Can A Technology Transfer Office Make A Difference In Increasing Licensing Numbers: Incorrect Assumptions And Inadequate Context?

By Mojdeh Bahar and Robert Griesbach

Abstract

Data suggests that an overwhelming majority of patented technologies remain unlicensed. It is generally believed that if access to technologies is provided or simplified, commercial partners will be more likely to come, license and commercialize the technologies. While access to technologies will facilitate commercialization, there are other factors that need to be considered. While some reasons for lack of licenses can be remedied or at least minimized by technology transfer offices (TTO), there are three factors on which TTOs have little or no impact. They are: economic viability issues; and adoption/perception issues; and scientific progress. The TTOs can, however, have impact by engaging in several activities, namely, information gathering, judicious patenting, skillful claim drafting, holistic view of the portfolio, mindful approach to incremental patenting, and marketing.

Licensing programs, their outputs, and more recently their outcomes, have gained more importance in evaluating the performance of Technology Transfer Offices in both academic institutions and federal laboratories. The past decade has seen the advent of studies such as the Kauffman Report on University Technology Transfer[1] and Science and Technology Policy Institute Report[2] on the existing landscape of Federal Laboratories, publications and programs encouraging technology-based entrepreneurial ventures such as lean start-up[3] and its federal iteration, National Science Foundation's Innovation Corps (I-Corps),[4] cross agency initiatives to streamline the licensing of federal technologies[5] and Association of University Technology Managers' Global Technology Portal, a compilation of technologies across many universities.[6] Similarly some states have undertaken projects of compiling technologies across their state institutions. The common theme underlying all these efforts is that if access to technologies is provided or simplified, commercial partners will be more likely to come, license and commercialize the technologies. Simply put, "if you build it, they will come."

This article will examine some of the beliefs regarding technology licensing to explore recommendations that can be implemented by Technology Transfer Offices.

While access to technologies will facilitate commercialization, there are other factors that need to be considered. The current patenting and licensing data may help provide an appropriate framework for the discussion and help manage expectations. While the percentage of unlicensed patents may vary, a review of articles, books and blogs on licensing patents suggests that an overwhelming majority of patented technologies remain unlicensed.

In an article in *Forbes*, Jay Walker, the co-founder of Priceline, provides that the real problem in patenting is not granting patents or patent litigation, but lack of patent licensing. "Of today's 2.1 million active patents, 95 percent fail to be licensed or commercialized. These unlicensed patents include over 50,000 high-quality patented inventions developed by universities. More than $5 trillion has been spent in the U.S. alone on research and development over the past 20 years, much of which went to create the very patents that remain unlicensed."

He goes on to say that "according to Forrester Research, 'U.S. firms annually waste $1 trillion in underused intellectual property assets by failing to extract the full value of that property through partnerships.' In other words, we're pouring money—and productivity—down the drain."

1. Litan, *et al*. "Commercializing University Innovations: Alternative Approaches," 2007.

2. Hughes, *et al*. "Technology Transfer and Commercialization Landscape of the Federal Laboratories." Institute for Defense Analyses Science and Technology Policy Institute, 2011.

3. S. Blank, "Why Lean Start Up Changes Everything?" *Harvard Business Review*, May 2013.

4. "The National Science Foundation (NSF) I-Corps program prepares scientists and engineers to extend their focus beyond the university laboratory, and accelerates the economic and societal benefits of NSF-funded, basic-research projects that are ready to move toward commercialization." *www.nsf.gov.*

In the recent years, some federal labs have adopted the I-Corps model. Some agencies use the model with their grantees and others have expanded it to their intramural scientists. Department of Energy's LabCorp, NIH's I-Corps, I-Corps at Agricultural Research Service (ARS) are some examples of the adoption of I-Corps at the Federal and National Labs.

5. The Federal Laboratory Consortium for Technology Transfer (FLC) started the compilation of technologies available for licensing across all 14 research agencies in 2011. *www.federallabs.org.*

6. AUTM's Global Technology Portal *https://www.autm.net/resources-surveys/global-technology-portal/my-gtp/.*

Similarly, many sources offer that a large majority of patents remain unlicensed; some use the numbers to merely report and others offer explanations as to why the patents remain unexploited. In his book, *Ideas to Assets: Investing Wisely in Intellectual Property,* Bruce Berman writes that "at any given time, over about 95 percent of patents are unlicensed and over about 97 percent are generating no royalties. This is often because the technology the patents protect is not useful, feasible, or marketable. Many are never licensed, however, because the companies that own them secure more value by monopolizing the technology than by licensing it out."

