12 Critical Components of University Technology Commercialization Making Knowledge Useful and the University Competitive

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State legislators across the country question the benefit of funding public universities that have a substantial research component. They question the benefit to society and the state's return on the investment of funds not spent in the classroom. Research without impact is an exercise. Successful research results change the world, but only after they leave the lab. The move from research to commercial implementation is known as technology transfer (aka tech-transfer).

Research universities have departments dedicated to patenting and licensing technology for commercial use—to transfer technology from the university to the private sector. Licensing technology to startups instead of to existing companies is one way to commercialize technology. Startup success is dependent on an ecosystem consisting of the university, the community and various resources. This primer briefly discusses the 12 critical components of commercializing university technology with startups:

1. Policy
2. Culture
3. Research
4. Graduate Students
5. Tech Transfer Effectiveness: Creating Intellectual Property
6. Licensing v Startup Decision
7. Programs to Advance Startups
8. Funding
9. Available CEO Talent
10. Early Adopters/Strategic Partners
11. Off-Campus Office Space/Affordable Professional Services
12. An Engaged Business Community

Policy

The university's written policies regarding ownership of intellectual property (IP) directly impact their success in transferring technology to the market. If a faculty member creates IP on his own time, off campus, with no university resources or persons, who owns it and what is the rationale? If a faculty member's technology is licensed to a startup that consists at least partially of former graduate students of that faculty member, and/or of which he is a part owner, how is that addressed? What state law, governing body and university policies affect commercialization efforts and IP ownership and when were they last updated? Are the IP policies oriented toward encouraging innovation or creating fear in faculty, students and startups? When working with industry partners is new IP jointly owned with industry having the first right to license or co-invest?

IP policy should be viewed by faculty as friendly and encouraging innovation. Words matter. If the IP policy is perceived to discourage innovation and technology transfer, then that IP policy does discourage it. In that case, the IP policy must be re-written. When IP policy is re-written, it should be re-written by faculty who are heavily involved in technology transfer and should be based on benchmarks from universities that are successful with technology transfer.

Written policies should also encourage faculty to collaborate—even when their names won't appear on a patent. Faculty should embrace and not fear each other when working on patentable projects.

Culture

How does the university's culture impact the development of IP and its transfer to the outside world? Are commercial results encouraged or celebrated? Are successful commercial results promoted in university media? Are they included as part of the matrix in determining raises, promotion and tenure?

Faculty strive for tenure, promotion, raises and endowed chairs. The traditional university reward system centers around papers, publications, citations, grant awards and service on both university and national committees—all of which are valuable. Often faculty who pursue the commercialization of their research results are seen as distracted from their main purposes—research, service and teaching. It should be clear to faculty that while they will still be rewarded for the traditional milestones, they will also be rewarded for obtaining IP, having it licensed to a third party or to a startup, and by starting companies. This is an additional responsibility to faculty but well-within the purview of a faculty member at a research institution.

Faculty need to know what successful technology transfer looks like. Faculty with patents, licenses and startups should be heralded by senior university leaders. Extra compensation for successful technology transfer should be clearly documented and promoted.

Research

Research is the cornerstone of a university with impact. Successful research results may produce technology to transfer. Faculty who are leaders in their field, who apply for and are awarded grants for their research, whose results solve real-world problems and challenges are critical to the commercialization of university technology. This means that promising research must be supported not only by entities such as the National Institute of Health (NIH) or the National Science Foundation (NSF), the Department of Defense (DOD), and others, but by industry who look to the University for its researchers' ability to solve problems better, faster and cheaper than they could themselves. Research that solves problems in industry results in technology that is more likely to be successful in the marketplace.

Graduate Students

Faculty conduct most of their research in onsite labs. They direct their work and their graduate students and post-doctoral fellows perform it. One faculty member can have numerous graduate students and numerous research projects. Without bright, ambitious and cost-effective talent, research would suffer dramatically. One of the valuable outputs of a faculty member is his graduate students. Top graduate students select their university based on the faculty member with whom they intend to study. Graduate students and post-doctoral fellows are often (and ideally) the founders of startups out of a professor's lab. A university's commitment to commercialization includes policies that enable departments to add doctoral students on an as needed basis. From a master degree through a doctorate degree, it is common for the faculty and grad student to have a mutually dependent relationship for six or more years.

