Know thyself: how well do you understand your own IP strategy?

A groundbreaking benchmarking study by Columbia University examines the IP development programmes and patenting strategies of a number of leading research institutes and discusses the implications of the results

By Orin Herskowitz and Brady Butterfield

Intellectual asset managers in research-based organisations are faced with thousands of seemingly discrete but critical decisions each year – from which new discoveries deserve a provisional patent application to which applications should be converted into utility applications. Each of these decisions in isolation is relatively affordable and is often made case by case, based on the manager’s best judgement about that asset’s fundamental novelty, freedom from prior art, how it fits into the product roadmaps and potential enforceability, among other concerns.

However, in actuality, these decisions are not made in isolation. To loosely borrow a metaphor from Massachusetts Institute of Technology President Rafael Reif’s recent article in the Washington Post, each patent can be thought of as fruit from a tree that is part of a broader ‘innovation orchard’. With hundreds of new inventions each year, and thousands of ongoing patent prosecution and maintenance decisions to be made on the new and existing assets over time, collectively these actions add up to an enormous investment in that organisation’s inventory – as well as of the manager’s scarce time. And, like any other question of resource allocation, these investments should naturally be prioritised to ensure that they fit the overall objectives and missions of the organisation.

But how confident are you that each of the keep/kill decisions being made across your organisation today truly supports that broader mission? Given the definitional uniqueness of each patent and the exceptionally long time between these intake decisions and the patent’s eventual success or failure in the marketplace, IP managers often do the best they can to predict the future based on their own intuition, analysis and past experience. Across an organisation, the decisions of each individual managers no doubt influence other IP managers, and over time these collected practices can easily become functionally equivalent to organisational standard operating procedures. But without near-term market feedback, and given the challenges that most companies experience in getting benchmark data from their competitors within the same industry, intellectual asset managers can find it extremely challenging to determine whether those standard operating procedures truly represent best practices that support the organisation’s mission, as opposed to “the way we have always done it”.

Genesis for the benchmarking study

This was certainly the case at Columbia University. Our office, Columbia Technology Ventures (CTV), had developed a set of patent prosecution practices based on over 30 years of history. As is the case at many universities, each of our 10 technology licensing officers is responsible for managing the inventions emerging from the labs of between 40 and 50 faculty members, resulting in between roughly 30 and 40 new inventions per officer each year. The filing and conversion decisions made by the officers are considered bespoke based on that technology, that faculty researcher and the licensing objectives that we are trying to achieve. The decisions made for the 400 new inventions each year and the roughly 1,000 patent assets already under management collectively form a set of IP practices. Over time, these IP practices have turned out to be relatively consistent year after year, reinforced as new technology licensing officers watch the decisions made by their CTV peers in our portfolio decision and review meetings.

In Autumn 2014 we at CTV decided to take a step back. While our IP practices were internally consistent over time, we realised that we were having trouble clearly articulating a set of IP strategies beyond the sum of these individual decisions. While CTV has been extraordinarily successful as a tech transfer office (100-plus industry licences and 20-plus start-ups per year; over $3.5 billion in licensing revenues to date), we wanted to ensure that our IP management practices were more than simply an organic growth from what we had done previously; that they reflected the best practices and wisdom of our peer academic institutions; and that they collectively supported Columbia’s broader innovation mission.

Tech transfer offices frequently share certain best practices on operational topics such as running internship programmes, managing standardised agreement processes and marketing analytics. With this knowledge, and mindful of the type of information that generally should not be shared, we decided to compare our practices against those of our university peers. Since universities manage a tremendous breadth of scientific disciplines, we searched for IP best practices not only overall, but also specifically for high-tech assets as opposed to biopharma assets, to see whether the practices would vary by asset type. That survey was launched in February 2015.
Context on university tech transfer

For readers unfamiliar with university tech transfer: initially due to the Bayh Dole Act and later expanded via employment contracts, universities typically assert ownership rights to intellectual property developed using institutional resources. While the practices vary, this generally means that universities claim intellectual property developed by faculty and staff, emerging from grant-funded research or using special equipment.

