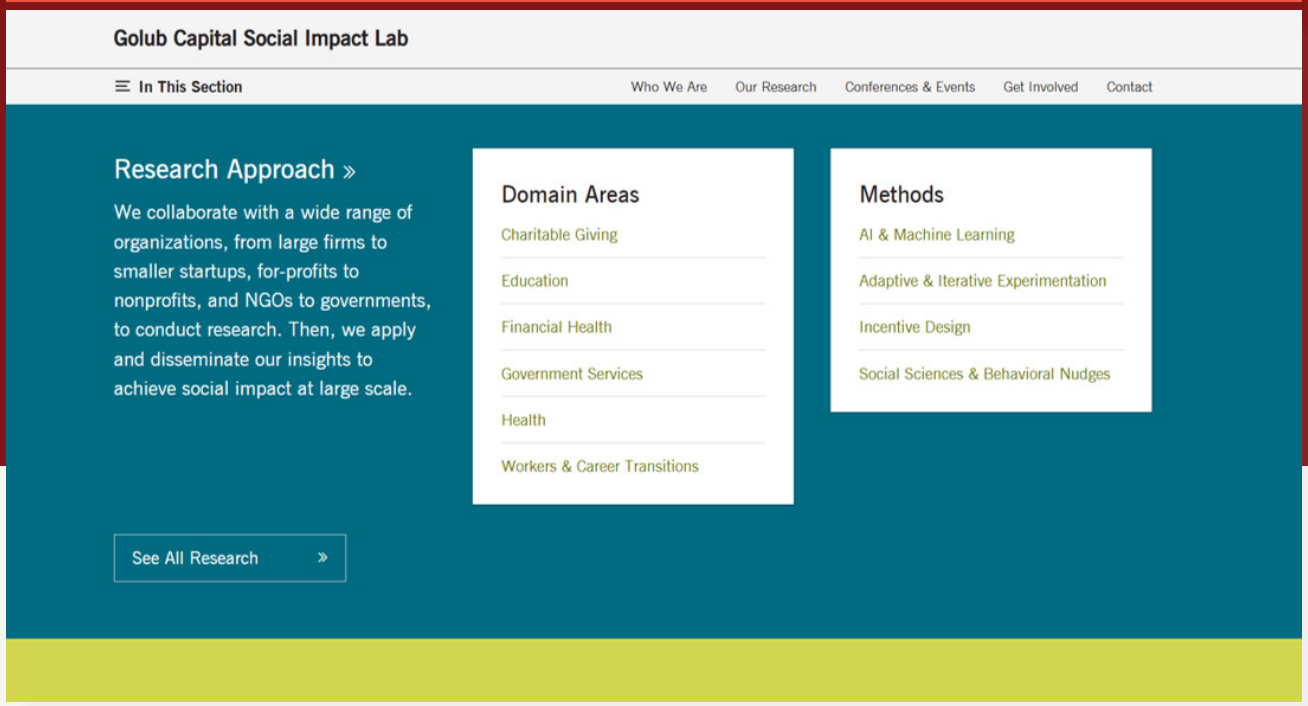
– **Ram Rajagopal**, Associate Professor of Civil and Environmental Engineering at Stanford University

WORDS OF ADVICE

"It is crucial to start early in identifying potential CEOs or project leaders for initiatives that are mature and experienced," Rajagopal says. "There is a considerable gap between theoretical ideas and practical application and having the right leadership in place can bridge that gap effectively."

He adds: "Concentrating on projects with substantial practical impact has proven to be highly beneficial and meaningful. While writing papers and attending conferences are valuable activities, they may not always translate into significant impact. Science can actually be better when it responds to the real world. It creates a natural feedback loop of impact and inquiry."

THE GOLUB CAPITAL SOCIAL IMPACT LAB



FOUNDED

2019

(Formerly the Shared Prosperity and Innovation Initiative 2017 - 2019)

MISSION

To use digital technology and social science research to improve the effectiveness of leading social sector organizations.

FACULTY FOUNDER

Susan Athey, The Economics of Technology Professor at the Graduate School of Business at Stanford University

Current role:
Faculty Director

Susan Athey is The Economics of Technology Professor at Stanford Graduate School of Business. She received her bachelor's degree from Duke University and her PhD from Stanford, and she holds an honorary doctorate from Duke University. She previously taught at the economics departments at MIT, Stanford, and Harvard. She is an elected member of the National Academy of Science and

is the recipient of the John Bates Clark Medal. Her current research focuses on the economics of digitization and the intersection of econometrics and machine learning. She has worked on several application areas, including timber auctions, internet search, online advertising, the news media, and the application of digital technology to social impact applications. Additionally, she served as consulting chief economist for Microsoft Corporation for six years as one of the first "tech economists" and has served on the boards of multiple private and public technology firms. She was a founding associate director of the Stanford Institute for Human-Centered Artificial Intelligence. From 2022 to 2024, she served as the chief economist at the U.S. Department of Justice Antitrust Division.

BACKGROUND AND MOTIVATION

During Athey's time working with Microsoft and other organizations as a tech economist, she was exposed to a variety of tools, including machine learning and A/B testing, which she now collectively refers to as the "tech toolkit." She saw these tools used widely in the for-profit sector, where organizations have data, compute power, and teams of data analysts readily available to deploy them. In contrast, social sector organizations were generally under-resourced — even if they had the data, they often did not have the capability to make full use of it. Seeing the opportunity to take what she had learned as a tech economist and make it accessible to the social sector, Athey founded the Golub Capital Social Impact Lab, formerly the Shared Prosperity and Innovation Initiative, in fall of 2017. It was renamed the Golub Capital Social Impact Lab after a generous gift from David and Lawrence Golub in 2019.

The Golub Capital Social Impact Lab uses digital technology and social science to design and analyze complex experiments using machine-learning tools and AI more broadly. When the GC Lab team first engages with a social sector organization, they propose solutions based on experience, social science research, and a detailed understanding of the context and problem, including empirical work that supports a theory of change. Next, they engage in a cycle of incremental innovation where they conduct experiments, analyze data from the experiments, use the learnings to improve on the intervention (tools, programs, etc.), and launch new experiments. Finally, once a promising intervention has been identified, the GC Lab collaborates with organizations that have scaling capabilities to expand the reach of the intervention.

PIVOTING DURING COVID

In its early years, the GC Lab explored a range of problem areas and potential partnerships. The team held conferences and events bringing together academics with social impact investors and entrepreneurs in order to foster academic-industry partnerships and to understand how market shaping and incentives can foster innovation for social impact.[xxviii] One result was launching a course that engaged students in these academic-industry collaborative projects.

When COVID-19 arrived, they pivoted to provide help. As an initial step, they built on their work on market shaping to advise more than a dozen

xxviii Market shaping is a process that uses economic instruments and market mechanisms to address market failures and improve markets' ability to make products accessible.

governments and NGOs on procurement of vaccines. Moreover, they began a line of research based on health misinformation, partnering with the WHO, which emerged from the class Athey taught in Spring Quarter 2020. Launching the lab in 2020 was challenging, but the GC Lab's projects met the moment and also created methods and domain knowledge that extended beyond the pandemic.

CONSTRAINTS AND PROJECT PRIORITIZATION

When contemplating starting the GC Lab, Athey looked around and saw near limitless possible applications of the tech toolkit to benefit the social sector. Almost no one else was doing the work. A key goal was to support multi-year partner engagements: the GC Lab provided a vehicle for fundraising, grant management, and hiring longer-term staff to make this possible. Their biggest early mistake was taking on too many projects, particularly lower-impact projects, since the main constraint on the GC Lab's work is the time of its senior staff. Today, Athey and her team carefully consider the projects' potential and prioritize those that can deliver the highest results.

HIRING TALENT

Recruiting is an ongoing process for the lab. Stanford attracts the best students and postdocs in the world but they only stay for a few years. The Bay Area is notoriously difficult for hiring due to the high cost of living and the competition for talent, so the GC Lab is continuously recruiting. Athey supports each lab member making their mark on a research project so that they may advance their careeres and ultimately leave the lab. Personnel transitions can make continuity difficult, but the lab benefits in the long run by creating an extensive network of former colleagues that spread the lab's methodology and continue to support the lab as advisors and partners. The lab structure and long-term funding make this model possible, but it requires careful thought and hard work. The GC Lab currently has four postdoctoral scholars, eight student researchers, and three staff members. In addition to academic publications and engagements, the lab's mission involves teaching and thought leadership. The GC Lab has been integral to three iterations of an experiential learning course (Designing Experiments for Impact) at Stanford Graduate School of Business in which teams of Stanford students collaborate with the GC Lab's partners to use social science research methods to solve real-world problems with impact in the social sector. The lab also develops public reports, tutorials, webinars, and blogs to communicate their research and how to use it to practitioners in the social sector.

ENGAGING PRACTITIONERS AND TARGET AUDIENCES

Athey and her team find that their network of advisors and practitioners are key contributors to the selection of the GC Lab's projects and the interventions they implement. The GC Lab is focused on the application of the tech toolkit to the social sector, but there are many domains within the social sector — each of which require specialist knowledge — so they rely on their contacts within partner organizations as well as specialist advisors to provide guidance. Furthermore, when the GC Lab designs interventions, they almost always start with a pilot phase in which they request feedback on their core questions: Does the intervention make sense? Is it likely to change behavior? How would they improve it? They often find useful insights through this exercise. Lastly, they are not finished with their research until they have

shared their results with those who can best put it to use. Since most partner organizations and other similarly-situated practitioners do not read academic papers, that means deciding the medium and communication strategy to best reach practitioners, such as traditional print media or social media.

ACHIEVING IMPACT

The GC Lab's mission is to increase the effectiveness of the social sector, which they accomplish in three ways. First, they aim to impact the social sector directly using digital technology interventions, the tech toolkit. Second, they provide thought leadership by communicating what they learn to practitioners, who can use it directly in their work, and to other researchers, who can build on what they have learned to generate new knowledge to improve the social sector. Last, they train their staff researchers in their methodology, which encourages the spread of those ideas once these staff leave the university. GC Lab alumni can be found at some of the top universities around the world, in the private industry from large tech companies to innovative startups and nonprofits, and many of them continue to collaborate with the GC Lab.

For example, the GC Lab worked with Coursera to assess the value of non-standard academic credentials (certificates) for individuals from developing countries and those without a college degree. They designed an intervention that reminded individuals to post their certificates on job search sites and created a one-click tool for doing so. They evaluated the intervention, showing that the reminder increased credential-sharing and that the credential-sharing increased new jobs for participants. The tool has since been implemented on Coursera's platform, which is accessed by millions of users annually.

As another example, the GC Lab created a program to help women in Poland transition into the growing information technology sector, where women were underrepresented. The lab showed that the program, which helped women create digital portfolios to demonstrate work capability, was effective at helping women get jobs. The lab's partner organization has since implemented the program at scale, and thousands of Polish women have completed the program. In this way, the GC Lab can use straightforward, high-leverage technology interventions to drive better social and economics outcomes.

Nonprofits

Nonprofits play a crucial role in society by addressing diverse social, cultural, and environmental challenges that may not be adequately met by the private or government sectors alone. By focusing on a mission rather than profit, nonprofits can do work that is not highly valued in the market in order to pursue long-term societal and environmental benefits. This section explores what makes nonprofits unique, featuring case studies of faculty who founded nonprofits.

