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WHAT DO PATENTS MEAN?

In today's corporate environment,
patenting may have little to do
with innovativeness.

A few years ago, I met with a group from a company interested in a technology I had developed and my company had patented. After the standard niceties, followed by a technical discussion, and then lunch, I could now get to the point of the meeting. I asked the manager of the visiting group whether their company was interested in licensing my technology. "Why should we take a license to your company's technology," he replied, "when our competitors are already using your technology for free?"

That exchange encapsulates much of the reality of patenting today. If patents were once seen as a powerful policy tool for incentivizing invention, today their value and role are complex and ambiguous. If a company is unwilling to strongly defend its patents in court—and many are not—then isn't that company undermining its own investments in technology development and in the researchers who devote their talents to this work?

The basic idea behind patents is that they encourage innovation by giving an inventor protection for an invention for a substantial number of years. This being the case, a good metric of a company's innovativeness ought to be the number of patents it receives. But the first thing to know about patents is that although they confer the right to block someone else from using your technology, they do not confer an obligation on you to use the patent. So if a company files for a patent, that doesn't mean it intends to develop, commercialize, or defend the patent against infringement. Indeed, after 42 years in industrial R&D, drawing on my own experience inventing and patenting new technologies in a corporate setting, and working with a number of companies, universities, and technical organizations, I have come to question the value and meaning of patents.

We have met the enemy

Let's start with the degree to which patents encourage innovation. (For this article, I'll define innovation as something new that is used in the marketplace, in contrast to invention, which I'll define as something new but not necessarily commercialized.) When a researcher working for a particular company finds something new in the laboratory that could improve a technology already patent protected by that company, filing a patent application can protect the improvement against a competitor, broaden patent coverage in that technology space, and give the company further protection in case the validity of prior patents is challenged. Or, if that researcher discovers an improvement on a technology owned by a competitor, for example a new application for an existing process or a way to reduce the cost of the process, filing a patent application can block the competing firm from making that improvement, inhibiting innovation in that space. Improvements on a competitor's patent can also help gain access to that technology through a cross-licensing agreement. It's in this context of competition between firms that we often think about patents.

But perhaps the more interesting case occurs when the researcher finds something new that could lead to a technology that would directly compete with technology already owned and marketed by the company where he or she works. One might think that this would automatically be good news, and that the new technology would be patented and commercialized as quickly as possible. Yet competition occurs not only between companies, but within them as well, and anyone (from researchers to marketers to executives) who has a major vested interest in the currently commercialized technology (including their very jobs)

may well oppose a new technology that threatens to make the old one obsolete, even if the change would benefit the company's bottom line. Vested interests also may include large investments in capital equipment, supply and distribution chains, marketing, and the know-how associated with long experience producing an incumbent technology. For example, think about the companies whose businesses for decades revolved around photographic film, and the internal vested interests that would have to be overcome in switching their emphasis to digital photography. In fact, this was exactly the story for one of the nation's great high-tech corporations, Kodak, which invented the digital camera and patented it in 1977, but viewed it as a threat to its business model, and ended up filing for bankruptcy in 2012. As Machiavelli noted in *The Prince* some 500 years ago, "The innovator has for enemies all those who are well off under the existing order of things, and only lukewarm supporters in those who might benefit under the new."

In my experience, it's far more difficult for a researcher to move an innovation forward when it competes with technology already owned and used by that researcher's company than when it does not.

Yet this brake on innovation is difficult to see from the outside, and insiders are understandably reluctant to acknowledge what is happening. Indeed, a firm's executives can offer a number of seemingly logical reasons for why the new technology should be patented but should not be pursued. One standard excuse is that resources are insufficient to adequately bring the new technology to commercialization. In some cases, that may be true, but often that is because management is reluctant to move resources away from the existing technology, which may be profitable, to something that is less certain, even if economic evaluation shows it to be a likely winner. This tendency may be reinforced in many firms today because the individuals responsible for making decisions on new technology often gain their position by successful cost management, but they do not know how to bring a new technology to market. It should be no surprise, then, when such managers end up prioritizing cost management over innovation.