Unlike a corporation or venture investor, revenue maximisation is not the primary objective, but rather one among many. Academic mission statements generally include explicit objectives similar to those shown in Figure 1.

However, there are also many implicit objectives — such as attracting and retaining faculty, ensuring student satisfaction, demonstrating technological capabilities in specific disciplines, supporting local and statewide political agendas, building community infrastructure, creating technologies around which students can start companies and supporting technologies — which can save or improve lives, even if they are not big money makers.

For better or worse, these various missions are played out in the so-called ‘long tail’ (the large number of inventions which never get licensed or are licensed but never make it to market). Even more than for venture capital or biopharma (both of which are already blockbuster-driven businesses), tech transfer operates on a highly skewed power law distribution of returns:

- Only a portion of inventions get patented;
- Few patents ever get licensed (between approximately 5% and 20%);
- Most licences do not result in products on the market; and
- Most products on the market generate relatively low licence revenues, even if the products are useful and successful, due to low royalty rates and milestones.

While the US tech transfer industry generates over $2.7 billion per year in licence revenue, these returns are highly concentrated among the top 20 earners and within these in a small number of licences, with only approximately 0.5% of all currently active licences generating over $1 million per year according to the latest Association of University Technology Managers licensing survey. Even facing the relatively grim revenue statistics, universities continue to support tech transfer — partially out of hope, but largely due to the other non-revenue portions of the mission statement.

University research inventions are often (but not always) at an exceptionally early stage of development, akin to Stages 1 to 2 of the National Science Foundation’s technology readiness levels (see www.cbirc.iastate.edu/industry/technology-readiness-levels/). As the assets are often at an earlier stage and a higher risk than even a typical venture capital portfolio’s assets, the power law nature of the business is unsurprising. While often quite fundamental, these innovations are often made well in advance of a pull from the market due to the objectives of the basic research funding provided by the government (as opposed to the more applied focus of industry R&D). In some cutting-edge areas (e.g., machine learning, silicon photonics, graphene and regenerative medicine), universities are often filing patents that are 10 years or more ahead of industry production — hammers waiting for a nail to appear. It is thus unsurprising that even the most promising inventions often remain unlicensed for years, with an average time lag to licence industrywide of roughly three years and some deals not being completed for more than 10 years (data for approximately 400 of Columbia’s executed licences over 20 years is shown in Figure 3, with similar results coming from peer schools).
**Survey methodology**

Our focus for the survey was on the filing and conversion decisions among a set of our peer institutions, both overall across their portfolios and then specifically comparing their strategies for high-tech assets (ie, software, IT hardware and semiconductors) as opposed to biopharma assets (ie, potential therapeutics and diagnostics).

We were extremely gratified by the response to our request for participation in the benchmarking survey, with 25 institutions responding, including Stanford, Berkeley, Cornell, Harvard, Princeton and Oxford (see full list below).

In order to ensure that we were gathering a representative sample from each institution, we collected data for two consecutive years (FY11 and FY12). For all but one of the 25 responding institutions, the data across the two years was consistent – absolute difference between FY11 and FY12 typically being less than 10% – implying that each institution’s strategy was relatively steady year on year. Since these years were pre-America Invents Act and pre-dated many of the issues that have made the current legal landscape difficult for patent owners, we also asked each institution whether the strategy represented from FY11 and FY12 would still be true today; all but two institutions confirmed that they have not significantly changed course in the intervening years.

Each institution submitted:

- its total number of inventions received;
- which of those inventions were given at least a provisional patent filing; and
- which of those provisional patent filings were later converted into a full utility application (either US or Patent Cooperation Treaty (PCT)).

The institutions submitted the data overall, as well as broken out for high-tech assets and for biopharma assets. The data on the following figures has been anonymised at the request of the participants.