Key Takeaways

AUTONOMY AND RESPONSIBILITY

- As compared to a Stanford initiative, founding a nonprofit offers autonomy and freedom of vision but also involves significant operational setup (which Stanford would otherwise support).
- Balancing day-to-day management can be demanding, requiring effective time management, delegation, and a robust support network.
- Building a strong new team is crucial for addressing operational demands while pursuing innovative ideas.

"You need support to handle partnership challenges effectively. Having dedicated staff whose expertise is in building and maintaining partnerships is key. These individuals are engaged with partners in ways that faculty typically cannot manage on their own."

– **Jim Leape**, Co-Director of the Center for Ocean Solutions

IMPACT MEASUREMENT

- Measuring impact requires more than tracking participant numbers or session frequency; it involves evaluating the actual outcomes and effectiveness of programs.
- Accurate impact measurement helps nonprofits show their value to stakeholders, including funders, board members, and the community, building trust and credibility.
- Start with clearly defining program objectives and determining specific, measurable outcomes aligned with these goals.
- Use impact data to inform decisions, refine strategies, and enhance program interventions, ensuring they remain relevant and effective.

SECURING FUNDING

- Securing funding is complex and competitive, requiring a strategic approach to navigate grants, donations, and other financial support mechanisms.
- Cultivate relationships with individual donors through personalized outreach and stewardship to create a reliable stream of contributions and enhance donor retention.
- Some nonprofits generate income by charging for services or products related to their mission, providing a predictable revenue stream and reducing reliance on grant funding.
- Establish a reserve fund as a financial cushion to buffer against funding fluctuations and unforeseen expenses, ensuring long-term sustainability and stability.

HIRING AND CULTURE

- Staff who feel connected to the mission are more motivated, proactive, and dedicated.
- Ensure staff are fairly compensated to retain talented individuals.
- Offer training, mentorship, and career advancement opportunities to help employees grow and contribute effectively.

COMMUNITY ENGAGEMENT

- Effective community engagement requires a strategic, intentional approach.
- Start with grassroots initiatives to establish a meaningful presence and build trust within the community.
- Conduct thorough assessments through surveys, interviews, and focus groups to understand the specific challenges and opportunities presented by the mission and all stakeholders.
- Cultivate trust through consistent, transparent communication, active listening, and respect for stakeholders' values and perspectives.

DIGITAL INQUIRY GROUP

(FORMERLY STANFORD HISTORY EDUCATION GROUP)

FOUNDED

2024

(Stanford History Education Group 2002 - 2023)

MISSION

To prepare young people to be more discerning consumers of the information they encounter online.

FACULTY FOUNDER

Sam Wineburg, the Margaret Jacks Professor at the Graduate School of Education at Stanford University (Emeritus)

Current role:
Co-Founder and Chief Innovation Officer

Sam Wineburg is co-founder and chief innovation officer of Digital Inquiry Group (DIG). He is the Margaret Jacks Professor of Education, Emeritus, at Stanford University. Educated at Brown and Berkeley, he holds a doctorate in psychological studies in education from Stanford and an honorary

doctorate from Sweden's Umeå University. Since the 1990s, Wineburg has been a leading figure in research on historical thinking and the teaching and learning of history. In 2002, Wineburg founded the Stanford History Education Group; SHEG's curriculum and assessments have been downloaded over 16 million times globally, making it one of the largest providers of free curriculum in the world. Since 2016, Wineburg's research investigating how people judge the credibility of digital content has been published in the Wall Street Journal, New York Times, and BBC and translated into dozens of languages.

Joel Breakstone is the co-founder and executive director of DIG. He previously directed SHEG from 2013 to 2023. He completed a bachelor's degree in history at Brown University, a master's degree in liberal studies at Dartmouth, and a PhD at the Stanford Graduate School of Education. Before Stanford, he taught high school history in rural Vermont, where he aimed to cultivate a deeper interest in history among his students. However, he noticed the lack of resources available for effective teaching — only a set of classroom textbooks stored in a filing cabinet and mimeographed worksheets. Working at SHEG enabled Breakstone to build online materials and strategies that would serve other history teachers.

BACKGROUND AND MOTIVATION

Wineburg founded SHEG in 2002 to enhance history education for students and provide free high-quality educational materials via the internet, which at the time was a new distribution channel. The first major breakthrough occurred in 2008 when the group completed a curriculum called "Reading Like a Historian." Their approach emphasized how historians analyze documents, prioritizing source information and context over singular narratives of the past. Testing these lessons in the San Francisco Unified School District revealed significant benefits: students improved their historical understanding, performed better on tests, and enhanced their reading comprehension. (School administrators cared most about improved reading skills, which raised standardized test scores.) The group uploaded these materials online for free, and they quickly gained popularity through word of mouth. Says Wineburg, "to make a real impact and change lives, high-quality educational materials need to be available for free." In the first year, downloads approached 200,000, and by 2013, they crossed a million downloads, including in distant places like Fiji and South Africa.

SHEG's success caught the attention of a foundation interested in digital literacy — understanding how online information is shared and understood. The foundation reached out in 2015 and suggested the creation of content on this subject. Realizing the potential of SHEG beyond history-focused topics and the importance of the internet in the age of misinformation, SHEG took on the project. Their digital literacy research was published in November 2016: "Evaluating Information: The Cornerstone of Civic Online Reasoning," (Wineburg, S., McGrew, S., Breakstone, J., & Ortega, T. (2016)). Given the contentious U.S. presidential election and new widespread concerns about digital misinformation, their timing was impeccable. SHEG's research revealed that high school students, supposed "digital natives," often struggled with basic tasks such as identifying advertisements from news stories or discerning the credibility of websites, a finding that garnered significant attention from major news outlets like the Wall Street Journal, NPR, and BBC and resulted in significant additional funding, including a million-dollar grant from Google to develop an online civic reasoning curriculum.

DISCONNECT BETWEEN ACADEMIA AND THE OUTSIDE WORLD

Breakstone noted that a key reason he was attracted to SHEG (instead of academia) was due to the disconnect between the academic world of educational research and real-world classroom impact. As Breakstone says, "many academic articles are laden with jargon that teachers struggle to comprehend, and there often seems to be little effort to translate findings into practical tools for educators." SHEG committed to conducting rigorous research and to making its information and curriculum freely accessible and easily understandable with teachers and students. "You should not sequester yourself; it is not just about publishing in journals," Wineburg says. "It is about making an impact on the world. If you are not achieving that, then you are not doing it right."

"You should not sequester yourself; it is not just about publishing in journals. It is about making an impact on the world. If you are not achieving that, then you are not doing it right."

– **Sam Wineburg**, Professor Emeritus at the Graduate School of Education

SHEG published in major education journals but also intentionally sought coverage from prominent news outlets. Among the many papers the group published were: "Civic Preparation for the Digital Age: How College Students Evaluate Online Sources about Social and Political Issues," (Breakstone, J., Smith, M., Ziv, N., & Wineburg, S., 2022), "Educating for Misunderstanding: How Approaches to Teaching Digital Literacy Make Students Susceptible to Scammers, Rogues, Bad Actors, and Hate Mongers," (Wineburg, S., Breakstone, J., Ziv, N., & Smith, M., 2020), and "Improving University Students' Web Savvy: An Intervention Study," (McGrew, S., Smith, M., Breakstone, J., Ortega, T. and Wineburg, S., 2019). Wineburg and Breakstone acknowledge that SHEG's affiliation with Stanford provided many advantages, allowing them to amplify their research findings and attract attention to their work.

THE DECISION TO LEAVE STANFORD

SHEG's decision to spin out of Stanford after 22 years of working within the university was driven by three main factors. First, given Wineburg's desire to retire from Stanford , the SHEG team needed a transition plan to ensure long-term sustainability beyond Wineburg's faculty sponsorship. Second, SHEG needed greater operational agility to expand its impact. Stanford processes that were helpful and supportive at first had become burdensome, added delays, and hindered SHEG's ability to deliver services. Finally, the SHEG team thought that being independent of Stanford would improve fundraising. While SHEG won many competitive grants and self-funded through mission-related services revenue,

some potential philanthropic donors believed that SHEG did not need funding because they had Stanford's financial backing and chose not to give money. Furthermore, for the grants that SHEG did secure, Stanford, as with all grants, took a portion of the funds for overhead costs.

OPTING TO LAUNCH A NONPROFIT

Wineburg, Breakstone, and the SHEG team initially considered various entrepreneurship pathways beyond Stanford, including nonprofit, for-profit, and a for-profit public benefit corporation. A nonprofit provided the best structure to achieve their goals. Throughout this decision making process, they revisited their values and motivations and asked themselves why they were doing this work in the first place. "No one enters education to make a fortune," says Wineburg. "The resources we received this past year since starting a new 501(c)(3) have come about as a result of the past quality of our work, not because we were driven by profit." While they wanted fair compensation, they were more concerned that the work remained aligned with their core values and mission. Given their momentum toward digital literacy and their need to move beyond Stanford branding, they changed their name from Stanford History Education Group to Digital Inquiry Group.

"The resources we received this past year since starting a new 501(c)(3) have come about as a result of the past quality of our work, not because we were driven by profit."

– **Sam Wineburg**, Professor Emeritus at the Graduate School of Education

INTELLECTUAL PROPERTY

DIG's core IP assets are the extensive curricula developed while at Stanford. DIG's conversation with OTL was unusual, both because these materials are protected by copyright, not patent, and because they have no intention to commercialize them. Free distribution is a cornerstone of their mission. The two parties reached a licensing agreement where OTL would license all the Stanford-created materials to DIG for free, but the agreement included a provision that Stanford would receive a percentage of any future revenue should DIG decide to monetize.

STARTING AND RUNNING A NONPROFIT

Spinning DIG out of Stanford took five years, starting in 2019. Early on, the team worked with the GSB's alumni consulting program to formulate a strategic plan. None of the team members had prior experience running a nonprofit so there was a steep learning curve — while Stanford's bureaucracy was

frustrating at times it also provided support in areas like tax, audit, and legal.

During Breakstone's time at Stanford, there was a good work-life balance, but since they spun out, things have become more demanding. While he eagerly anticipates passing off some of these new responsibilities to future team members, Breakstone has also enjoyed growing to meet these challenges and working to ensure a successful transition. "It is far from mundane," he says. "Each day brings new tasks and opportunities to solidify our new, stable, independent entity."

FUNDRAISING

While at Stanford, SHEG employed three to five full-time staff members and was initially supported by grant funding. Later, SHEG supplemented grant funding with fee-for-service work with school districts, where they provided their history curriculum at no cost but charged for professional development services ("teaching the teachers" how to use the curriculum). Their largest partner was Los Angeles Unified School District, the second-largest school district in the country. The professional development model involved extensive travel for in-person workshops before the pandemic and shifted to online professional development sessions starting in the summer of 2020. Fees from this line of work typically covered 20 to 30% of their annual budget, while the rest came from grants and other partnerships. SHEG is an excellent reminder that being a nonprofit does not mean you have to rely solely on donations; nonprofits can offer mission-aligned services that generate revenue.

