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In the last decade, there has been an explosion in the number of research deals between companies and universities. Companies, which have been reducing their spending on early stage research for three decades, have been increasingly turning to universities to perform that role, seeking access to the best scientific and engineering minds in specific domains. And faced with stingier government

support of academic research and calls for them to contribute more to their local economies, universities have been more receptive.

Instead of one-off projects, both sides have become much more interested in forging long-term, collaborative relationships. But both sides face familiar obstacles, especially when it comes to navigating non-disclosure agreements and creating a flexible but constructive master research agreement that accounts for potential intellectual property (IP).

I have watched these relationships taking shape not only at greater Boston's eight major research institutions, including mine, but also around the country. I hear about them regularly from university administrators, heads of foundations that fund scientific research, and executives at leading companies. And what I hear most often is that neither side wants a transactional model that requires a negotiation every time another research project is being considered. Instead, they want a relationship model – a durable, cooperative model that enables companies to partner with academia in a fashion that allows them to stay continuously connected to early stage research and to accelerate the translation of that research into new products that drive economic growth. Here's what that entails.

Locate the company's R&D near the talent. The advantages of having an R&D presence in industry clusters near major research universities are well known. Silicon Valley, with its proximity to Stanford and University of California, Berkeley, has long been the paradigm for innovation ecosystems. Minneapolis, with the University of Minnesota and its dedicated Earl E. Bakken Medical Devices Center for research, continues to grow one of the largest medical-technology clusters in the world.

But in the last 10 to 15 years, the movement to such places has greatly accelerated as companies acknowledged the importance of being where the action is. Greater Boston, home to 55 institutions of higher learning, has attracted a slew of companies in health care and other industries. They include Pfizer, which established one of its largest research centers there in 2014, and Philips Healthcare, which moved its U.S. R&D headquarters to Cambridge in 2015 from Westchester County, New York, where it had resided for the preceding 67 years. Giants such as Facebook, Twitter, and Amazon have established East Coast headquarters or opened engineering and R&D offices in the area, joining Google, IBM, Schlumberger, Microsoft, Comcast, and Oracle, among others. GE transferred its world headquarters along with 600 tech-oriented jobs to Boston, in 2016, in order to "be at the center of an ecosystem that shares our aspirations," then-CEO Jeffrey R. Immelt said.

Seed early-stage research. Instead of just monitoring early stage research at universities and pouncing when something of interest happens to emerge, smart companies increasingly seed it in areas of interest to them. In the past, some large companies ran their own internal post-doctoral programs without any concrete connection to an academic research group or they sponsored PhD students for philanthropic reasons but without getting directly involved in the students' progress.

A more attractive model is emerging: The company funds or co-funds PhD candidates or postdoctoral researchers studying difficult scientific problems or new areas of technology of interest to the company, and its scientists or engineers co-mentor the researchers with faculty members. If something promising emerges, then more funding is forthcoming either directly from the company or via a collaborative proposal to a government agency by the university and the company.

For example, my school has recently partnered with Schlumberger to co-fund PhD students on projects, some of which have justified continued funding from the company. We are also in the early stages of seeding a project with Philips Healthcare related to acute care. The intent is to submit a joint proposal for funding to the U.S. National Institutes of Health. Similar discussions are taking place with other health care companies with the near-term aim of submitting joint proposals to government agencies and the long-term aim of translating the results into innovative products.

Cultivate institutions, not just individuals. Typically, companies have pursued one-off projects. Now more durable cooperative models are emerging that enable companies to remain connected to institutions in order to foster long-term research relationships on specific projects of interest as they emerge. For instance, after representatives from Philips Healthcare had moved to Boston, they met and got to know several members of the Boston University School of Engineering's faculty. Soon thereafter a project with multi-year funding was developed to focus on a question of fundamental science in personalized medicine. A licensing agreement was negotiated in advance, stipulating that any emergent IP must be converted into a product within a specified period of time or it would revert to sole ownership by the university.

Another example is Red Hat, a world leader in open-source solutions that just opened an "open innovation lab" in Boston. The company has now created a formal $5 million partnership with BU to advance research and education on open source and emerging technologies, including cloud computing, machine learning and automation, and big data. The funds run the gamut from co-supervising PhD and post-doctoral students to funding collaborative projects with faculty under the umbrella of what is called the Open Cloud Computing Initiative.

BU and Red Hat will jointly license co-developed technology while each party retains exclusive rights to its pre-existing IP. In addition, IP developed solely by either BU or Red Hat will be owned by whichever organization employs the inventor. The aim is not only to establish an enduring relationship with BU that spawns co-developed IP in Red Hat's sweet spot — cloud computing technologies and systems — but also to create a pipeline of graduate students who will seriously consider jobs at the company.

Look beyond the usual suspects. Companies also recognize that top talent is not confined to just a handful of schools. The Carnegie Classification of Institutions of Higher Education identifies 107 colleges and universities as engaging in the "highest research activity." Companies are tapping into the rich resources they offer.