**Survey results: all asset types**

When designing and launching the survey, we were not naive enough to assume that we would see one unified best practice emerge. However, we did assume that we might find between two and three dominant strategies, along with a few outlier strategies. Hence, we were surprised by the results.

The first cut of the data analysed the proportion of invention disclosures which received at least a provisional filing and the proportion of those filings which were eventually converted into a full utility application at the 12-month mark. As can be seen from Figure 4 (anonymised at the request of the institutions), the results represent a seemingly random scatterplot of nearly all possible outcomes.

We initially thought that the dispersion might be caused by the diversity within the university group sampled. Could the results be explained by the inclusion of smaller institutions alongside larger ones? Of institutions that focus largely on high tech or on life sciences? Of institutions with full-scale IP licensing operations alongside those with smaller tech transfer offices? Accordingly, we re-ran the analysis with only a subset of institutions of roughly similar research scale and similar technology breadth: Columbia, Cornell, Stanford, Northwestern, Princeton, Harvard, University of California, Berkeley, University of California, Los Angeles, University of Michigan, University of Minnesota, University of Maryland College Park and Johns Hopkins. Surprisingly, this 12-institution subset...
(which we use in Figure 5 and throughout the rest of the analysis) showed a similar dispersion to the initial run.

In August 2015 we held a conference call with the directors of the tech transfer officers to see whether we could explain the results. The first hypothesis that arose was that the differences might be explainable simply by the size of the patent budget allocated to each institution: schools with smaller patent budgets might be reasonably assumed to behave similarly to each other. However, when we controlled for patent budget based on survey data from the Association of University Technology Managers, schools with similar budgets were to be found at vastly different parts of the graph. To confirm that supply constraints were not the root cause, we surveyed all participants again as to whether they would change their filing strategies if their patent budgets were doubled. Once again, there appeared to be no correlation between an institution’s location on the chart and its likelihood to change its strategy if budgetary constraints were removed.

As alternatives, the management of the tech transfer offices offered the possible rationales shown in Table 2 in support of their strategies.

We found it particularly interesting that a similar customer service argument could be used to support two seemingly contradictory strategies (A4 / C2).

Survey results: high-tech versus biopharma assets

To get a sense of the cumulative impact of these provisional and conversion decisions, we looked at the total percentage of invention disclosures received that eventually received a full utility application (either US or PCT). When including all asset types, the percentage ranged from just under 25% to just over 50%, with a significant cluster around the median of approximately 40% (Figure 6). However, when narrowing in on just high-tech assets, the range widened significantly: 20% up to almost 80%, with more disparity in the middle as well (Figure 7). Breaking out just biopharma assets showed a narrower range (Figure 8).

Intrigued by the heightened dispersion seen when selecting by asset type, we looked at each institution’s relative preference for high-tech versus biopharma assets at both the filing and conversion decision points (Figure 9). The way to read this chart is that an institution in the upper-left quadrant would show a higher likelihood to file on high-tech assets compared to biopharma assets, but a higher likelihood to convert biopharma assets compared to high-tech assets.

Viewing the same data differently, Figure 10 shows each institution as an arrow. The origin is the institution’s strategy for biopharma assets; the terminus is the strategy for high-tech assets; and the length of the arrow is the difference between those two strategies.

As a group, we found Figure 10 particularly surprising. Some institutions (B, K, D) show a strong preference for biopharma assets at both decision points (origin = up, right, and far away from terminus). Others (H) show an equally strong opposite preference in favour of high-tech assets. Some (G, L) make a distinction between biopharma and high-tech assets for either the filing or conversion decision, but not for the other decision. Those with arrows sloping down and to the right (L, F) show a filing preference for biopharma, but a conversion preference for high tech. Still others (C, A, I) appear to treat biopharma and high-tech assets almost identically, despite their very different licensing and revenue generation prospects.