When they decided to spin out as DIG, the team had to focus on raising funds outside of the university context. This proved challenging. Nonprofit fundraising can be slow and nonlinear. Initially they secured 10–15% of their fundraising target from a generous individual and a foundation in San Francisco with whom they had previously worked. In early 2023, knowing that they would leave Stanford in January 2024, their fundraising goal seemed daunting. They worked tirelessly and reached out to everyone they knew (as well as those they did not know). Then, in the span of a few weeks at the end of September 2023, they secured millions of dollars in funding from the Department of Education and the Hewlett Foundation, exceeding their fundraising target. They eventually had to turn down funds in order to make sure that they did not grow too quickly or make too many promises given the small size of the team and their high standards for quality.

HIRING TALENT

DIG has a tight-knit team with a remarkable level of stability. The four core members of their team have each been fully committed to the group's purpose for over a decade, fostering a strong sense of camaraderie, ownership, and autonomy. As they transitioned out of Stanford they knew they needed to match industry standards for nonprofits, including livable salaries and great benefits.

Breakstone says: "A great deal of ownership and autonomy are crucial for retaining our core team." Their projects are never the work of just one person; everyone is deeply invested in the team's collective success. Regarding the recruitment of future team members, Wineburg notes that they approach recruiting very carefully. Firing an incorrect hire is difficult in any context, but it can be especially

painful for a nonprofit, which is already operating on a slender budget. SHEG and DIG have been cautious here, often choosing to initially bring candidates into part-time consulting roles. Only after developing a strong conviction about the person do they offer them a full-time position.

MEASURING AND ACHIEVING IMPACT

Impact reporting is foundational in the nonprofit sector and typically occurs annually. Some education-focused organizations measure and report metrics like the number of teachers served, hours of professional development provided, and number of students who used their material — but this begs the question of whether real, measurable learning has occurred.

While DIG acknowledges some value in these metrics, their primary focus lies in assessing the quality and effectiveness of their initiatives through student and teacher learning outcomes. As part of this commitment, they applied for and won a U.S. Department of Education grant to partner with the American Institutes for Research to conduct rigorous assessments of their curriculum and professional development. This evaluation will include validated measures of learning that provide independent, evidence-based insights into the impact and effectiveness of DIG's work.

IDEOLOGY

Recently, there has been significant controversy surrounding the teaching of history, and digital literacy has become another contentious issue. While DIG's work has occasionally intersected with broader policy debates — and has been referenced in congressional reports and media coverage — DIG is committed to nonpartisanship, and its educational resources do not cater exclusively to any particular political viewpoint or geographic region. "It is crucial to us that our materials prompt students to engage actively with content rather than dictating what they should believe," Breakstone says. Currently, DIG's materials are endorsed by the departments of education of 41 states.

SCALING

Wineburg and Breakstone are often asked if DIG's goal is to expand to every school in the country, but that is not their aim. They observed how other organizations focused on digital literacy in the wake of the 2016 election expanded rapidly with the influx of funding, sometimes growing quickly from a small team to 60 or 80 staff members. However, Wineburg is skeptical of this approach. "If we follow the path of many other nonprofits by expanding too rapidly and hiring people who do not understand our values or mission," he says, "we risk compromising quality." Nevertheless, DIG needs to expand so that Breakstone can delegate aspects of operations to dedicated team members. Given their current funding, Breakstone says they are currently "planning for the next three to five years," and are considering "the types of projects we can undertake with a team of 10 to 15 people."

"If we follow the path of many other nonprofits by expanding too rapidly and hiring people who do not understand our values or mission, we risk compromising quality."

– **Sam Wineburg**, Professor Emeritus at the Graduate School of Education

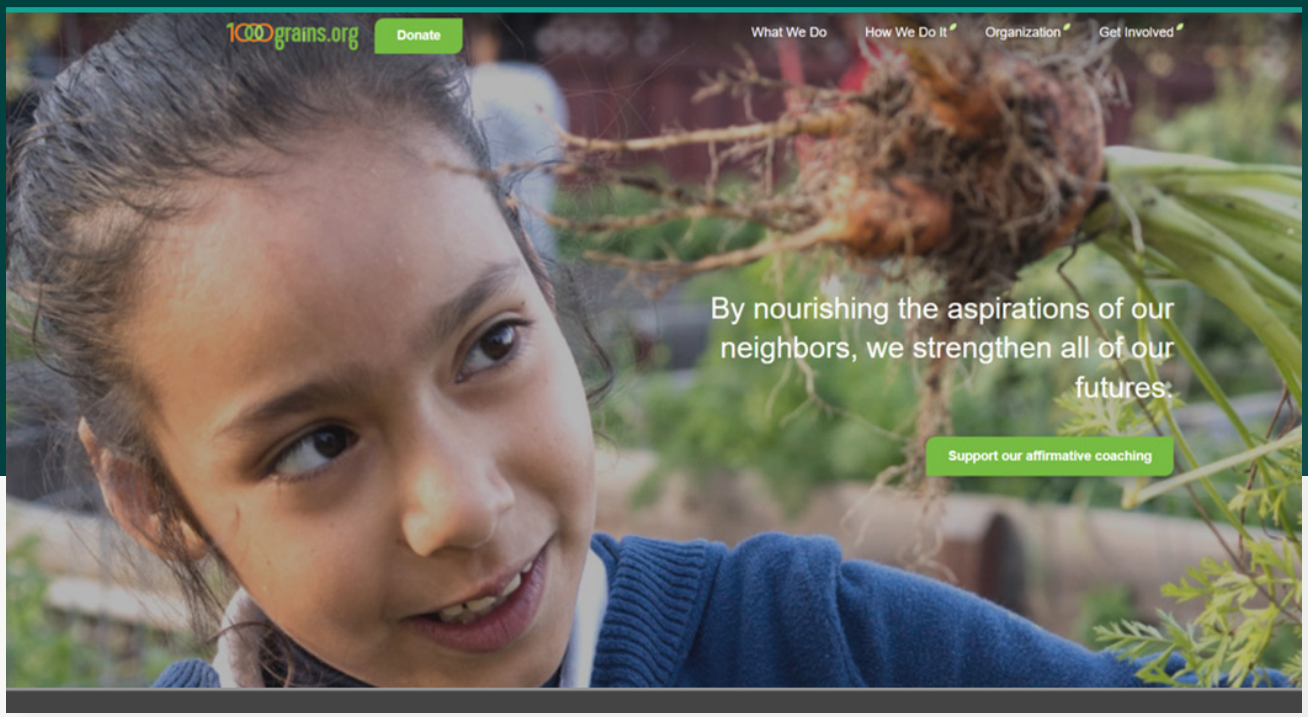
WORDS OF ADVICE

Wineburg's first and most important piece of advice is to produce high-quality work. SHEG and DIG's success have all flowed from their outstanding research and commitment to quality. The second is to find channels that enable academic research to reach a broader audience (beyond academic journals). Academic publication should not be done merely for its own sake; the wider non-academic audience is interested, it just needs to be engaged with on its own terms. Receiving mainstream media coverage for SHEG and DIG has resulted in national impact, funding, partnerships, name recognition, social proof, and many other benefits. "These things cascade," Wineburg says. "You do not know what is going to sprout, but nothing will sprout unless you broadcast seeds to the broader public." Second, take the time to plan. Spinning DIG out of Stanford has been a multi-year process: OTL, securing 501(c)(3) status from the IRS, fundraising, etc. "If you are starting a nonprofit," Breakstone says, "you should plan far ahead."

"You do not know what is going to sprout, but nothing will sprout unless you broadcast seeds to the broader public."

– **Sam Wineburg**, Professor Emeritus at the Graduate School of Education

1 GRAIN TO 1000 GRAINS



FOUNDED

2013

MISSION

To vitalize families and their communities through healthier lifestyles.

FACULTY FOUNDER

Kenneth Singleton, the Adams Distinguished Professor of Management at the Graduate School of Business at Stanford University (Emeritus)

Current role:
Co-Founder and President

Kenneth Singleton is the Adams Distinguished Professor of Management, Emeritus, at the Graduate School of Business at Stanford University. Singleton holds a bachelor's degree in mathematics from Reed College and a PhD in economics from the University of Wisconsin-Madison. He has spent 35 years at the GSB and has published widely on financial risks and their impacts on the decisions of households and financial institutions, including books on credit risk and dynamic asset pricing. He

was the executive editor of the *Journal of Finance*, a former senior associate dean for Stanford GSB, and a founding advisor to the GSB Impact Fund. His social-entrepreneurial activities draw upon his experiences as special advisor to the chief economist at the IMF in 2009 during the global crisis, affiliate of the Stanford Institute for Innovation in Developing Economies (focusing on poverty alleviation), and scientific advisor to projects helping individuals improve their credit.

His wife and co-founder at 1 Grain to 1000 Grains, Fumi Arao, has 25 years of college-level experience in curriculum design and teaching, is a certified macrobiotic counselor, holds certificates from the Campbell Center for Nutrition Studies and Japan TCM-Traditional Chinese Medicine, and is a specialist on the impact of food on healthy and energetic lifestyles. Arao's career includes teaching at Stanford University, corporate strategy work at Sony in Japan, lectures on promoting healthy lifestyles in the Bay Area, and contributions to projects at the Stanford University School of Medicine.

BACKGROUND AND MOTIVATION

Arao was the catalyst for starting 1 Grain to 1000 Grains (1000 Grains). She is an expert in food and health. She left Stanford to pursue these interests independently and gradually became involved in advising research teams at the Stanford School of Medicine and local communities. Through her advisory role, she recognized an opportunity to empower communities in need to take charge of their well-being and wellness. She was inspired to establish a nonprofit organization with her husband dedicated to achieving these goals.

Singleton and Arao decided not to join an existing nonprofit because they had no guarantee that they would receive financial or administrative support or be strategically aligned with another organization. By founding their own nonprofit, they could maintain autonomy and create curricula according to their vision for impact. But launching 1000 Grains was not easy. There were hundreds of nonprofits already operating in San Mateo County alone, and the idea of adding a new organization was something Arao and Singleton approached with mild trepidation. They realized that in order to succeed they would need to take the time to deeply understand their stakeholders.

Arao and Singleton decided to walk the streets to meet the community — pounding pavement to connect with those most likely to benefit from their work in food and health: low-income immigrant families. This grassroots "walk and talk" effort lasted a full year. Initially, the community members had misgivings about Stanford academics offering to help. Prior experiences with researchers had been negative, as their priority was data collection, not sustained positive impact (which typically requires extended engagement).

Singleton and Arao worked diligently to establish trust. From the outset, they made it clear that they were committed to the long term. They also often communicated with the population in their native Spanish.

Next, Arao spent another year crafting a curriculum for more healthful eating that was tailored to the community, drawing from her extensive experience and training as a nutrition counselor and educator. After this preparatory phase, they approached the nonprofit Siena Youth Center in San Mateo County with the idea of collaboration, hoping to assist the member families. The center, familiar with Arao's

work, agreed to collaborate and spread the word and helped collect a lengthy list of families eager to participate in the program.

Singleton and Arao built programs to empower individuals to take greater control over various aspects of their lives. The programs initially centered around food, health, and stress management, but over time they evolved to include financial wellness. These programs typically run for two months, which allows participants to form connections with each other and foster a sense of community.

FUNDRAISING

Running a lean organization provides significant freedom. 1000 Grains operates with just the two founders, along with a few dedicated part-time volunteers. Some of these volunteers were participants in their programs years ago and wanted to stay involved and assist (they receive a symbolic stipend).