Another standard excuse for not adopting a new technology is to claim that it is economically inferior to the current technology. But such comparisons are always problematic. Any technology in its earliest phases can easily be shown to fare poorly in a technoeconomic evaluation that compares it with a well-established technology that may have been optimized over many years. Because of the uncertainty around the new technology, the engineer doing the assessment can assign the new technology a large "contingency factor" in the evaluation, usually large enough to make it look worse than current

technology. A contingency factor is an added cost multiplier that the cost estimator uses to cover unforeseeable expenses the project may incur. If the project is then dropped, the validity of that contingency will not be challenged by further development.

New technologies I worked on were typically assigned contingencies of 50% or more, a large handicap right from the start. In addition, I was almost always required to show an internal rate of return for the investment of at least 30%, when most projects that were being commercialized had a rate of return far less. These sorts of technoeconomic assessments usually start out strongly biased toward the incumbent technology. Indeed, evaluations are often done not to determine whether to pursue a new technology, but to justify shutting it down, ostensibly to save money that some parties argue would be better spent making incremental improvements to the current technology. Moreover, typical corporate technoeconomic evaluations focus on metrics that make the current technology look good, rather than those that could give the new technology an advantage. Consider, for example, the introduction some years ago of cameras in cell phones. If the companies that introduced this innovation had assessed the cameras by picture quality, they would of course not have matched a decent 35mm camera. But if assessments also took size, portability, and ease of use into account, the balance would have shifted—a perspective that the marketplace has decisively endorsed.

Even if a technology does not directly compete with a firm's current technology, it may be seen by vested interests within the company as a competitor for resources. In such cases, a typical excuse for not pursuing the technology is to declare that it is outside the company's "core" business. In such cases, the uncertainties of development and commercialization would justify even greater technoeconomic contingency factors, again supporting continued focus on existing technologies and acting against innovation even if the new technology is patented.

Inventors but not innovators

The tendency of many companies to patent and then bury new inventions might be less of a problem if corporate scientists and engineers were free to develop unwanted inventions independently, or to look for another company to carry the technology forward. But the first day on the job for researchers in technical industries usually includes them signing over to the company the permanent rights to anything and everything they discover or invent while an employee. This can even include ideas totally unrelated to the job assignment, so long as the company can claim the individual came up with, or developed, the idea on company time. Under this arrangement, patents will list the actual inventor, but all rights are assigned to the company, and if the company decides not to pursue development or

commercialization of a technology, the inventor has no recourse. I've certainly had this experience. Some years ago, I developed a technology for which my company acquired several patents. When I was told that the company had decided not to commercialize my invention, I asked if I could buy back the patent rights to that technology. The answer was no. In fact, even if a company abandons a patent, it can still prevent an inventor from doing anything with the technology since the company can accuse the employee of theft of confidential company information—even if the patent already disclosed to the public all information that would otherwise be considered confidential.

The loss of ownership of their discoveries and inventions obviously reduces the negotiation leverage of inventors when it comes to compensation and other benefits. It also allows companies to lay off inventors without the fear of them taking what they know to a competitor. Perhaps less obviously, these standard business practices undermine the inventor's ability to advocate for her or his invention within the company, thus elevating the potential for the invention to be stifled by others in the company whose interests it might threaten. In this way, innovativeness, potential business growth, or long-range benefits to the company's customers may actually be sacrificed.

Of course, burying new technology is not as easy as it once was. Published US patent applications and patents are carefully monitored by a growing list of countries with sufficient resources, both people and facilities, to copy and commercialize the technology to the detriment of the company holding the US patent position and to the detriment of US innovation in general. Even if the company has obtained patents in other countries, these may prove ineffective, especially if the countries where the technology is developed or marketed has limited patent protection laws. Consequently, burying the technology may be a less accurate description of some corporate patent practices than setting it aside for foreign players to benefit from.

Honored in the breach

Even if a company is serious about developing a product that one of its scientists has patented, it doesn't mean that the company will then enforce the patent. Yet filing a patent that is not enforced amounts to educating the competition for free. Infringers will seldom go out of the way to inform a patent holder that they are using his or her invention, so being serious about enforcement means having the people in place who are responsible for determining whether company patents are likely being infringed, a process made all the more difficult by the globalization of innovation capacity. With many competitors now residing in countries outside the United States, information about what competitors are doing is often hard to come by, and patent enforcement in those countries may be weak at best—even

if patents are also filed in them. In some countries, such as China, customers for US technology may insist on a patent being filed in that country before they will license the technology. Since the chances for enforcement of the patent there are slim at best, this requirement may be more intended to give the customers more in-depth knowledge of the technology so they can copy it for their own use. Although this practice may enhance innovation in China, it certainly doesn't help advance US innovation, particularly if the licensee then proceeds to market the technology in countries where the US patent holder also markets, or would like to market, that technology.