Curious how the directors of the tech transfer offices would explain this dispersion, we convened them to discuss these results. During the call, the following hypotheses were presented.

Possible rationales for a preference for biopharma patents

Rationales might include:

- a greater track record of licenseability (eg, more active voluntary licensing by industry or prevalence of tech scouts);
- a greater likelihood of significant revenue potential from blockbuster intellectual property; or
- Provisionals are cheap (especially if in-house).
- Provisionals allow time to generate market feedback and more research data, allowing for better keep/kill decisions at conversion.
- Because faculty are driven to publish, universities have to file more and earlier provisional applications to protect intellectual property prior to publication, often without time for a full analysis of the IP potential.
- Unfortunately, faculty often do not end up having research funding to continue the experiments, resulting in a lack of sufficient enablement data to justify the costs of conversion at 12 months.
- Customer service: tech transfer offices like to say yes to faculty, who like to see their inventions protected – even if those provisional patents are eventually abandoned at conversion.
- Belief that the first 12 months do not provide enough market feedback. Institutional experience that many technologies that look like ‘dogs’ at conversion turn out to be valuable licensed assets.
- Some institutions have policies or local laws that require fully fleshed-out provisional applications, making them too expensive to be used broadly.
- Customer service: avoids creating false hopes among faculty (“If we file, they will want us to convert”). Especially true since faculty have then put time and effort into the filing and may have become attached to it. Prefer to simply disappoint faculty at the provisional stage, when they have less attachment to the asset.
- Anything that gets a filing almost must be managed and marketed, which takes up scarce IP manager resources.
Horses for courses | Feature

Patents being more central to the development pathway and having a longer commercial lifespan due to longer incubation periods for biopharma technologies.

**Possible rationales for a preference for high-tech patents**

- Provisionals in high tech tend to be cheaper than those in biopharma, since they often stand alone (as opposed to the sequential nature of life sciences inventions). Usually, such patents do not need further enablement data before filing and can be filed as thin cover sheet more easily than with biopharma assets.
- Some high-tech inventions turn out to be fundamental to industries that did not even exist at the time of invention, such as photonics, augmented reality and natural language processing. It might be too early to make a reasoned kill decision at the one-year mark. Accordingly, high-tech patents tend to be binary: most generate very little revenue, but a small number generate enormous equity and royalty returns.
- The increasing passion for entrepreneurship – both on campus and by local government – has dramatically increased the number of start-ups emerging from universities. Given the lower barriers to entry in high tech, as opposed to biopharma, these start-ups are increasingly being formed around high-tech patents, creating a newfound demand for these assets.

**Possible rationales for treating assets equally regardless of industry**

Schools that treat all assets similarly might be practising a customer service effort to give all faculty...
Once articulated, and where appropriate and feasible, know your own data. Many of us were surprised by our own results and found that the reality of our filing and conversion outcomes by sector did not match the way we had been describing them internally and externally.

As an initial exercise, articulate as clearly as possible how your filing strategy is meant to support your organisation’s mission (if you do not know your mission, start by clarifying that). Try to be as specific as possible. Are you there to support the R&D strategy of a specific division? To demonstrate the cutting-edge nature of the institution’s early-stage research? To lay down a ‘picket fence’ in key areas on your company’s product roadmap to enable cross-licensing? To attract world-class researchers with the goal of building up specific expertise? To appear (as we have heard is the case for certain companies) in the list of Top 50 Institutions by Patent Filings each year? Each IP group’s mission will not only be unique based on the institution, but will also likely evolve over time based on changing stakeholder needs, so this review should be undertaken regularly.

- Be honest with yourself about whether your current filing practices best serve the mission or whether they are simply an evolutionary outcome of years of individual decisions. Are you maximising your investment of resources in support of your objectives? Does each individual patenting decision roll up into a cohesive overall approach?
- Once articulated, and where appropriate and feasible, benchmark that strategy off peers with similar assets and similar missions. An appropriately anonymised third-party benchmarking study within a given industry about patent filing, conversion, nationalisation and costs would be tremendously useful.
- If any peer organisation with similar missions and assets has a markedly different strategy, take the time to consider those differences. For instance, this study has led to a number of significant changes to Columbia’s filing strategy, based on these identified best practices. We found the investment of our time in doing this analysis to have a highly positive return on investment and we are sure that you will too.