Tech Transfer Effectiveness: Creating Intellectual Property

Successful research findings should be protected in order to optimize their potential value to the University and to have an impact on the world. Inventions are protected primarily by patents and, in some cases, copyrights where software is the invention. Prior to seeking protection for the invention, faculty inventors must submit what is known as an invention disclosure with the institution's tech transfer office (TTO). The faculty decide who the inventors are on the patent and their respective levels of contribution. A TTO researches the technology (using software designed for universities for this purpose) to get a sense for similar or competitive technologies, and market size. If the discovery appears to be novel, nonobvious and valuable, the TTO may instruct patent counsel to file a provisional patent application with the US Patent and Trademark Office (USPTO). The provisional patent application establishes a filing date for the invention which is important in proving that an inventor is the first to make the invention. The provisional patent application is not examined by the USPTO, is not public information, and goes abandoned by the USPTO after 12 months if a utility patent application is not filed within that 12 month period. During the pendency of the provisional application the TTO can determine whether or not the invention is commercially viable. If the evaluation is positive, the TTO will normally instruct patent counsel to file, with much greater detail, a utility patent application. After 18 months from the filing date of the provisional application, the utility patent application is "published" or made public. The USTPO takes an average of about three years to issue a patent. Once issued it is good for 20 years from the date the utility patent application was filed.

https://www.uspto.gov/learning-and-resources/newsletter/inventors-eye/provisional-patent-application-what-you-need-know

Timing is Critical

The tech transfer office must file a provisional patent prior to a faculty member submitting a paper to a journal or for a conference presentation. If faculty present their findings in any public arena (campus poster sessions/on or off campus conferences) the information is considered public and the ability to protect it is compromised.

Licensing v Startup Decision

The most common vehicles for transferring technology developed at a university to the outside world are licensing agreements (to an unrelated third party) and startups. In the case of startups, the university licenses the IP to the start-up.¬ University startups are usually started by a faculty member, his graduate students and a business lead. One of the most successful models for creating university startups is the one developed by MIT's Robert Langer who has started over 30 companies with his former Ph.D students.

Licenses

If a faculty member wants little to do with commercializing his technology, the tech transfer office assumes the responsibility of finding a company with an interest in licensing the IP from the University. They may also license IP to new companies (startups not founded by faculty or their graduate students) founded with the intent of licensing the particular IP.

The University receives a royalty for the license agreement and shares those funds with the inventors. As an example, at MIT the inventors get 1/3, the department gets 1/3, and the university gets 1/3. This scenario gives the department an incentive to support the faculty who commercialize their IP.

Startups

If a faculty member and/or his graduate students want to be involved with the commercialization of the technology, they start a company. Their success is dependent, among other things, on bringing in business expertise. There is still a licensing agreement, but in this case the University licenses the IP to the startup. Together they determine if the startup gets an exclusive license or a field of use license. There are further distinctions between national and international licenses. In any case, if the startup does not get an exclusive license, the tech transfer office seeks other licensees for uses outside the parameters of the startup.

The university requires the startup to repay patent expenses. The timing of this repayment directly impacts the ability of the startup to access capital. Investors want to see their first funds advance the new company. They don't like to see their funds repay a debt to the university when the startup is trying to get off the ground.

The university may negotiate an equity and/or a royalty interest in the startup. The university's share should be no more than single digits in each. In general a downside for the University taking an equity interest is the need for them to continually review legal documents. This can get expensive. A downside for the startup partially owned by a university is that many investors don't want to have a higher education institution as an equity owner.

Programs to Advance Startups

The NSF has a program designed for university researchers that combines intensive entrepreneurship training with technology vetting. This is the premier resource for university inventors. It is known as Innovation Corps, or ICORPS, and has a record of proven success. ICORP is discussed in the next section.

Faculty Salons are another successful program. Inventors present their startups or proto-startups (soon to be startups) in lay language to a mixed crowd of both industry and university members and get business feedback, helpful connections and mentor introductions.

Business plan competitions can be valuable to the extent that they provide the opportunity to develop financial models, hone presentation skills, expand networks, and earn prize money. A downside of such competitions is that startups can get wrapped up in the competitions as ends in themselves, as opposed to learning opportunities.

Funding

Often the first commercialization funds accessible by university startups are those provided by the NSF. Their National ICORP program awards $50,000 to teams for the purpose of traveling to interview 100 potential customers and collaborators.

In addition, the NSF awards $200 million of non-equity funding each year to help startups and small businesses transform their IP into marketable products and services. The NSF focuses on high-risk, high-impact technologies—those that show promise but whose success hasn't yet been validated. These grants are called Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) awards. This is a rare opportunity for a startup to access capital without giving up any equity.