In *Open Business Models*: *How to Thrive in the New Innovation Landscape,* Henry Chesbrough states that "somewhere between 75 percent and 95 percent of patented technologies simply lie dormant." Similarly, the World Intellectual Property Organization estimates that five-seven percent of patents are commercialized. In a 2003-2008 result of the S*urvey of Intellectual Property Related Activities*, the Japanese Patent Office data showed that each year more than 50 percent of the patents remains unused.

In *Technology Transfer's 25 percent Rule*, Stevens and Kato suggest that "Technology Transfer programs only succeed in commercializing 25 percent of the invention disclosures they receive." They further propose a formula for determining licensing success rate (LSR). LSR is calculated by dividing the number of licenses by the number of invention disclosures in the same year.[7]

In 2015, in its annual survey, the Association of University Technology Managers (AUTM) summarizes the licensing activity at universities as follows:

- 15,953 academic patent applications were filed (up 14.7 percent)
- 6,395 licenses were executed (up 17.6 percent)
- 654 licenses contained equity (up 19.1 percent)
- Total licensing income was $2.5 B (up 24.8 percent)[8]

As previously stated, most of the available data suggests that the majority of patents are not licensed. A patent may not be licensed for a variety of reasons.

I. Defensive Patenting

First and foremost, the assumption that all patents need to be licensed may be false in some instances. Some entities may engage in defensive patenting, *i.e.*, patenting a technology not for the purpose of commercializing the invention themselves, but to use it as a means to stop others from commercializing the technology. In managing intellectual property, an entity may as a matter of course have a defensive and an offensive patent strategy. The defensive patents will probably not be licensed or commercialized thus contributing to the percentage of unlicensed patents. Defensive patenting is a strategic call made by the patent owner and as such lack of licensing and commercialization is part of the intellectual property management, and therefore desired.

There are other reasons, mostly not contemplated, and sometimes undesirable, that contribute to sleeping, unused, unexploited or unlicensed patents. Here are some of those reasons:

II. Timing: Technology's Place on the Scientific Continuum

(a) Patented technology is ahead of its time- Some scientific findings can cause a paradigm shift. These game changers are usually ahead of their time when they are discovered and as such are not readily adopted.

■ Mojdeh Bahar,
U.S. Department of Agriculture,
Agricultural Research Service,
Office of Technology Transfer,
Beltsville, MD U.S.A.
E-mail: mojdeh.bahar@ars.usda.gov

■ Robert Griesbach,
U.S. Department of Agriculture,
Agricultural Research Service,
Office of Technology Transfer,
Beltsville, MD U.S.A.
E-mail: robert.griesbach@ars.usda.gov

7. While this formula is simple to apply, having the number of invention disclosures as the denominator may be overly inclusive. Not every invention disclosure will result in a patent application. For example, the disclosed invention may not be patentable, there may not be sufficient data to support the filing of a patent application, etc. As such, not every invention disclosure submitted could be licensed. Furthermore, the inventor-employee is usually under an obligation to report an invention to the TTO whether they work in a federal laboratory or an academic setting. As a result, the employee-inventors need to report their invention as a matter of course. For example, Stanford University's patent policy "requires that all potentially patentable 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 be disclosed on a timely basis to the University." Similarly, federal employees are obligated to report their inventions as set forth in President Harry S. Truman's Executive Order 10096, later codified in 15 USC 3710 (d). The acceptance of an invention disclosure by the TTO is neither a testament to the patentability of the invention nor to its commercial potential. It may be more prudent to use the number of patent applications filed as the denominator.

2. Though the first generation technology itself may not be licensable and/or economically viable, when appropriate, a university or federal lab may choose to file a patent as a way to attract a commercial partner to further develop the technology. In other words, further financial investment in and development of a technology may require that the background IP be protected.

(b) Patented technology has become obsolete; some industries move rather rapidly. By the time others outside of the inventing organization/patent owner learn about the existence of the technology, other new technologies may have come along. This is especially true in the software or business methods technologies/arena.