In all cases I was involved in regarding licensing to Chinese companies, these factors were lightly regarded by my company, since management performance was judged much more on current income than potential future income.

Even if a likely infringer of a patent has been identified, companies may decide to take no action for several reasons. One is that the cost of litigation can be high, where the chances of success are uncertain, and where that cost and risk can be justified financially only in a limited number of instances. More often, companies may simply offer the infringer a license to the invention. The infringer will then have to weigh the cost of that license against the possible cost of being found guilty of infringement in court, where a principal factor in that calculation will be the known aggressiveness of the company whose patent they are infringing. For companies with a history of not enforcing their patents, more than likely the offer of a license will be ignored.

For example, early in my career, I developed an oil refining technology for which my company was awarded a patent. Several years after that, I became aware that another company was offering to license a technology that I was fairly sure infringed my patent. That company was also opposing my patent in Europe, where revocation of my patent would have allowed the company to freely license its competing technology. I was able to convince my company to defend against the opposition to our European patent, which we did successfully. I then expected my company to go after the other company for damages. Instead, mainly because our company was concerned about the costs and uncertainty of litigation, it simply asked the other company whether it wanted to take a license. The answer, of course, was no. Not only did my company's failure to pursue damages nullify any benefit that might have been obtained from successfully defending our European patent; it also taught the other company that it could then proceed to infringe other patents of mine with impunity, which it did over a number of years afterward.

Another reason a company may take no action against a likely infringer is that the company already has an existing

TO PATENT OR NOT TO PATENT?

Given the complexities of real-world patenting practices, the costs and benefits of patenting are not always clear. Here are some of the uncertainties facing an inventor deciding whether or not to pursue a patent.

- Many inventors and companies assume that if they obtain a patent, it will be effective for 20 years after filing. But since patents are usually filed very early in the development history of a new invention, there often is no financial return for several years or more. Meanwhile, filing and maintaining patents can be expensive, especially if one seeks protection in multiple countries, typically amounting to between \$10,000 and \$25,000 per country per year. When corporate managers want to control costs, it is not surprising if they choose to abandon patents that cannot be justified financially, particularly during a business downturn. Consequently, it's also not surprising when management, some years later, tries to assert a patent against a competitor only to find that it is no longer in force. The actual life of a patent, then, can be quite short, greatly reducing the patent's benefit.
- The American Inventors Protection Act, adopted by Congress in 1999, requires that most patent applications be published 18 months after filing, in order to be more consistent with European patent law. A principal objective of this requirement is to prevent users of an invention from being sued for infringement under a "submarine patent" that has been hiding in the Patent Office for years. But this requirement also means that an invention is made public before the inventor knows whether or not a patent will actually be granted. In cases where a patent is not granted, the inventor winds up disclosing the invention with no protection for it at all, even if the invention is novel and nonobvious, the two main requirements for a patent.
- If an inventor or company does not mind an invention being known to the public, perhaps because they want to use the patent only to prevent a competitor from patenting the invention, they only have to file the patent application so that it will be published by the Patent and Trademark Office. This action is sufficient to serve as a reference ("prior art") against anyone else attempting to patent the same thing. An even less costly option would be to publish the invention in a well-known technical journal. But this can be risky because patent examiners may not search thoroughly for prior art outside of US patents and patent applications, and so may easily miss prior art published in the academic literature.
- On the other hand, sometimes patent examiners can make the opposite type of mistake. Indeed, with the high turnover of examiners in recent years in the US Patent Office, it is not unusual that a patent application is assigned to an examiner who has considerable difficulty in understanding the invention being claimed. I once had a patent application for an organic synthesis rejected by the examiner because he asserted it was obvious, although he was unable to find any prior art supporting that assertion. He claimed that because he was educated in physics, he didn't need to show prior art—the synthesis seemed obvious to him.
- Collaboration with universities raises its own set of patenting challenges for private firms. Because timely publication is a critical requirement for collaborating faculty, universities will typically insist that no restraints be placed on publishing. Such requirements are not a problem if patent applications are filed promptly before publications are submitted. But faculty often want to submit results for publication well before any work is done on the actual invention. A prior academic publication may only hint at the possibility of the invention, yet it can then become a prior art reference against any patent application. Such a reference can severely limit the allowable claims in any further filing. Given the appropriate culture of openness in academia, such leakage of confidential information is difficult to control. Companies may therefore decide to limit collaboration with universities to nonproprietary research aimed at fostering good relations and identifying promising candidates for future employment, but such tensions may be yet another obstacle to valuable innovation.