But what funds carry a startup from ICORP to an SBIR/STTR award? This is the primary financial challenge facing university startups. This gap in funding is aptly named the "valley of death". Universities across the country recognize that without bridging the funding gap between research and commercialization, successful research results and discoveries often disappear. Prototyping and commercialization readiness funds are only made available if a university creates this funding mechanism. Ideally equity-free gap funding will be available for university startups up to the point in time that they receive funding from an SBIR award.

Early Investors

The first type of investor funding for a startup is frequently "friends and family". After that come angel investors and venture capitalists. Let us define both. Angel investors invest their own money. Venture capitalists invest the money of others. Angel networks are attractive to accredited investors (high net worth individuals) since they get to see "deal flow"—an ongoing series of startups at various stages, from the region and beyond. And they get the opportunity to invest their financial and business resources in collaboration with trusted colleagues. The angel network's attraction and deal flow extend beyond the region as each network makes its own rules regarding the types of investments they seek.

With so much focus on venture capital investing one might think that it is both the most recent investment vehicle invented and the optimal source of financing for startups. In fact, both statements are inaccurate. George Doriot founded the first venture capital firm in 1946 to encourage private sector investments in businesses run by soldiers returning from WWII. Its first major success was a $70,000 investment in 1957 in Digital Equipment Corporation (DEC). In 1968 when DEC went public that investment was valued at over $38 million. It is no wonder that venture capital investing became popular.

The goal of venture capitalists is to provide financial resources with the object of making a return by that company going public or being acquired. If the startup founders are interested in building their business and retaining the ability to own and direct its future, venture capital is not for them.

Available CEO Talent

Investors look at the technology, the anticipated market demand/pricing, and the team. It is rarely the case that career faculty members or newly minted MBA's have the skill set and experience to lead a new company and gain the trust of investors. The best CEO for a startup is one who has led a startup, successfully raised capital, and has experience in acquiring and managing customers, or managing a team that has done so. CEO talent is often found in mentors who are looking for their next opportunity. Candidates don't have to be perfect, but they do have to be good enough to get the company off the ground, communicate effectively with potential investors, and start a revenue stream. Investors usually want to inject both capital and expertise in the form of talent in someone they trust, into the startup they fund. A startup makes a better impression on investors if they have a formidable team in place.

Early Adopters/Strategic Partners

These are the first clients/customers of the startup. Strong business connections who can make influential introductions, as well as presentations and attendance at industry conferences are good opportunities for customer acquisition. Startups that have participated in the NSF National ICORPS program have an advantage of having already conversed with 100 potential customers.

Off-Campus Office Space/Affordable Professional Services

Startups have few if any resources and the lower they can keep initial costs, the better. Pre-revenue startups need space to work. In fact, having off-campus office space is a pre-requisite for the most common source of funding (NSF-Small Business Innovation Research awards) startups based on university technology. The space need not be fancy. Internet connections, parking, and easy access to campus are the primary needs.

There is a lot of talk about incubators and accelerators. The difference between them and off-campus office space is people—entrepreneurial expertise that mentors startups to laser focus on the market, customers, building a management team, and acquiring capital.

Startups need legal documents from law firms that have extensive experience with technology-based startups. They may also need assistance negotiating the terms of the license agreement with the university. Many law firms have "startup packages" that consist of boilerplate agreements that a new technology-based company can expect to use. These firms offer these low cost tools with the hopes of getting in on the ground floor of a new company and being retained by that company for years to come.

Startups also need services from a certified public accounting firm. These services can be obtained inexpensively by utilizing book-keepers and junior members of a CPA firm.

An Engaged Business Community

The business community needs an organized way to interact with the University's startups. Ideally this interaction takes place early in the process, before the formation of the startup. They need to know what rules of confidentiality, invention ownership, and equity they might expect. They need to know how best to engage initially as a mentor and then if the fit seems catalytic, how to move forward with a more formal arrangement with the startup. The expectations and lines drawn must be clear. A business community that can experience a faculty member's excitement about their invention is one that can be tapped to fund research and other programs.

Summary

Startups flourish in a supportive environment—an ecosystem—filled with entrepreneurial experience, generous mentors and "connectors", and access to funding at all stages of development. A research university is primed to be a key player in a startup ecosystem if it embraces the policies and practices of universities that have excelled in startup creation and if their scientists solve real world problems. How does a university measure success in this arena? MIT's Robert Langer measures success by "lives impacted".

The purpose of this primer is to inform and inspire discussion, self-evaluation, and comments. Your comments are welcome and may be sent to Louise Epstein, Director of University Partnerships, Walton Family Foundation
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