III. Stage of Development

Some federal laboratories and universities conduct basic research. The immediate outcome of this research can be a basic finding as to the way in which an organism functions; a particular previously unknown activity of a compound; the involvement of a molecule in a particular biological pathway or the role of a known pathway in a pathological state. While scientifically significant, these technologies need a lot of additional research and development and substantial monetary investment. As such, there are not very many takers/licensees who can take on the technology scientifically or financially.[9]

IV. Redundancy

Sometimes, the technology in question may be a "me, too" technology. From the vantage point of the technology's ultimate user, these technologies may have no discernable difference with analogous technologies. An obvious example of this type of technology can be seen in the pharmaceutical industry where from the patient's perspective, some therapeutics may be one of a handful of options to treat a particular condition and where the new technology may have a distinction, without a difference with its earlier functional equivalents. For example, there are many different beta blockers on the market that are used to treat cardiovascular disease and more specifically high blood pressure. In the agricultural sector, another example could be the use of enzymes or catalysts in chemical reactions where there may be more than one enzyme or catalyst appropriate for use in the chemical process.

V. Economic Viability

For the private sector, the financial bottom line is an important consideration. In some cases, in order to bring a product to market, the technology needs to be bundled with other patented technologies, necessitating multiple licensing deals with a variety of patent holders thus making technology development and commercialization too expensive. In other words, the best the commercial entity can hope for is low profit margin.

In another instance, the invention may be a derivative product whose value largely depends on another commodity. Recently, we have observed this in derivative products whose economic value has been greatly affected by the fluctuation and decrease in oil prices. A decade or so ago, bioproducts and bioderivatives were not only good for the environment, but also economically competitive, however, with the drop in price of oil some of these products are no longer economically viable.

In 2004, USDA-ARS researchers developed and patented a process to create biodegradable plastic resins from the keratin protein in poultry feathers. Even though feathers were a 2.5 billion pound waste product that was disposed of at a loss to poultry producers, this technology did not become a viable alternative to petroleum-based plastic until in 2010 when crude oil prices climbed to over $120 per barrel. At this time, the horticulture industry as the commodity group partnered with USDA-ARS to create biodegradable, keratin-based, plastic pots. The partnership was very successfully with the creation of a series of commercially acceptable pots; however, in 2014 crude oil prices began to decline and reached below $50 per barrel. The industry could no longer afford keratin-based, plastic pots, even though they offered a biodegradable solution to the 470 million pounds per year waste problem created by used petroleum-based, plastic pots.

VI. Design Around

The patented technology offers a very specific embodiment that can be designed around by those who practice in the given scientific field. In these cases, the new technology provides enough information to enable an analogous technology. The enablement of analogous technologies in turn means that the newly patented technology will not be licensed.

VII. Lack of Awareness/Marketing/Outreach

The patent Owner may not be aware of the true value or of all potential applications of the technology. Lack of awareness of all the technology's possible applications may cause the patent owner to target market the technology to an inappropriate or an incomplete list of industry partners. Certain assumptions about the technology may result in pursuing the wrong marketing leads.

For example, in 2000, USDA-ARS researchers developed and patented a rice flour batter that absorbed up to 50 percent less cooking oil than traditional batters. In 2004, a conventional food ingredients company licensed the technology and marketed the batter as low-fat batter for fried foods. After a year, the company terminated the license due to lack of market interest. In 2006, this technology was included in a marketing project for a business school class. The students concluded that the market for this batter was not for consumers wanting low-fat, fried foods, but rather for consumers with celiac disease who are unable to eat most fried food batters because of the gluten they may contain. Rice batter is gluten-free. In 2008, a new license was granted

for marketing the rice batter as a gluten-free product. Within two years the product was being sold in over 500 retail stores throughout the country. The rice batter is currently being used not only for fried foods, but also in cookie, brownie, and muffin batters. The contemplation of a new and different end-user resulted in the launch of a very successful product line.

The other side of the same coin is that the patent owner does not make the existence of the technology known and, consequently, a potential Licensee may not be aware of the existence of a technology. The technology is not advertised in a forum that is readily accessed by potential industry partners.

It is important to note that outreach and marketing are two of the functions that can be readily lost in a budgetary downturn at Technology Transfer Offices as such the requisite manpower to effectively market the technology may not exist.

