

# Case studies for use with Intellectual Property Teaching Kit

Reprint from the California Management Review special issue on intellectual property management, produced in collaboration with the EPO

## Contributors

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# Foreword

Innovation is the life-blood of any company. Without innovation, no company can compete in today's marketplace—innovation has a value which is all too easy to overlook, and yet it represents the advantage that one company has over others. It is often the result of painstaking research, the costs of which need to be recouped.

Intellectual property (IP), which can be used to protect innovation, needs to be managed like any other asset if the maximum benefit is to be derived from it. Companies know this, and almost no business model can be successful today without integrating an IP strategy.

Apart from being seats of learning, universities have been pioneers in the search for new knowledge through research for centuries. Publishing this knowledge enhanced the reputations of universities—and individual professors and researchers—and building on this pushed back the frontiers of technology.

More recently the role of universities has evolved to reflect the growing awareness of how this new knowledge can be used to benefit society as a whole, and a university in particular. Industry is well placed to incorporate it into their business, thereby creating markets or improving existing products or services.

Interaction between industry and universities, and between different companies, therefore often hinges on IP. Universities have an interest in seeing their research results reach the marketplace; companies have an interest in having access to these results to profit from them; and companies trade IP between themselves in a variety of ways. Benefits can include the protection of their investment in research, attracting and securing industrial partnerships to sponsor and commercialize research as well as balancing the economic benefits of such partnerships. In the longer-term, commercialization of IP can also be a significant source of income. Suitable IP management is also required in many national and international programs (such as the EU's Horizon 2020 funding scheme).

Management of IP needs to be part of the (business) model of every university and every company. All the stakeholders need to know how to do it best in their specific situation.

The European Patent Office (EPO) supports innovation, competitiveness, and economic growth across Europe by granting high-quality patents after an exhaustive procedure. It also offers a variety of patent information services, allowing users easy access to the fantastic wealth of technical knowledge in patent documents. Its European Patent Academy supports patent-related IP training across Europe and develops patent-related IP teaching material, such as the *Patent Teaching Kit*. This helps to establish a more comprehensive IP culture within universities and amongst the business community.

As business-to-business IP transactions become more sophisticated, and as universities find themselves operating in technology transfer contexts, a practical understanding of the role of IP management can best be gained from seeing how others have done it, e.g., from reading case studies. This special issue—with a series of case studies—gives a deep insight into the benefits, the methods, and also the pitfalls of IP management. The European Patent Academy has supported the creation of this special issue of the *California Management Review* from the outset, even hosting a workshop in Munich at which the various proposals were examined in detail.

It is essential for everyone to have an understanding of intellectual property and its management. Our tools—coupled with this valuable collection of case studies—bring IP to life.



Raimund Lutz  
Vice-President  
European Patent Office

# IP Models to Orchestrate Innovation Ecosystems: IMEC, A PUBLIC RESEARCH INSTITUTE IN NANO-ELECTRONICS

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*Companies increasingly organize innovation activities within innovation ecosystems. This study illustrates the central role of the IP-model that an orchestrator develops for the innovation ecosystem partners. The governance of IP is instrumental for the success of innovation ecosystems as it determines the value appropriation potential for the ecosystem partners and positively influences the success of innovation ecosystems. The insights are based on a case study of IMEC, a public research institute in nano-electronics. IMEC has an IP-based orchestration model for innovation ecosystems through multi-party research collaborations between public and private firms. (Keywords: Innovation Management, Intellectual Property, Innovation Networks, Innovation Ecosystems, Open Innovation)*

In a growing number of industries, the development of new technologies becomes so expensive and risky that companies are forced to join forces in complex innovation networks or ecosystems. A prime example is the semiconductor industry where the costs of developing new generations of semiconductors have increased exponentially.<sup>1</sup> Depending on the innovation needs of the industry, ecosystems can be made up of different sets of partners at different times where companies collaborate and pool their resources on a temporary basis to achieve joint innovation goals while sharing associated costs and risks.<sup>2</sup> Innovation ecosystems generate value for partners by reducing development costs and risks and by combining complementary knowledge, enabling partners to address problems with high complexity.<sup>3</sup> Ecosystem partners can subsequently use the knowledge created within ecosystems to support their own businesses.