When fundraising, Singleton and Arao faced stiff competition. Many philanthropic foundations emphasized numerical metrics and scale. However, what is feasible to measure is not always tightly connected to the deep, meaningful impact. Singleton and Arao aimed to achieve. After extensive back and forth, they received seed funding from the San Mateo County Health Department. They also reached out to friends and family for tax-deductible donations. They raised $50,000 for a successful launch.

Recruiting new course participants was based almost entirely on strong word-of-mouth recommendations from past participants, and attrition was very low. Seeing this impact, their partner youth center proposed a collaborative fundraising effort. This was a pivotal moment. The partnership allowed them to secure sustained funding, marking a significant breakthrough for 1000 Grains. And, as word spread about their initiatives and impact, they gained additional support from a few family offices.

Combining these sources of support with their efficient model allowed Singleton and Arao to build a reserve fund that provides financial stability for 1000 Grains. They continue to fundraise, but they have a reserve that allows them to cover any light fundraising years without posing any risk to the organization.

SCALING AND ACHIEVING IMPACT

Singleton and Arao's focus has never been on "scale" in the hackneyed Silicon Valley sense; instead, it has always been on making a deep, meaningful impact on a few individuals. A key aspect of these initiatives was the small group size, typically 15 to 20 people. This provided a safe space where families felt comfortable sharing their life challenges and experiences openly — a level of trust and openness that was remarkable considering the community's initial misgivings.

The small group size, consistency and commitment of the founders, and the homogeneity of the cohort (all from the same demographic and neighborhood) were the key reasons Singleton and Arao succeeded in creating trusting spaces. These spaces met the community where it was, physically and culturally.

Before COVID-19, Singleton and Arao used entry and exit surveys for program participants to measure impact. Additionally, they attempted to maintain contact with families post-program through bilingual

volunteers, aiming to gauge the persistence of the impact. However, this approach proved challenging as families often found it difficult to allocate time for follow-up or attempted to tailor their answers to please Singleton and Arao, thereby compromising the data's reliability.

Over the years, some of the most candid feedback has come from informal end-of-session discussions, where participants openly shared their real-life experiences and reflections on the program's effects. The final session of the classes typically involved presentations from Singleton and Arao, followed by a Q&A session and potluck where families shared their healthy recipes. During these gatherings, they engaged in informal conversations about how the 1000 Grains program had positively affected them.

BALANCING PRIORITIES

A significant investment of time was needed during the program's early years. Arao was working on the nonprofit full time, while Singleton managed the business side part-time. He assisted in establishing their tax-exempt 501(c)(3) status and handling overall financial management. He also participated in the programs and gradually offered workshops on finance to the families, which took up a few hours per week. But Arao led the charge in the early years: Singleton sometimes had difficulty making time for 1000 Grains given his professional responsibilities, including his academic and administrative roles at the GSB and as an editor of academic journals. Now that Singleton is emeritus, he has stepped into the role of president of 1000 Grains, and he can dedicate more of his attention to the organization.

Even if it was not always easy, Singleton is immensely grateful for the experience and credits his work at 1000 Grains with expanding and enriching his teaching, shaping his worldview, and introducing him to people and communities he otherwise never would have met.

"We academics are accustomed to seeking answers and engaging in intellectual debates. As a result, we may not always excel at listening. It is essential to set aside our academic mindset and approach situations with humility, actively listening to others."

– **Kenneth Singleton**, Professor Emeritus at the Graduate School of Business

WORDS OF ADVICE

"We academics are accustomed to seeking answers and engaging in intellectual debates and discourse, often advocating for our own point of view," Singleton says. "As a result, we may not always excel at listening. It is essential to set aside our academic mindset and approach situations with humility, actively listening to others. The solution we envision, the approach we believe could work, or even our understanding of the problem itself might not align with reality or the perspectives of those we are striving to serve. Behind any symptoms or outcomes we are striving to address, there are often layers of complexity."

For-Profit: C Corporation

For-profit C corporations are essential in driving economic growth and addressing market needs through innovation and competition. Unlike nonprofits, for-profits are driven by financial objectives and shareholder value, which requires them to focus on scalable solutions and operational efficiency. This section delves into the details of for-profit C companies, showcasing case studies of faculty who have launched successful ventures.

Key Takeaways

EQUITY DISTRIBUTION

- Inventing a new technology or conceiving of the startup idea does not automatically entitle a founder to the majority of equity, especially if they are not fully committed to the venture.
- who remain at Stanford should have minority equity (2-12%) in the new venture.
- Equity distribution should be based on contributions and risks over the lifetime of the venture, as startups often pivot and evolve and execution is the most difficult and grueling part of the journey.
- Investors closely examine equity arrangements and may be hesitant to invest if one founder holds disproportionate equity without corresponding commitment.
- Retain sufficient equity for future hires, including key positions and executives, to offer competitive compensation and attract top talent.

"Funders are only funding the future execution and are sharing that risk with the executors. Everything that happened before is nominally valued."

– **R. Todd Johnson**, Formerly: CEO at Activate and Partner at Jones Day

"Entrepreneurs and founders have a vision — they see opportunities that others might overlook. However, to be successful, they need to surround themselves with people who have complementary skills and perspectives."

– **Jane Woodward**, Adjunct Professor of Civil and Environmental Engineering and Founding Partner, MAP Energy and WovenEarth Ventures

"Startups with more than one founder have a greater chance to raise outside funding and sooner than a solo founder. Solo founders have a better track record on longevity and revenue, likely due to more efficient decision-making in the early period, but also have a higher failure rate in the first three years."

– **R. Todd Johnson**, Formerly: CEO at Activate and Partner at Jones Day

HAVING A CO-FOUNDER

- Co-founders can bring diverse skills and expertise, filling critical gaps (e.g., technical development, business acumen, marketing).
- Co-founders provide encouragement, act as a sounding board, and help maintain motivation.
- Prior work history with a co-founder can help avoid misunderstandings and ensure compatibility.
- In some cases, experienced entrepreneurs or full-time founders (on a leave of absence) may forego a co-founder and instead hire for key early roles like product, operations, and engineering. Hiring requires cash & equity, so fundraising is a key first step.

HIRING A CEO

The CEO may be a co-founder or they may be hired by the founding team.

- Select a CEO who aligns with the startup's vision and has a proven track record.
- Choose a CEO who matches the startup's stage; early-stage startups benefit from leaders experienced in raising capital and scaling, while mature companies may need CEOs with experience in managing larger organizations and strategic growth.
- Use brainstorming sessions and strategic discussions to assess candidates' problem-solving abilities and thought processes.

- Obtain prior references and feedback from people who have worked with (and for) the candidate to gain insights into their performance and leadership style.
- Faculty founders may face challenges in finding an ideal CEO due to limited networks. It is advisable to connect with fellow faculty entrepreneurs, advisors, and recruiting firms to find qualified candidates.

FUNDRAISING

- SAFEs are commonly used to secure initial capital with low legal cost.
- Articulate the commercial potential, market value, and competitive advantages of the innovation to attract investors. Many investors want founders to tell a billion-dollar story.
- Demonstrate a path to future profitability and a compelling business case.
- Partner with investors who have a long-term perspective rather than those seeking short-term gains.
- Ensure investor goals align with the company's mission to foster a supportive and collaborative relationship.

INTELLECTUAL PROPERTY

- Patents can enhance technology's appeal to investors by creating a competitive advantage.
- However, operational and strategic execution often play a more critical role than IP. Success is driven by market strategy, product development, customer acquisition, and operational efficiency.

"You can have the best technology in the world, but without hands-on project execution, you would not be able to advance and reach full potential."

– **Jane Woodward**, Adjunct Professor of Civil and Environmental Engineering and Founding Partner, MAP Energy and WovenEarth Ventures

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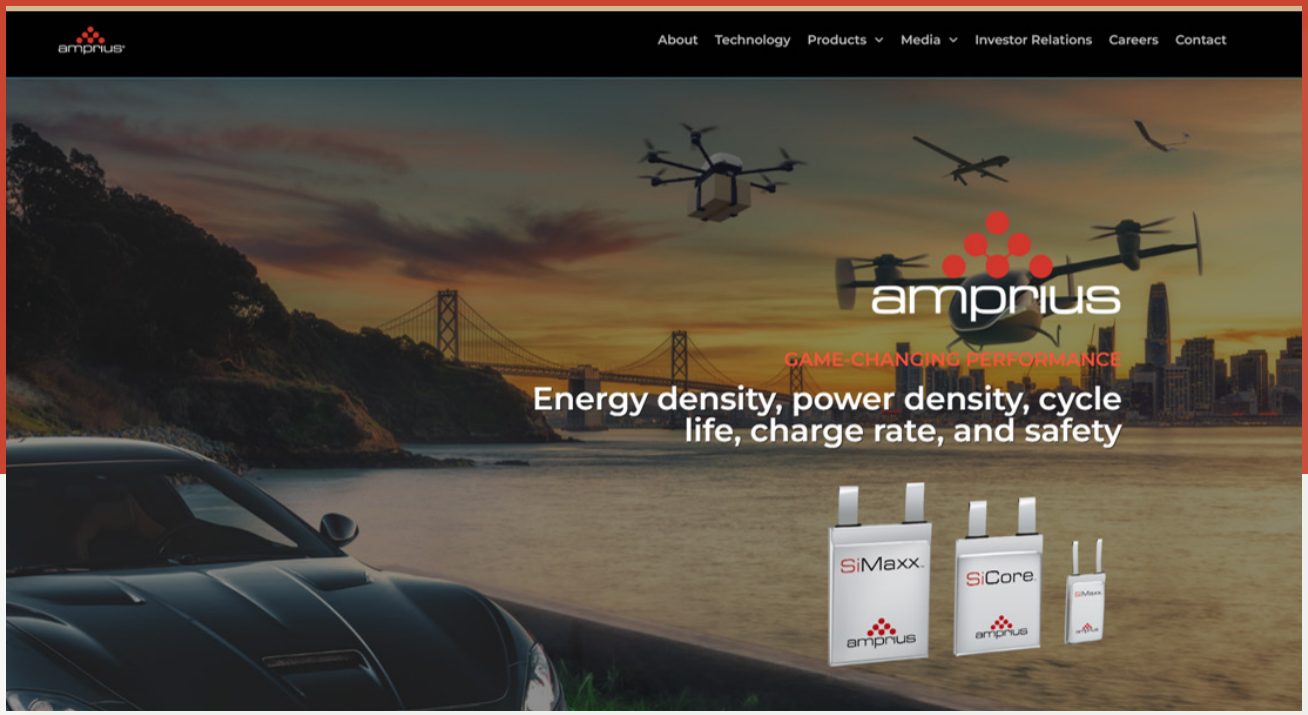
AMPRIUS TECHNOLOGIES



FOUNDED

2008

MISSION

To make the highest energy density lithium-ion batteries in the world.