VIII. Adoption or Perception Issues

In some cases, the end-user may be reluctant to adopt the technology and be resistant to change. Some technologies, though inventive, may not deliver what the consumer "thinks" is desirable. For example, many consumers believe that food crops created using modern biotechnology (GMO) are not as safe as conventionally developed crops. Therefore, many consumers will not accept GMO crops that are resistant to pests, even though these crops allow the decrease, or even elimination, of the use of pesticides. Another example concerns organically produced crops. Most consumers believe organic produced crops using bio-based pesticides are safer than conventional produced crops using synthetic-based pesticides. The Environmental Protection Agency (EPA) is responsible for registering and labelling substances for use as pesticides. Following label directions is required by law. Before a pesticide is labelled for use, EPA assesses a wide variety of potential human health and environmental effects associated with use of the product. EPA uses the same standards for both bio-based and synthetic-based pesticides.

IX. Incremental Patenting

In case of incremental patenting, the patent offers very little additional development over its last iteration which does the job. In other words, sometimes the existing method of performing a task is good enough, albeit imperfect. Tolerance for imperfection is industry dependent and may involve profit margins. For example, in the poultry processing industry where profit margins are low, any increase in the price of processing method not yielding radically different results, *e.g.*, increasing the speed of processing by an order of magnitude or cutting down on resources used in the process, can affect the bottom line. As such, new technologies with higher costs are rarely desired or adopted, absent a radically improved end result.

In the pharmaceutical industry a therapeutic regimen for a particular disease may be patented. Throughout the years the regimen may be perfected, but these modifications may yield similar clinical efficacy as the initial method. In such cases, the latter regimen may not be readily adopted.

X. Incorrect Assumptions/Incomplete Information

The majority of TTOs have a process to evaluate an invention disclosure and decide whether or not a patent application should be filed.[10] At times, the invention disclosure may make unverified assertions or its teachings may be prophetic and not yet tested. In other instances the essence of the technology may be misunderstood; the corpus of relevant prior art may not have been closely examined; assumptions about the market size and demand for the ultimate product may have been faulty. All these factors can lead to making what amounts to an incorrect decision based on incomplete information or wrong assumptions. During prosecution and sometimes well after the patent has issued these issues may come to light and explain the lack of interest of a commercial entity.

10. At ARS, the patent committees comprised of subject matter experts and technology transfer professionals address a set of questions to arrive at their recommendation on whether or not the invention ought to be patented. The questions are as follows:

Q1: Would a patent likely play a significant role in transferring the technology to the ultimate user beyond what could be achieved through publication? How would a patent enhance the transfer of the technology?

Q2: Is the invention of sufficient scope to justify patenting?

Q3: Would a patent on this invention be enforceable, i.e., is the invention drawn to, or does it employ, a unique and readily identifiable material or device which could be bought or sold?

Q4: Would stakeholders support the patenting and licensing of this technology? Is there current commercial interest in the invention or a high probability of commercialization in the future? Provide the names of any companies and contact information that you think may be interested in this technology for licensing. Provide the names of any companies and contact information that you think may be interested in collaborating to further develop/commercialize this technology through a CRADA and/or SBIR proposal.

Q5: Is the magnitude of the market relative to the costs of commercialization large enough to warrant a patent?

Q6: Do you know of any ARS or non-ARS patents, pending patent applications, invention disclosures, or research that could impact the technology described in this invention disclosure?

Q7: Is the invention ready to write as a patent application right now if approved by the committee?

Now that some of the reasons for lack of licensing has been explored, it may be useful to contemplate ways in which TTOs can address these factors to increase their outputs.

How Can TTO Make a Difference?

The TTOs can affect the outcome by engaging in several activities:

I. Information Gathering

The best way to overcome some of the licensing challenges is to research and understand the context of the invention. This context includes scientific publications of the inventors, prior art searches and market assessment. The initial studies best take place at the time of making the initial patent filing. Though it is best to update such searches at each patent milestone. Inventors are a great source of information and should be consulted at this initial stage.

Information gathering minimizes the number of wrong decisions based on incorrect assumptions or incomplete information.

II. Judicious Patenting

In most, if not all, Federal Research Agencies, intellectual property rights are sought as an incentive to attract a commercial partner and help accelerate commercialization of the technology. As such, if a technology can be adequately and appropriately transferred through publication, most likely a patent will not be filed. This is one definition of judicious patenting. Other examples may be when a patent is nice to have to round out a portfolio but the patent owner has already decided that the patent is not necessary for any of their products. More importantly, judicious patenting must include effective review and monitoring of patent applications and later issued patents at defined milestones.