or potential relationship with the infringing company, often in another sector or sectors of business, as a partner, a customer, or a supplier. If the real or perceived value of that relationship is greater than the estimated value of the invention, which in its early stages is usually quite uncertain, then the patenting company may choose not to go after the infringer. I saw this happen at a time when my company was negotiating a business deal with another company that I was confident had been infringing one of my patents. Our management decided the value of the deal being negotiated was greater than the value of the technology under my patent, so they refused to try to enforce it. This may or may not have been a sound business decision, but it certainly provides another example of how disconnected the practice of patenting has become from the pursuit of innovation.

Besides undercutting the intent and value of patents, these sorts of practices may also have the unintended consequence of reducing corporate investments in research, since such investments are typically justified on the basis of the income they generate. Failure to defend patents automatically reduces the income generated by research, and thus justifies reductions or even elimination of research investments, a completely self-defeating cycle of poor innovation practice.

The proper measure of innovation?

The number of patents granted to a company is often taken as a measure of innovation. A recent article in *Issues in Science and Technology* by Geoffrey Funk (“Beyond Patents,” Summer 2018) showed that patent databases are poor tools for understanding and analyzing innovation. I’ve tried to provide an insider’s perspective on some important reasons why patenting may not say much about innovation, and how the value of patents may be reduced or completely negated through internal company politics or through a weak commitment to enforcement. These problems, which in my experience are quite common in at least some technological sectors, mean that a firm’s patenting activity may be a very weak indicator of its innovativeness.

In reality, number of patents is a better measure of the size of a company’s budget for filing patents than it is of innovation. Indeed, there might be a large burst of innovation within a company when business is in a downturn and budgets are tight. In this case, patent applications may be filed only in a very select number of instances, or not at all. There may even be an effort to cram as much as possible into a single application, which in better times would be spread over multiple applications. In my own experience, during one stretch of my most productive years, filing for patents was strongly discouraged due to pressure to reduce cost. Consequently, important technology was poorly protected, and the opportunity to gain strong coverage lost. Likewise, there might be little true innovation occurring when funding for patenting is high and both the technical staff and attorneys

who write patents are rewarded for number of patent applications filed regardless of their value to the company or merit. Managers may even budget for a specific number of patent applications in their area in order to use that number to help justify their R&D budget to upper management, whether the inventions being patented have real value or not.

In other cases, a company may want a large number of patents on various aspects of the same invention to help protect that invention against attack via challenge of a single patent. It may also want a large number of patents in an area it believes a competitor is working, not because it intends to develop or market any of the inventions, but to block that competitor, possibly to create an item of trade in a cross-licensing agreement.

Finally, patents may vary radically in terms of their plausibility and potential value. As I’ve mentioned, many patents may be granted for minor variations of the same invention. This is quite different from patents on several distinctly different inventions. But even patents on distinctly different inventions may be of radically different quality. For example, patents that tell how to make the invention without actually having done it are especially uncertain, and may signal that the perceived value of the invention is not enough to justify the cost or time of carrying out a trial. The value of patents that show only partial steps in the invention should also be viewed skeptically, as should patents of inventions that do not show a surprising benefit versus the prior art. Inventions demonstrated at pilot scale are better than those tested only at small lab scale, because larger scale signals both reduced commercialization uncertainty and greater commitment to develop the invention.

But most importantly, as I’ve been emphasizing here, since private-sector innovation is best understood as creating something new that is used in the marketplace, counting patents to measure innovation would start to make sense only if patents were almost exclusively on products and processes actually in the marketplace. As we have seen, that is often not the case.

That patents encourage innovation may have been largely true in an age where most patents were owned by their inventors. Today, when most inventors have no ownership or control over their inventions, that assumption needs to be reexamined. The United States needs to recognize that its most innovative companies are not necessarily those that have the most patents, but are those that are most successfully growing new businesses and business lines on the basis of technologies that they develop internally. If the nation is to understand how well its companies are innovating, it will need to take a much more realistic approach to understanding the complex and often contradictory role of patents.

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