FACULTY FOUNDER

Yi Cui, the Fortinet Founders Professor at the Department of Materials Science and Engineering at Stanford University

Current role:
Co-Founder, Director

Yi Cui is the Fortinet Founders Professor of Materials Science and Engineering, a senior fellow at the Stanford Woods Institute for the Environment, an affiliate at the Precourt Institute for Energy, and the inaugural faculty director at the Stanford Sustainability Accelerator. He obtained a bachelor of science degree in chemistry from the University of Science and Technology of China and a PhD in physical chemistry from Harvard University. Following his graduate studies, Cui conducted postdoctoral work as a Miller Fellow at the University of California, Berkeley, and in 2005 he joined Stanford

University, focusing on energy and environment-related research. Cui is the most-cited scholar in Stanford's history and was named one of the world's "most influential scientific minds" in 2014 and 2015 (Thomson Reuters, 2014/2015). Cui has helped educate and train over 150 doctoral students (~100 of whom have gone on to become professors) and embodies the intersection of academia and entrepreneurship at Stanford. Cui began exploring entrepreneurship nearly 20 years ago, motivated to translate academic discoveries into meaningful real-world applications. Since then, Cui has founded five companies, including Amprius Technologies, which went public on the New York Stock Exchange in 2022.[xxix]

BACKGROUND AND MOTIVATION

Cui's entrepreneurship journey began in 2007-2008. His *Nature* paper "High-Performance Lithium Battery Anodes Using Silicon Nanowires" sparked worldwide interest in the application of nanotechnology and nanomaterials for energy storage (Chan, C., Peng, H., Liu, G., et al., 2007). Venture capitalists and technology luminaries like Elon Musk encouraged Cui to start his first company, Amprius Technologies. Despite being an assistant professor without tenure, Cui took the leap. "You should not wait for tenure to start a company," Cui says. "If you have a good idea and the passion to be an entrepreneur, you should go for it, even though it can and will be challenging."

"You should not wait for tenure to start a company. If you have a good idea and the passion to be an entrepreneur, you should go for it, even though it can and will be challenging."

– **Yi Cui**, Fortinet Founders Professor at the Department of Materials Science and Engineering at Stanford University

LICENSING VS. DELAWARE C CORPORATION

Cui considered licensing his technology but it was too nascent to attract a willing party. In deep technology domains, large companies typically require a functioning prototype or commercial product to consider a license. They are often reluctant to assume the technological risks of taking a technology from research and development to prototype to commercial product. Consequently, faculty inventors are often best-suited to oversee the initial stages of development (and this is a key reason why OTL often licenses to faculty despite running an open and unbiased licensing process).

xxix Additional companies founded/co-founded by Cui: 4C Air Inc, EEnovate Technology, EnerVenue, and LifeLabs Design.

INTELLECTUAL PROPERTY

When negotiating with Stanford, faculty are prohibited from engaging directly with OTL due to the automatic conflict of interest. Cui relied on his lawyers and investors to negotiate. Cui found OTL to be fair and reasonable in its terms. He considers Stanford one of the premier institutions for technology spin-outs due to its well-established processes, extensive experience, and strong commitment to faculty entrepreneurship.

Cui also emphasizes that while protecting IP is important, its significance is sometimes exaggerated. "Founders' success typically does not hinge on the strength of IP protection; instead, success often depends more on how effectively they execute their ideas and plans." (It is worth noting that different sectors, such as biotechnology, may prioritize IP protection more than others.)

"Founders' success typically does not hinge on the strength of IP protection; instead, success often depends more on how effectively they execute their ideas and plans."

– **Yi Cui**, Fortinet Founders Professor at the Department of Materials Science and Engineering at Stanford University

FUNDRAISING

Cui, now an experienced fundraiser, first secures a few million dollars from VC investors with SAFEs. After the initial fundraise, Cui recruits a CEO and a team. Over time, and with his track record of success, It is now much easier for Cui to raise money and build a team than it was the first time around.

Cui maintained majority ownership in his first startup without working full-time for his company. However, Cui acknowledges that venture capitalists are generally hesitant to allocate a majority equity percentage to faculty who are not fully committed to their startup (i.e., willing to leave Stanford and work full time). Therefore, faculty should not anticipate retaining a majority share in their startup, even if they conceived the original idea, especially if they prioritize their academic careers. Additionally, founders' ownership stakes naturally decrease over time due to subsequent funding rounds and the need to allocate shares to attract talented team members.

ROLE OF FACULTY

Faculty can assume various roles within a company. The most common model involves serving as advisors, dedicating a few hours per week, and typically receiving a small percentage of the company (2–6%). They offer guidance on significant ideas and technology but are not directly involved in daily operations and defer to the CEO with regard to long-term strategy.

In a more involved role, faculty may own 4–12% of the company and commit the maximum time allowed by Stanford COI rules. In this case they may co-lead long-term strategy, although they will still delegate day-to-day operations to the CEO. But there are also cases in which a faculty member has extensive experience in entrepreneurship and helps guide company technology, strategy, customer and supply chain networks as well as bring in investment. In such cases, their ownership of the company can go significantly higher.

(The rarest scenario occurs when a faculty member exits the university entirely, retaining a substantial ownership stake and potentially assuming a leadership role in the company. Such was the case with Patrick Brown, the founder of Impossible Foods, a case we describe below.)

If there are multiple founders, e.g., a faculty member and a PhD student, and one opts to work full-time while the other stays in academia, their equity distribution need not be equal. This is a common misconception among academics. Startups hinge on execution with initial ideas often evolving and necessitating pivots. There are multiple factors to be considered for equity distribution including, leadership role in the company, time to be dedicated, and values and networks to be brought in.

FINDING A CO-FOUNDER

Cui frequently launched his startups as a solo founder due to the challenge and time required to establish a relationship with a co-founder. He quickly learned how to successfully pitch to investors, so was able to raise capital quickly and hire a CEO and team. However, for other founders, particularly those lacking experience or connections, having a co-founder can be valuable for a multitude of reasons: motivation, morale, expertise, network, credibility, etc. It is essential to find someone who you trust and who shares your vision. Cui says: “It is almost like finding a spouse; establishing a deep relationship takes a long time.”

BALANCING ACADEMIA AND ENTREPRENEURSHIP

Effectively managing academic and entrepreneurial responsibilities requires maximum effort. Cui’s role in his companies typically involves weekly meetings lasting 1-2 hours. In these meetings, he focuses on technology development and discusses business strategy, market fit, and execution. In addition to these deep dives, Cui remains available around the clock should the CEO or team require input. Cui emphasizes the importance of making swift decisions via email or phone calls to keep momentum moving forward.

Balancing roles as a faculty member and founder is demanding. Cui has not taken an extended vacation since starting at Stanford 19 years ago. When he does take time off, it rarely exceeds two weeks, and he is often still online. For Cui to effectively manage his academic, administrative, and entrepreneurial activities, this level of dedication is essential. And there are trade-offs: Before assuming roles as the Precourt Institute director and Sustainability Accelerator faculty director, Cui’s lab typically published 40 to 45 papers annually, but now that he

has partially transitioned to administrative work, the lab now produces 10 to 12 publications each year.

Lastly, Cui emphasizes that it is crucial to have a conversation with the chair of the 's department. "Talk to your department chair as you weigh different pathways," he says, "so that they can provide advice and they are not surprised."

"Talk to your department chair as you weigh different pathways so that they can provide advice and they are not surprised."

– **Yi Cui**, Fortinet Founders Professor at the Department of Materials Science and Engineering at Stanford University

RECRUITING A CEO

The most valuable lesson Cui has learned is to hire the right CEO. Even with exceptional technology, having someone adept at market strategy, business management, company growth, and prudent financial management is crucial to the success or failure of the company. This person might be a co-founder if they join early enough, but in Cui's case the CEO is typically his first employee.

Cui usually does early technological development and raises funds first and then uses his personal network, investor network, and professional headhunters to identify 10 to 15 CEO candidates. Many startups may struggle to access top CEO talent before securing funding. They will either have to grant significantly more equity to the CEO to offset a lower salary or survive with a more junior or interim CEO (such as a recent MBA graduate).

When selecting a CEO, it is essential that they are available around-the-clock (being a CEO is a 24/7 job) and possess experience in small companies or startups. Executives accustomed solely to large corporations might find it challenging to effectively manage resources and conserve funds, which is critical for startups operating with limited capital. Moreover, a lack of fundraising experience could make a CEO less suitable for startup leadership positions.

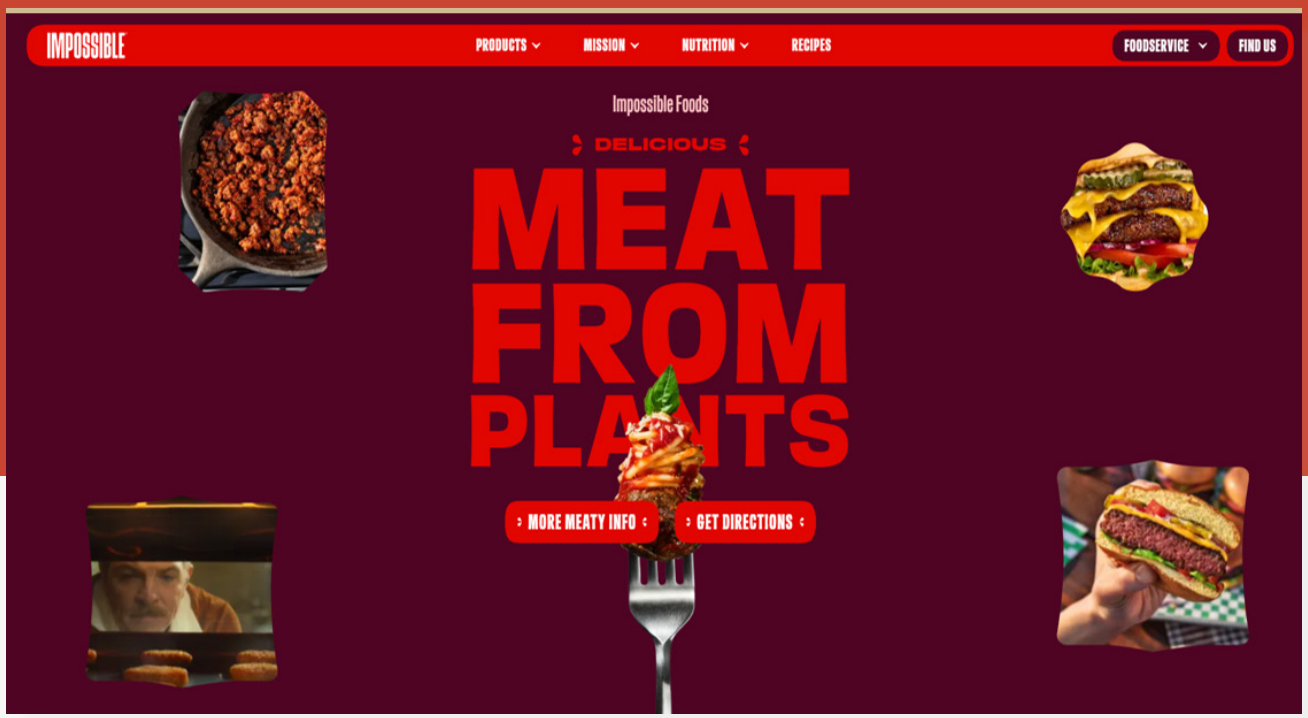
Compensating a seasoned CEO can be difficult for a startup. Startups typically cannot match the cash compensation offered by larger companies, but a CEO who prioritizes cash over equity may not be the right fit for a startup. (And in some cases, CEOs are not even the highest-paid individuals at a startup.) According to Cui, a competitive salary range for a very capable CEO usually falls between $300,000 and $400,000 annually. However, it is worth noting that CEO salaries can vary widely. Some CEOs may join as a co-founder, assist with pre-commercial R&D and product development, help land the first customers,

and take $100,000 to $200,000 in salary, or no salary at all in the early months. Obviously early-joining co-founding CEOs taking such a low salary will have a much higher equity stake, perhaps 10–20%, or even more. On the other hand, some CEOs might join after the company has launched a first product, received early revenue, and raised funds. This CEO might have a salary of $300,000 but a much smaller equity stake, perhaps in the mid-single digits (3–8%).