Judicious patenting and effective monitoring of patent applications and patents can minimize incremental patenting and redundancy

III. Mindful/Skillful Claim Drafting

By the time the patent practitioner sits down to draft the claims, ideally s/he has gathered all the relevant information, and s/he has interviewed the inventors about the ultimate goal of their research project and has a thorough understanding of the place of the instant/current invention disclosure in reaching that goal. Consultation with colleagues involved in licensing helps elucidate factors impacting similar technologies and the desired claim type and claim scope.

Thinking about claim scope can minimize the possibility of design around.

IV. Holistic View of the Portfolio

Knowledge of a given patent portfolio plays an important role in licensing. Managing complex portfolios comprised of many patents capturing different yet related technologies is an art. It is of utmost importance to know what each patent in a single portfolio claims, to know which patent is considered background intellectual property for other patents in the portfolio and which of the patents can be licensed on their own. If a patent serves as background for other patents in the portfolio, and each of the latter patents could result in different products, the background patent can only be non-exclusively licensed as it is ostensibly the common piece of IP to multiple platforms/products. This common piece is in some instances the most valuable piece.

This acquired knowledge about the portfolio both as a whole (sum of the parts) and its parts is the antithesis of lack of awareness factor.

V. Mindful Approach to Incremental Patenting

Earlier, incremental patenting was enumerated as one of the causes of a TTO's inability to license a particular technology. Yet, in some instances incremental patenting is a function of the progress of science and can be an effective portfolio management tool. For example, patents obtained by the pharmaceutical industry have layered patenting: one patent covers the molecule that is the marketed drug, a second patent covers the marketed drug and 5-10 of its close analogues, yet a third covers a Markush group covering thousands of molecules. The Markush group is usually the earliest filed application, followed by the identification of a handful of 5-10 molecules and finally a third patent covering the molecule that is the marketed drug and may be its analogs. In most cases, these patents all expire on the same day, but incremental patenting guarantees that the molecule is broadly covered and minimizes risk.

Incremental patenting, if used appropriately, can help minimize risk and serve as a portfolio management tool.[11]

VI. Marketing

If and when the TTO has adequate resources, the patented technology should be marketed to appropriate industry partners. While some TTOs have a separate marketing, others are not adequately staffed. One way to target market technologies is to draw upon business or marketing students from a

11. Incremental patenting can refer to seeking a patent for an incremental improvement on an existing technology. In some industries given the timeline and expense for product development, incremental patenting is widely used. This practice, especially when referred to as "evergreening" which refers to a legal, business or technological strategy that enables the patent holder to extend the life of his patent has also been widely criticized.

nearby university. Also, some post-doctoral fellows seek non-research scientific jobs and an internship in the TTO can help expose them to TT. The students/post-doctoral fellows could be tasked with writing abstracts for the technology, finding industry partners that work in that particular area of research and sending them information about the technology. Some companies have streamlined this process and the TTO can track the progress of the abstract through the company.

Effective marketing to carefully identified industry partners helps introduce the technology to potential licensees or collaborators.

While some reasons for lack of licenses can be remedied or at least minimized by TTOs, there are three factors on which TTOs have little or no impact. They are: economic viability issues; adoption/perception issues and scientific progress.

I. Economic Viability Issues

In case of derivative products discussed above, no amount of marketing, outreach, patent strategy or portfolio management could help alleviate the obstacle presented by oil prices. While this is a cut and dry example, other economic viability issues may be more complex and require more analysis.

In case of combination products requiring multiple components to be used in design or manufacture of a single product, many different pieces of intellectual property may be required. Sometimes, the mere acquisition or licensing of the IP rights may become cost prohibitive as it would result in a final product that is not economically viable.

II. Adoption or Perception Issues

Some industries by their very nature are more adaptable to change. In such industries, adoption of new technologies is not just accepted, but required as the technology progresses quickly. The software industry is an example of a fast growing and adaptable industry. The others have established practices, tried-and-true methods of performing a certain tasks, thus rendering the adoption of new technologies more challenging.

In other instances, the end user may be uninformed or worse yet ill-informed about an issue, a scientific principle or a product that negatively affecting its adoption. While outreach and education can help remedy the misinformation or provide information where it is lacking, TTOs are rarely positioned or enabled to conduct such outreach and education.