We take away five primary best practices from this study, which we believe are applicable not only to university tech transfer, but also in some cases to industry IP licensing:

- Know your own data. Many of us were surprised by our own results and found that the reality of our filing and conversion outcomes by sector did not match the way we had been describing them internally and externally.
- As an initial exercise, articulate as clearly as possible how your filing strategy is meant to support your organisation’s mission (if you do not know your mission, start by clarifying that). Try to be as specific as possible. Are you there to support the R&D strategy of a specific division? To demonstrate the cutting-edge nature of the institution’s early-stage research? To lay down a ‘picket fence’ in key areas on your company’s product roadmap to enable cross-licensing? To attract world-class researchers with the goal of building up specific expertise? To appear (as we have heard is the case for certain companies) in the list of Top 50 Institutions by Patent Filings each year? Each IP group’s mission will not only be unique based on the institution, but will also likely evolve over time based on changing stakeholder needs, so this review should be undertaken regularly.
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In the absence of clear external feedback, it is only natural that offices would look within themselves for validation. At most universities, patent decisions are generally made fairly autonomously by the licensing officers within an office. In the absence of clear office-wide defaults or external influences, looking at the behaviour of one’s internal peers over time is a reasonable approach when structuring one’s own decisions. Many of those licensing officers have worked primarily within that one institution or at a small handful of other schools. Further, while the Association of University Technology Managers does collect a limited set of patent data (eg, total inventions, total patent applications and total awarded patents), it is still difficult to compare one institution’s strategy against that of its peers using this data. Hence, it is unsurprising that an office’s filing strategies tend be self-reinforcing, year after year.

“The seeming randomness of our collective approaches made us question whether our industry truly had IP strategies, as opposed to simply a collection of historical practices”
However, we also believe that local norms do not go all the way to explaining the observed effect. As pointed out by my colleague John Swartley from the University of Pennsylvania, the diversity of strategies is, unsurprisingly, also reflective of the multifaceted missions and multiple stakeholders that university tech transfer must constantly try to keep in balance. If our sole objective were straightforward revenue maximisation, most of us agreed that our strategies would not look as they do today, but rather would be more uniform. However, university tech transfer offices have many reasons to file and convert patents, as diverse as the missions we support. While each institution may have a fairly similar mix of assets, the local factors will vary, including their relative strengths of departments and their local mix of industries.

For instance, some institutions (especially state schools) may be influenced by their state and local government’s political agendas. Institutions in economically disadvantaged regions may focus disproportionately on local economic development via start-ups. Institutions in tech clusters with highly active industry licensors and venture investors may be more willing to place bets on higher-risk technology areas. Administrations that are actively promoting entrepreneurship and industry relations may see patenting as simply a must-have to play in the broader game and hence may be willing to be more liberal with the resources they allocate to patent filings. Institutions may favour patents from a particularly strong department or lab in order to attract and retain expert faculty, even if the licensing prospects are not immediately clear. And institutions with a strong track record of giving birth to world-changing inventions which bring great benefit to society may be more willing to hold on to unlicensed assets longer in order to give them a chance to thrive. Even the customer service argument mentioned above can cut both ways: some institutions may choose to attract and retain faculty by being generous with early patent filings to encourage inventorship, while others may determine that faculty are best served by not having their hopes raised unreasonably. Seen through this lens, it is perhaps unsurprising that a variety of strategies are employed to meet these local objectives.

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With gratitude to all of our participating university colleagues, as well as to Columbia’s chief patent counsel, Jeff Sears, for helpful discussions on patent law topics.

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