IMPACT

"Changing the world involves three main efforts in my lab," Cui says. "Developing top science and technology, translating innovations into impactful products for the public, and educating students into highly creative thinkers who move science forward in remarkable ways, which leads to a significant amplification effect." His approach integrates academic excellence with entrepreneurial vigor to drive substantial positive impact.

IMPOSSIBLE FOODS



FOUNDED

2011

MISSION

To make delicious meat products, from plants, and save the planet we love.

FACULTY FOUNDER

Patrick O'Reilly Brown, Professor at the Department of Biochemistry at Stanford University (Emeritus)

Current role:
Founding CEO, now the Chief Visionary Officer

Patrick O'Reilly Brown is the founder of Impossible Foods and Professor Emeritus in the Department of Biochemistry at Stanford University. He is also the co-founder of Lyrical Foods, Inc., maker of Kite Hill artisanal nut-milk-based cheeses and yogurts. After receiving a bachelor's degree, medical degree, and doctoral degree in biochemistry from the University of Chicago, Brown completed a residency in pediatrics at Chicago's Children's Memorial Hospital. At Stanford, Brown and colleagues developed DNA

microarrays, a new technology that made it possible to monitor the activity of all the genes in a genome, along with the first methods for analyzing, visualizing, and interpreting global gene expression programs. He pioneered the use of gene expression patterns to classify cancers and improve prediction of their clinical course and is a recipient of the American Cancer Society Medal of Honor. Brown has also been a leader in making scientific and medical research results freely available to scientists, physicians, and the public, through his work as a co-founder of the Public Library of Science.

Impossible Foods' first employee, Nick Halla, holds a degree in chemical engineering from the University of Minnesota and an MBA and master's degree in environment and resources, both from Stanford University. He was a founding employee at Impossible Foods, where he teamed up with Brown in 2011 to create plant-based protein for a better food system. He helped build Impossible Foods from the ground up. Halla held several executive roles, including senior vice president of international, where he spearheaded Impossible Foods' international strategy, development, and commercial operations as the company expanded globally. Today, Halla is a founder of GigaClimate, a climate-tech venture studio focused on building the next great climate companies, and serves on several boards.

BACKGROUND AND MOTIVATION

Brown had an established career in biochemistry and genomics, but in 2009 he decided to take an 18-month sabbatical to consider the ways in which he could use his skills to have the greatest impact. During this break, he zeroed in on one of the most critical global issues: the environmental impact of food production, in particular the beef industry. He realized that shifting the global diet toward plants was an essential step toward sustainability.

At first, Brown attempted to influence change through academia, organizing conferences to explore the potential benefits of a plant-based food system. However, he soon realized that theoretical discussions and policy recommendations were insufficient to drive meaningful change. "Policy was not changing fast enough," Brown says. "We needed a marketplace solution."[xxx]

He identified a gap: while plant-based meat alternatives existed, they often fell short in taste and texture compared to traditional animal-derived products. "We need to find a way to meet the huge demand for these foods with a much lower environmental footprint and compete in the marketplace," Brown says. "These destructive industries will go away not with regulation. We have to beat them in the marketplace with better products." Brown framed this problem technologically: First, to understand the biochemistry of meat and meat consumption, and second, to match or improve upon that experience using plant-based alternatives. Brown believed that by understanding how meat cooks and tastes at a cellular level, he could develop plant-based alternatives that not only matched but exceeded the sensory experience of animal meat. Driven by the urgency of global environmental issues and the potential for technology to transform food systems, Brown left Stanford faculty and founded Impossible Foods in 2011.

xxx Brown's quotes were taken from his interview on the Rich Roll Podcast, *Can A Burger Help Save The Planet?* (Oct 20, 2019).

His vision was clear: to offer consumers a sustainable choice without compromising on taste or texture, thereby outcompeting conventional meat products in the marketplace.

> **"These destructive industries will go away not with regulation but by beating them in the marketplace with better products."**
>
> – **Patrick O'Reilly Brown**, Professor at the Department of Biochemistry at Stanford University (Emeritus)

TRANSITION FROM ACADEMIA TO THE BUSINESS WORLD

Brown faced a steep learning curve as he transitioned from academia to CEO of a VC-backed startup. He surrounded himself with knowledgeable individuals who could fill those gaps. Vinod Khosla, a prominent VC, was an early advisor and supporter. Brown also brought on Halla as his first employee, a Stanford MBA student with prior experience in the food industry. Halla grew up on a dairy farm and trained as a chemical engineer before working at General Mills, so he had a strong foundation in science, business operations, and a deep-seated passion for sustainability and renewable energy.

"Faculty founders often approach problems from an academic standpoint," says Halla, "focusing on the technical aspects more than how the business will be built and scaled. They also may have challenges communicating and building trust with business focused leaders. It is critical for scientific founders to have someone on the team who can bridge the worlds of science and business." For Brown, adjusting to the timeline and expectations of for-profit research and development proved challenging at times. "Fortunately we had people who were good at that and could both help educate me and bring that expertise," says Brown. Halla adds that Brown's academic career, visionary and disruptive thinking, and status as the founder CEO made him "legendary" in the organization and that it was important for Brown to have an executive team and board that could speak truth to him and "advise him, fill key gaps, and help him grow into his role, particularly in difficult times."

FUNDRAISING

Early on, Brown struggled to convey the commercial potential of his plant-based meat alternative, focusing instead on the science or the environmental crisis. The company had more fundraising success once Brown placed the enormous commercial potential front and center.

Impossible partnered with investors known for their long-term vision rather than just short-term gains, including Khosla Ventures, Bill Gates, Google Ventures, and Horizon Ventures, Li Ka-shing's Fund in Hong Kong. This approach allowed them to avoid the typical pressures of venture capital and focus on

developing the scientific platform for achieving the long-term vision of replacing all meat consumption with plant based foods. However, as time went on and more stakeholders were involved, they faced more scrutiny and expectations, which posed cultural and governance challenges as they balanced their long-term impact goals with short-term business demands and divergent stakeholder interests.

HIRING TALENT

Brown attributes much of Impossible Foods' success to the quality of the team they have assembled. "We have been incredibly successful recruiting great scientists because they gravitate toward really important, challenging problems," he says. Hiring and empowering talented individuals to overcome initial business challenges and drive sustained growth is the key. Halla adds, "Brown's ability to recognize his own limitations as a former professor and delegate responsibilities to capable hands was pivotal in steering the company toward its current position as a leader in the sustainable food industry." Brown leveraged his star power in the academic community and at Stanford in order to attract other talented collaborators.

"Brown's ability to recognize his own limitations as a former professor and delegate responsibilities to capable hands was pivotal in steering the company toward its current position as a leader in the sustainable food industry."

– **Nick Halla**, Founding Employee, Impossible Foods

SCALING UP

Drawing from his academic background, Brown initially ran the R&D division like an academic lab, emphasizing discovery-driven research. "I was never in a position where the R&D team needed to do something on a timeline because that is just not part of the academic experience," says Brown. However, as the company grew, the focus shifted from pure discovery to practical application under tight timelines and included complexities related to production (building a large-scale facility), supply chain (including shelf life and packaging), and market forces entirely outside of the company's control (such as COVID-19).

"Unlike digital innovations that require minimal capital for scaling, creating plant-based foods on a large scale necessitated substantial upfront investments," says Halla. Their production facility cost tens of millions of dollars and took years to build and begin production.

"Unlike digital innovations that require minimal capital for scaling, creating plant-based foods on a large scale necessitated substantial upfront investments."

– Nick Halla, Stanford MBA and employee #1 at Impossible Foods

TRANSITIONING FROM THE CEO ROLE

Since its inception nearly 13 years ago, Impossible Foods has evolved from a small team of dedicated scientists focused on groundbreaking research to a robust commercial entity with a presence in more than 50,000 restaurants and supermarkets worldwide. The success of launching multiple new products and achieving significant revenue milestones underscored the company's potential to fundamentally reshape the food industry. However, as the company scaled in size, complexity, and market reach, Brown recognized that the demands on the company's leadership had shifted.

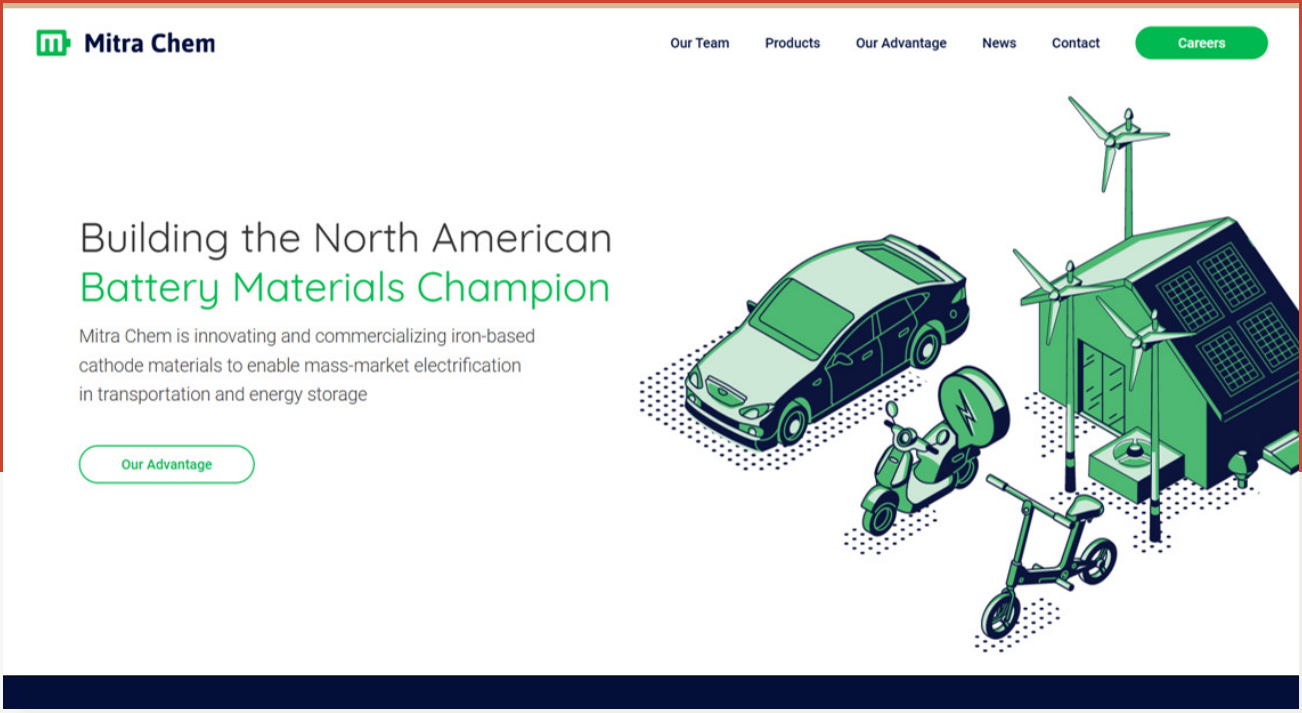
The CEO role increasingly required someone with deep expertise in scaling operations, driving business growth, and managing complex commercial challenges. These demands left less time for Brown to focus on his core strengths: guiding research and technology innovation, advocating for the company's mission, and leading strategic initiatives.