III. Scientific Progress

The progress of scientific research, however well planned, is unpredictable. A research team in another institution who may be working to solve the same scientific problem as that of our scientist may get further faster in solving the problem, rendering our solution obsolete upon arrival.

So far, we have explored some challenges that may be involved in licensing technologies and categorized them into those that can be affected by the TTO and those in which TTO plays little or no role. In summary, it may be useful to reduce our thoughts to a checklist to be used by TTOs when it comes to licensing.

Creating a Checklist

- Strategize on whether or not a patent is an incentive for commercialization
  - Involve TT as early as possible in the research cycle; this helps the scientist charter a path to their ultimate research impact/goal.
  - Have a patent review group that analyzes each invention disclosure using a set of criteria appropriate for that technology.
  - Educate the scientists that patents are but one way of facilitating TT, but not the only way!
- Learn as much as possible about ALL aspects of your technology
  - Understand the stage of development of the technology.
  - Be able to explain the technology scientifically.
  - Learn the distinguishing factor over existing products/technologies (prior art).
  - Learn about the market for the technology.
  - Learn about policy, regulatory, adoption and perception issues to the extent possible.
- Be mindful about claim scope and role of each patent in the portfolio
  - Assess the IP landscape to determine the ideal claim scope.
  - Assess the possibility and difficulty of designing around the invention. Determine whether and how the appropriate claim scope can diminish the possibility of design-around.
  - Determine the place/role of this particular patent in the technology portfolio.
- Determine your best “collaborator” or “licensee” as early as possible in the research cycle
  - Reflect on which company/university/federal agency/foundation works in the same scientific area and would be a suitable partner.
  - Protect your ideas by entering into discussions with interested/potential collaborators or licensees under a confidential agreement (CDA or NDA: confidential disclosure agreement or non-disclosure agreement).
  - Be deliberate and intentional about choosing collaborators. Diverse disciplines may be exactly what is needed to solve complex scientific problems.
  - Make sure that your relationship with your col-

laborators is memorialized using the appropriate collaboration agreement as soon as possible. It is easier to negotiate terms when the research has not yet borne fruits.

- Market your technology

It is important to note that the extent to which the TTO can market its technologies can vary considerably based on staffing and budget.

  - You can market your technology through third party intermediaries; *e.g.*, whether they are done in person or electronically, these services usually require that you be a subscriber to their site/services.
  - You can market your technologies by contacting technology scouts. Scouts can be third party intermediaries or employees of companies whose job it is to look for licensing opportunities that would complement the company's assets, advance their research goals, etc. This would require the TTO to first identify the scouts in each company and cultivate relationships with them.
  - TTO websites have customarily been used to advertise technologies. More recently, professional TT associations have provided a compilation of all available technologies in one spot, *e.g.*, AUTM, FLC Business, WIPO Green. These websites are not only a great forum for posting technologies, but also provide an efficient way for TTO personnel to see which other research entities are engaged in similar research. This is the first step in identifying research partners.
  - Existing licensees and collaborators provide another rich source of contacts.
  - Marketing as a joint effort between the inventor-scientists and TT has proven efficient and effective. Working with the scientists to enable them to pitch their technology to others who may not be in the same scientific field is both challenging and rewarding. The venue/forum in which the scientist can talk about the technology can be diverse: a teleconference, tele videoconference, posters, PowerPoint presentations, technology showcases, etc.

- Review the progress of the science and the patent application at defined milestones
  - After the patent application is filed, it is important to assess the technology at all major prosecution milestones, Actions on the merit, final rejection, allowance, payment of issue fees.
  - In addition to assessing the patentability of the technology, it is important to ascertain that the underlying science is still of interest. For example, if there is a new and improved version of the technology in the works and the patent application has been filed, one may want to discontinue prosecution.

The checklist is intended to help guide the thought process for technology commercialization and to enable the TTO to help the adoption of the research outcomes where possible.

Since both universities and federal labs report on their licensing activities on an annual basis it is paramount that TTOs manage the expectations of all their stakeholders appropriately. TTOs ability to assess a technology to understand the scientific context for the technology, strategize about IP protection (or lack thereof), evaluate its economic viability and market the technology to appropriate partners will enable the TTOs to concentrate their efforts on the more promising technologies and increase the chances of licensing and commercialization. ■

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We thank Brian Nakanishi and James Poulos for valuable discussions and critically reviewing the manuscript.

Available at Social Science Research Network (SSRN): *https://ssrn.com/abstract=3164398*