For instance, a little over five years ago Procter & Gamble funded a Modeling and Simulation Center for Product Development at the University of Cincinnati that focuses on collaborative research projects and the co-mentoring of PhD students. And in 2015 the University of North Carolina at Chapel Hill and pharma giant GlaxoSmithKline announced the creation of a dedicated HIV Cure center and a jointly owned new company that will focus on discovering a cure for HIV/AIDS. A small research team from GSK moved to Chapel Hill to be co-located with UNC researchers.

Find common ground on non-disclosure. The way non-disclosure is often approached continues to be a stumbling block to more fruitful cooperation, leading to misunderstandings and suspicion on both sides. Companies understandably want non-disclosure agreements (NDAs) to keep breakthroughs out of the hands of competitors. But agreements may employ general language that appears to restrict faculty members from discussing entire fields (like wireless systems or acute care) with anyone other than company representatives.

In addition, the agreements are usually brokered by university administrators (a dean, a VP for research, the general counsel, or the school's head of technology transfer), not the faculty who must operate under the agreements. This creates the potential for faculty unknowingly violating an NDA, antagonizing the company and inhibiting the development of a more lasting relationship.

How can such misunderstandings be avoided? Academics must understand that companies rarely intend to impose blanket restrictions on entire fields of inquiry. Universities and the people who actually broker the agreements must educate faculty about what the agreements really entail.

Companies must agree to be as specific as possible in meetings with faculty and spell out precisely what information under discussion they consider subject to the confidentiality agreement. That's what a health care company did in reaching an agreement with Boston University recently. The first draft (from the company) wanted the agreement to cover a broad range of general topics (e.g., medical diagnostics). The final agreement stipulated that the company would spell out during each meeting with faculty what was confidential and subject to the agreement.

Develop more-flexible patent licensing. Universities sometimes think that corporations are looking for cut-rate patents, and corporations often feel universities have unrealistic expectations about the commercial value of patents. Universities must recognize that a patent is not a product. Commercialization can be a long, expensive process borne by the company and not all licensed IP eventually gets embodied in a final product. Similarly, companies must recognize that when a product does succeed commercially, universities that contributed to patents used by the product understandably want to be rewarded fairly for their part in it.

Fortunately, understanding is growing on both sides. Models that are resonating include allowing the company to have royalty-free exclusive patent rights and paying the university license royalties or specific lump sums if revenue from the patent exceeds some negotiated threshold.

Of course, universities still need to negotiate how long a company can have rights to patent without converting it to a product before returning the rights to the university, as we did with Philips Healthcare. A university should also negotiate which industry sectors the company will have the right to apply the patent in, freeing the university to offer it to companies outside those sectors. For example, a patent that has been licensed to a medical device company might also have applications in industrial robotics — uses which the medical device company will never pursue.

Renegotiate in good faith. In many cases, a patent might be embedded in a complex device that comprises several other patents. For example, several hundred patents go into an Apple iPhone or even something as simple sounding as a drug-delivery or a diagnostic device. Determining the precise value of a single patent in such products is virtually impossible. What percentage of the iPhone's value lies in the special materials that go into its screen?

Typically, a company and a university will initially agree to royalty terms for a specific patent and renegotiate the terms once a real product that employs the particular patent as well as many others emerges and its level of success is clear. But such dealings are often contentious. The university may feel the company is lowballing them, and the company may think the university is deluded about the patent's contribution to the success of the product.

Such conflicts are more likely under the old one-off transactional model because by the time a product emerges the company no longer is conducting projects with the institution. Under the new model of collaboration, I anticipate this dynamic occurring less. Neither party will want to jeopardize a relationship that could be far more valuable to both parties in the long run than a single piece of IP.

Bridge the cultural divide. The distinction between commercial development and early stage research has traditionally been seen as a defining difference between the values of corporate culture and university culture: the bottom line versus advancing knowledge and training the next generation of scientists without regard to profit. In recent years, however, both sides have moved closer together, meeting somewhere in the middle as their missions have evolved.

Increasingly, companies recognize that if they are to attract the best and brightest talent they must create purpose-driven organizations aligned with values like meaningful work and social utility. Similarly, universities see their role extending beyond teaching and pure research to taking on social challenges and contributing to economic growth. Arizona State University is one of the most vocal. Its school of engineering, for example, emphasizes "discovery, design, innovation, entrepreneurship and societal impact."

At my institution, we have built our program around the concept of creating "societal engineers" who are dedicated to using their engineering foundation to improve society. Instead of diverging over whether the highest priority should be profit or knowledge for the sake of knowledge, companies and universities can come together around shared notions of the common good.

Both industry and academia stand to benefit from long-term cooperation. Companies will gain greater access to cutting-edge research and scientific talent at a time when corporate R&D budgets are increasingly under pressure. Universities will gain access to financial support and partners in research at a time when government funding is shrinking. Most importantly, society will benefit from a stream of previously unimaginable advances — in life sciences, biomedical engineering, communications, environmental sciences, artificial intelligence, and more — that will vastly improve everyone's life.

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