In 2022, Brown relinquished the CEO role and appointed Peter McGuinness as his successor. With over 30 years of experience in consumer brands, including Chobani, McGuinness was trusted to maintain the company's growth trajectory, improve operational efficiency, and spur continued innovation. Brown transitioned to the role of chief visionary officer, where he could continue to focus on the company's long-term vision, research, and technology advancements.

WORDS OF ADVICE

Taking risks is an essential part of innovation and growth. "If failure is not a regular part of your journey, you are either too cautious or not tackling bold challenges," Brown says. Nobody can accuse Brown of aiming too low: The Impossible Foods mission is to change the way all humans eat and, by extension, how we interact with the ecosystem.

MITRA CHEM



FOUNDED

2021

MISSION

To innovate and commercialize iron-based cathode materials to enable mass- market electrification in transportation and energy storage.

FACULTY FOUNDER

Will Chueh, Associate Professor in the Department of Materials Science and Engineering and Energy Science at Stanford University, and Director of the Precourt Institute for Energy

Current role:
Co-Founder and Chief Scientific Advisor

Will Chueh is a co-founder of Mitra Chem, associate professor in the Department of Materials Science and Engineering and Energy Science at Stanford and at the Department of Photon Science at SLAC National Accelerator Laboratory, and director of the Precourt Institute for Energy. He received a bachelor's

degree in applied physics, a master's degree and doctorate in materials science from Caltech. He leads a lab of more than 30 researchers aimed at (1) understanding reactions and transport involving ions and electrons and (2) decarbonizing various energy transformation pathways. In 2012, he was named as one of the "Top 35 Innovators Under the Age of 35" by MIT's Technology Review. Since then, he has received numerous awards, including the David A. Shirley Award (2023) and the Friedrich Wilhelm Bessel Research Award (2022).

BACKGROUND AND MOTIVATION

Mitra Chem's founders are Will Chueh, Vivas Kumar, and Chirranjeevi Gopal. Chueh's initial insight was that the key limitation in battery technology was the speed of development, scaling, and commercialization. Chueh's team at Stanford had been developing AI tools to accelerate battery development but had yet to explore commercial applications. Kumar, a Stanford MBA with prior experience at Tesla in battery supply chain, was introduced to Chueh at a Stanford talk by Professor Arun Majumdar, now the dean of the Doerr School of Sustainability. They discovered that their skills were complementary and that they both had a passion for batteries. Given that Chueh intended to remain in academia, he reached out to Gopal, a former Stanford postdoc from Chueh's lab, who was working at Toyota, and persuaded him to join as the third founder and CTO.

The group officially launched in early 2021. The first few months were dedicated to developing their strategy, particularly in defining their product focus. While they could have positioned themselves as an AI process automation company, they ultimately chose to develop physical battery products. This decision was driven by their commitment to making a meaningful impact on the energy transition, focusing on solutions that address challenges from atoms to kilotons, not just building another software tool.

ACHIEVING IMPACT

At the outset of his career, Chueh focused on conducting breakthrough research and publishing outstanding papers, as well as training exceptional students who could make a significant impact through their own research and teaching. Now he focused on creating and scaling solutions that reach billions of people and using the market economy as a tool for broader impact.

Chueh emphasizes the importance of business model, distribution, and scalability, considerations that are not always understood by Stanford. "We often concentrate on whether a technology is innovative or solves a problem," says Chueh. "While these factors are important, they do not on their own guarantee that the solution will succeed."

"We often concentrate on whether a technology is innovative or solves a problem. While these factors are important, they do not on their own guarantee that the solution will succeed."

– **Will Chueh**, Associate Professor in the Department of Materials Science and Engineering and Energy Science at Stanford University, and Director of the Precourt Institute for Energy

ENTREPRENEURSHIP AND THE STANFORD ECOSYSTEM

Stanford's environment allows faculty to dedicate substantial time and effort to impactful work that can go beyond the university, finding synergy between academia and the real world. "When you are working at a company, focus is essential, whereas at Stanford you have tremendous freedom," says Chueh. "'s ability to combine the two is an essential recipe to real world impact."

MULTI-FOUNDER COMPANY AND EQUITY ALLOCATION

Recruiting the team was crucial. Chueh recognized that while he had credibility as a Stanford professor, he lacked business experience and needed to partner with experienced operators. The founding team was able to successfully fundraise despite unresolved questions about product strategy and distribution. "I realized that the team was more important than the idea, and our investors shared the same perspective," says Chueh.

When considering the equity split among the founders, the team carefully considered short- and long-term contributions. "Given that I can only spend one day per week at the company according to university policies," Chueh says, "it was important to establish a fair equity split to effectively incentivize the full-time team members."

FUNDRAISING

Chueh and his team successfully raised a $20 million Series A round shortly after starting the company in early 2021. It was a favorable time for fundraising.

Chueh was able to secure funding relatively quickly based on the strength of the team and his reputation as an accomplished Stanford scientist. However,

subsequent fundraising efforts proved more challenging. After the first fundraise, a company is measured based on its actual progress, and macroeconomic factors may affect the availability of capital. (After the peak of the market in 2021, the macroeconomic environment has cooled off and it has been more difficult to fundraise.)

ENTREPRENEURSHIP AND THE STANFORD ECOSYSTEM

Stanford played a crucial role in Chueh's journey. Faced with many questions about governance as a first-time founder, Chueh reached out to faculty and staff for advice with issues like equity splits and defining the roles of academic co-founders. The TomKat Center was also instrumental in this process, working with Chueh and the team to determine the best configuration for co-founder relationships and governance. "We have something special here with a network of exceptionally talented people who are willing to mentor," says Chueh. Now, a few years later, Chueh gives back and advises new faculty founders.

Stanford was also pivotal in several other aspects of Chueh's entrepreneurial journey. During the early stages of the company, Chueh's credibility in the academic world proved crucial for networking, forming strategic partnerships, and attracting talent. In addition, Chueh used his connections with government leaders to build relationships between the government and the company. This was especially important because Mitra Chem operates in the clean energy and mobility sector where government involvement — through both regulation and funding — is significant. Chueh's second major role was to utilize his academic credentials to recruit top-tier scientific talent. "Given my public profile in the research community, my work is widely visible. Potential hires can check out my website, review my publications, and are motivated to join us if they find my research exciting," says Chueh. While this is less critical now that the company has a team of 65, Chueh's academic credentials were pivotal in the first two years. "Stanford faculty have a strong presence on the world stage. This is a powerful asset that brings significant value to the company," says Chueh.

WORDS OF ADVICE

Over the past four years, Chueh came to appreciate the complexity of the energy system and the industry. Often, academics focus on developing a small component, such as a battery material, which fits into a larger product like an electric car and even the electricity grid. However, for a technology or product to succeed, it must integrate seamlessly within this broader system of government policy, economic trends, supply chain, and consumer preferences. Success and failure is often outside of the founder's control.

"Many in academia might not fully appreciate the importance of a systems-level perspective until they experience it firsthand. Success depends on the entire system functioning effectively, not just on individual components," says Chueh. This systems-level understanding is often underemphasized at Stanford and is hard to acquire without jumping in and getting started. "Entrepreneurship is trial by fire," says Chueh.

For-Profit: Public Benefit Corporation

This section parallels the previous one, as public benefit corporations are identical to C corporations but for the public benefit statement, which requires directors and officers to manage toward a mission in addition to shareholder profit. In this section, we feature a case study of faculty who chose to pursue a for-profit venture with a social mission through a public benefit corporation. Additionally, we examine their lessons learned and highlight the key factors that faculty founders should consider when navigating the for-profit public benefit landscape.

Key Takeaways

The key lessons highlighted in the for-profit company section are also applicable to public benefit companies. Below, we outline two additional lessons that are particularly relevant to public benefit companies.

MISSION-ORIENTED TALENT

- Emphasizing a strong mission can resonate with potential employees who prioritize contributing to meaningful causes.
- Hiring employees motivated by the company's mission can lead to higher job satisfaction, engagement, and retention.

PUBLIC BENEFIT STATEMENT

- The public benefit statement should articulate the company's commitment to achieving positive societal and environmental impacts as well as financial returns.
- The public benefit statement can help build trust with stakeholders who value ethical and purposeful business practices.
- The public benefit statement protects against the risk of prioritizing short-term profits over long-term societal impacts.

ATLAS AI

FOUNDED

2018

MISSION

To monitor drivers of economic development across the emerging markets so that financial capital can advance societal well-being.

FOUNDERS

David Lobell, the Benjamin M. Page Professor at the Department of Earth System Science at Stanford University

Current role:
Co-Founder and Board Member

Marshall Burke, Associate Professor at the Doerr School of Sustainability at Stanford University

Current role:
Co-Founder

Stefano Ermon, Associate Professor at the Department of Computer Science at Stanford University

Current role:
Co-Founder

David Lobell is the Benjamin M. Page Professor at Stanford University at the Department of Earth System Science and the Gloria and Richard Kushel Director of the Center on Food Security and the Environment. He is also the William Wrigley Senior Fellow at the Stanford Woods Institute for the Environment, and a senior fellow at the Freeman Spogli Institute for International Studies and the Stanford Institute for Economic Policy and Research. He holds a PhD in geological and environmental sciences from Stanford University and a bachelor of science degree in applied mathematics from Brown University. Before his Stanford appointment, Lobell was a postdoctoral fellow at Lawrence Livermore National Laboratory. Lobell's research focuses on agriculture and food security, specifically on generating and using unique datasets to study rural areas throughout the world. His work has been recognized with various awards, including the Macelwane Medal from the American Geophysical Union (2010), a Macarthur Fellowship (2013), the National Academy of Sciences Prize in Food and Agriculture Sciences (2022) and election to the National Academy of Sciences (2023).

Professor Marshall Burke is an associate professor of Global Environmental Policy at the Doerr School of Sustainability and deputy director at the Center on Food Security and the Environment, both at Stanford University. He is also a research fellow at the National Bureau of Economic Research. He holds a PhD in agricultural and resource economics from UC Berkeley, and a bachelor's degree in international relations from Stanford. His research focuses on social and economic impacts of environmental change and on measuring and understanding economic livelihoods across the developing world. His work regularly appears in both economics and scientific journals, including recent publications in *Nature*, *Science*, the *Quarterly Journal of Economics*, and *The Lancet*.

Professor Stefano Ermoni is an assistant professor at the Department of Computer Science at Stanford University, where he is affiliated with the Artificial Intelligence Laboratory and a fellow of the Woods Institute for the Environment. Stefano earned a doctorate in computer science at Cornell University. His research is centered on techniques for scalable and accurate inference in graphical models, statistical modeling of data, large-scale combinatorial optimization, and robust decision-making under uncertainty and is motivated by a range of applications, in particular ones in the emerging field of computational sustainability. He has won several awards, including the NSF Career Award, ONR and AFOSR Young Investigator Awards, Microsoft Research Fellowship, Sloan Fellowship, and the IJCAI Computers and Thought Award.

BACKGROUND AND MOTIVATION

Lobell, Burke, and Ermon had spent years advancing research on how to apply cutting-edge AI techniques to develop high quality and localized socioeconomic measures in data-sparse environments like the developing world. They aimed to address significant societal challenges by translating this research into market-ready datasets and broadening access to insights regarding economic development.

They began a conversation with the Rockefeller Foundation, which saw the potential for their data to positively impact a key region of interest for the foundation: sub-Saharan Africa. The three professors did not have a clear business model or target customer at the time of launch but they proceeded anyway. They formed and funded Atlas AI in 2018 with Rockefeller's early support through the foundation's new startup investment initiative.

Atlas AI combines machine learning with various data sets and leverages the founders' domain expertise and technical skill to create a living map of population, wealth, climate, and economic development trends worldwide, enabling customers to build geospatial models to strategize and oversee critical investments such as infrastructure projects and market expansion programs. Specifically, Atlas AI leverages a vast feature and model library with an MLOps platform to unlock granular, real-time geospatial forecasts. This enables customers and partners to make sub-national predictions, facilitating strategic growth in even the most dynamic markets. Previously, long-term demand forecasting in sectors like manufacturing, aviation, and transport relied on broad national trends, often missing out on localized opportunities and lacking agility to respond to unforeseen events.

PUBLIC BENEFIT CORPORATION

For Lobell, Burke, and Ermon, positive global impact was imperative to the venture. They initially considered a nonprofit structure but realized it would hinder their ability to attract and compensate top talent. Instead, they opted for a public benefit corporation, which created ongoing accountability toward their stated public benefit in addition to financial goals, and which safeguarded against potential non-aligned strategic pivots. Atlas AI's specific public benefit statement is "to facilitate the measurement and analysis of socioeconomic indicators in developing countries, in order to inform policy and business decisions related to economic development."

A public benefit corporation can raise significant non-dilutive capital as well as dilutive VC, and issue equity to its employees. In addition to being able to provide market-rate cash and equity compensation, Lobell believes their mission helped them attract top technical talent amidst fierce competition from larger companies, as many engineers want their work to positively impact the world.

FUNDRAISING

As first-time founders, the startup and fundraising process was opaque. Lobell and his founders were unfamiliar with the world of entrepreneurship and fundraising and lacked connections to many investors. They attribute their Stanford association with opening many doors and providing initial credibility.

The Rockefeller Foundation's support was also critical in facilitating connections with startup lawyers and advisors. The advisors provided invaluable assistance, helping Lobell and his team connect with potential investors and secure their first hires — connections that would have been difficult to establish independently given their academic backgrounds and research focus at Stanford.

The Rockefeller Foundation initially invested through a SAFE agreement. This gave the Atlas AI team great momentum, but Rockefeller's partnership came with constraints. The foundation required them to focus at least in part on Africa, which was a priority for the foundation, deterring some other investors who perceived Africa as riskier and less profitable than other regions. (Atlas AI has since expanded their market beyond Africa.) Lobell emphasized the importance of conveying to investors that while the company prioritized its mission, profitability remained a core focus. The public benefit corporation entity type is relatively new, and educating the for-profit investment community about the dual fiduciary duties to mission and profit may be required.

In addition to the Rockefeller Foundation, the co-founders secured investments from two corporate venture funders, Airbus and Micron Ventures. Their goal was for this funding to carry them to a Series A; they believed they would benefit from finishing some milestones before pursuing a larger round.

INTELLECTUAL PROPERTY

Lobell thought that OTL's process was methodical but straightforward. Though the company did not rely heavily on patented or licensed technologies, which are less common for software technology, Lobell did have one preexisting Stanford software patent, for which Atlas AI negotiated a non-exclusive license with OTL. This technology was not a focal point because the company was not primarily focused on commercializing that specific technology. Instead, they integrated it with other technologies, many of which they already publicly published on platforms like GitHub, and then developed new technology.

For artificial intelligence companies, which run on data, being a first mover often matters more than proprietary IP, patents, and enforcement. First movers gain access to more data, which enhances the feedback loop for model training. Plus they can develop customer relationships, build a brand, and secure long-term contracts.

> **"We were generous with equity when we brought people on board."**
>
> – David Lobell, the Benjamin M. Page Professor at the Department of Earth System Science at Stanford University

MULTI-FOUNDER COMPANY AND EQUITY ALLOCATION

Having three co-founders has come with challenges, but also has enabled the trio to learn together and ensure joint accountability and engagement. While their roles differ, each co-founder has the same level of equity and contributes actively to the company's operations. Per university COI policies they do not hold managerial positions, but dedicate themselves part-time to advising on strategic matters and engineering roadmaps.

Lobell says: "We were generous with equity when we brought people on board," Lobell says — the Atlas AI team recognized the risk inherent in joining an early-stage startup compared to an established public company. The founders understand that equity compensation has been crucial for attracting talent and aligning interests with the long-term success of the company.

HIRING A CEO

None of the faculty founders intended to leave Stanford, so finding a CEO was a key early challenge. Sometimes faculty have former students or postdocs who step into roles like CTO or even CEO, but Lobell and his co-founders aimed to recruit someone with prior industry experience and proven leadership skills. Since they did not have the connections and did not know where to find a CEO, the Rockefeller Foundation connected them with advisors, who helped them find their first CEO.

In hindsight, Lobell says that although they had some help in identifying potential CEO candidates, interviewing a broader set of candidates and having a more specific and thoughtful interview process would have been valuable for him and his co-founders. "None of us really had experience hiring a senior manager," he says. "We should have talked to more people our candidates had worked with, including the candidate's subordinates, and we should have had more hands-on sessions with specific questions and scenarios."

"None of us really had experience hiring a senior manager. We should have talked to more people our candidates worked with and hands-on sessions with specific questions."

– **David Lobell**, the Benjamin M. Page Professor at the Department of Earth System Science at Stanford University

EXPANDING THE BUSINESS

Atlas AI has expanded its work in Africa while also building its global customer base, particularly focusing on larger enterprises with extensive data science teams capable of leveraging the company's data and insights effectively. The product is akin to a business intelligence platform, continuously refreshed with new data streams that reflect local economic trends and other relevant factors. One notable customer is Nutrition International, which uses the platform for targeted micronutrient interventions, requiring precise data on poverty and healthcare access. Atlas AI also works with utility, infrastructure, and energy companies, as well as transportation companies like Airbus, to assist them in route planning and forecasting air travel demand.

In terms of immediate goals, Atlas AI aims to further increase revenue; the company is currently at approximately $3 million per year, split evenly between grants from development organizations and revenue from subscriptions. The founders are targeting a next round of financing in late 2024, which will enable them to grow the team beyond its current size of 15. Their vision is that many governments and organizations will use their platform to improve living conditions in developing regions worldwide within the next four to five years.

CONFLICT OF INTEREST

One of the primary concerns for Lobell and the team, from a COI perspective, is keeping Atlas AI separate from their interactions with graduate students. Guidance from the COI team proved helpful and they have avoided steering students towards research projects that align with the company's interests and continue to take a proactive approach to safeguard the integrity of their interactions within the Stanford community to ensure the separation between Stanford work and the company.

ENTREPRENEURSHIP AND THE STANFORD ECOSYSTEM

Lobell notes that he and his team have been pleasantly surprised by how enthusiastically Stanford has embraced Atlas AI, recognizing it as a success story that extends the impact of their academic research. This point of view is not shared at many other universities.

For example, Lobell recalls attending a meeting where a professor at a UK university raised concerns about their company, suggesting that corporate interests might influence their academic publications. However, Lobell says, "those risks can be managed with a good process. The alternative to starting a company is that is that the work will not get done, because it definitely would not happen fast enough in a purely academic setting." Startups accelerate academic work by increasing the pace at which technological development and research can take place and allowing faculty to cede many operational tasks to the startup's management team. Lobell emphasizes that as a result Atlas AI has actually improved his academic work, both because it creates data that is useful for research, and also because he feels more free to use his Stanford time to innovate at the technical frontier rather than cater to partners and decisionmakers, which is Atlas AI's mission.

WORDS OF ADVICE

When Lobell started his venture, he already had tenure, but his co-founders did not. There is no universal answer to timing academic tenure and entrepreneurial launch; the extent of involvement depends on faculty time, talents, and interest. However, Lobell believes that with a capable team and a dedicated CEO handling day-to-day operations, starting a company does not significantly distract from one's academic work or jeopardize tenure.

> **"Faculty sometimes perceive the bar to be higher than it actually is, which can discourage them from getting out there and testing new ideas."**
>
> – **David Lobell**, the Benjamin M. Page Professor at the Department of Earth System Science at Stanford University

Second, he says, "do not set the bar too high to take the leap." Faculty do not need to have a perfect business model or extensive business experience prior to starting a company. According to Lobell, many faculty founders approach entrepreneurship with a scientific mindset, aiming for precision and accuracy in every detail. "Faculty sometimes perceive the bar to be higher than it actually is, which can discourage them from getting out there and testing new ideas," Lobell says. However, launching a startup is inherently dynamic and chaotic — that is normal. "I have learned a whole new world," he says. "Sometimes that world kind of shocks or frustrates me but it is also very interesting. It is a different experience, and you give yourself a higher probability of having a large impact."

12 Recap

This resource draws on Stanford's institutional knowledge to outline pathways for academic innovation translation. It covers essential issues, questions, and resources for academic innovators considering various launch options and provides detailed case studies of successful projects and technologies developed by Stanford. While primarily aimed at Stanford academic innovators, this playbook offers valuable insights for the universities in general and the global entrepreneurship community.

This is a recap of the key stages academic innovators should consider when starting a project:

1. Key Questions

Refer to Chapter 3 for questions guiding strategy decisions.

2. Translation Pathways

Refer to Chapter 4 for a comprehensive overview of the pathways.

- Stanford Initiative: Faculty leads initiative with administrative support and use of Stanford resources.
- Nonprofit 501(c)(3): Greater operational autonomy but potential constraints on Stanford-related activities.
- License to a Third Party: Partner with a company for technology development and potential passive income.
- For-Profit Delaware C Corporation: Ideal for commercializing high-potential technology.
- For-Profit Delaware Public Benefit Corporation: Integrates profit and a social or environmental mission.

3. Fundraising

Initiate fundraising efforts aligned with the project's narrative and network (Chapter 9).

4. CEO Hiring

Recruit a CEO or executive director aligned with the project's vision (Chapter 10).

5. Intellectual Property

Contact the Office of Technology Licensing for technology licensing and copyright (Chapter 6).

6. Conflict of Interest

Contact Office of Technology Licensing for technology licensing and copyright (Chapters 7 and 8).

7. Repeat Questions

After steps 1-6, review again the questions in Chapter 3 as your answers may have shifted. Consult other academic innovators who have launched ventures for additional insights.

Resources and Further Reading

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    - *For Faculty*
    - *For Grad Students*

For assistance with recruiting students to evaluate commercialization pathways or for marketing job opportunities for founding roles, please reach out to ***Keegan Cooke,*** *cooke@stanford.edu.*

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WEBSITE

1. TechCrunch (News outlet focused on startups/high tech businesses).
2. Termsheet (A daily briefing on venture capital, private equity, and deal-making).
3. Axios Pro Rata (Deal-making updates in VC, PE, and M&A).

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