While several authors within the ecosystem literature refer to the self-organizing characteristics of ecosystems, other publications stress the role of the leading firm or ecosystem orchestrator in the success of ecosystems.<sup>4</sup> In fact, authors have pointed out that the particular role the orchestrator plays in shaping the innovation ecosystem, stimulating cooperation amongst partners, setting the research agenda, and adding value through its own capacities can be an important determinant of ecosystem success as well an important source of competitive advantage for

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the orchestrator. An ecosystem orchestrator can positively influence ecosystem success if it is able to create a structure, including an IP-model, that stimulates cooperation by ensuring value appropriation for all ecosystem partners, and if it is able to keep on attracting partners based on its specific technological expertise.<sup>5</sup>

The purpose of this study is to illustrate the central role of the IP-model that an orchestrator develops to manage and grow an innovation ecosystem. The IP-model determines the value appropriation potential for the ecosystem partners and is in this way crucial in driving successful collaborative innovation initiatives. We study the case of IMEC,<sup>6</sup> a leading public research institute that orchestrates innovation ecosystems around specific nano-electronics technologies through multi-party

research collaborations. These joint research activities are organized in Industrial Affiliation Programs (IAPs), which function on the basis of innovation ecosystems including partners that hold different positions in the semiconductor value chain. The technologies explored within an IAP are costly and have a high risk factor and complexity,<sup>7</sup> justifying the cost, risk, and talent sharing. To induce companies to collaborate within an IAP, IMEC has designed an IP-model that ensures value appropriation for all partners. Prior research has shown that companies are often unwilling to collaborate if they have ex-ante knowledge appropriation concerns.<sup>8</sup> These concerns are explicitly addressed by IMEC by negotiating up-front bilateral IP agreements with the ecosystem partners based on an underlying IP-model.

The model is premised on foreground IP, which is developed in the IAPs, and which becomes largely available to all ecosystem partners. Although the goal is to generate generic IP that is of interest to all partners, for each partner there are also possibilities to limit IP sharing and to conduct additional proprietary research with IMEC to acquire exclusively owned IP. The combination of shared and exclusively owned IP allows each partner to build up its own unique IP fingerprint in a cost effective and speedy way. Furthermore, IMEC obtains co-ownership on most foreground IP, which enables it to build up a stronger technological base over time. This puts IMEC in an excellent position to define and initiate new IAPs.

## IMEC and the IAPs

IMEC is headquartered in Leuven<sup>9</sup>, Belgium. It was founded in 1984 by the Flemish government<sup>10</sup> as a research institute in microelectronics, but it later expanded its research into nano-electronics and applications in chips and systems design, energy, healthcare and life sciences, wireless communication, imaging, and sensor systems. IMEC has grown from €6.5 million in revenues in 1984 to

€300 million in 2011. At its foundation, IMEC received more than 90% of its operating revenues in public grants. This percentage has shrunk to only 15% in 2011, mainly due to the success of its IAPs. As of 2011, IMEC employed close to 2000 people, including 600 industrial residents, Ph.D. students, and guest researchers.<sup>11</sup>

Research at IMEC is conducted in three phases, i.e. basic, applied, and developmental research. The stage of development of the technology determines the type of collaborations that IMEC undertakes. Basic research is 8-15 years ahead of market applications, and most companies are reluctant to invest in this type of research because of the high degree of uncertainty, long times to market, and value appropriation difficulties.<sup>12</sup> Basic research is the domain of universities, where researchers examine the basic characteristics of materials and explore different paths to achieve technological goals. IMEC collaborates with over 200 universities attracting Ph.D. students by providing an academic-like environment, access to funds, and state-of-the-art infrastructure. The research output of Ph.D. theses is selectively patented. IMEC uses the output of its basic research initiatives as background knowledge for initiating new ecosystems thus ensuring that its future orchestration role is grounded in up-to-date technological expertise.<sup>13</sup>

Applied research focuses on technology that is 3-8 years ahead of market needs. It is pre-competitive research, which facilitates collaboration amongst industrial partners. In this phase, IMEC defines and initiates innovation ecosystems by bringing together partners in IAPs to advance research on particular nano-electronics technologies. Over time, IMEC has developed orchestrating capabilities necessary for managing simultaneously a multitude of innovation partners.<sup>14</sup> As a public research institute, IMEC can be considered as a non-player orchestrator as it is not active in end markets and therefore does not constitute a competitive threat to its partners. This helps IMEC in its role as orchestrator as it creates an environment where partners are willing to openly discuss technology roadmaps enabling IMEC to initiate valuable research programs that correspond to partners' needs.

The concept of IAPs was developed in the early 1990s by J. Van Helleputte, the former Vice President in charge of business development. It is a partnership formula for joint research by industrial researchers and IMEC research teams focused on a specific technology. Within an IAP, actors that typically take different positions in the semiconductor value chain cooperate in a common platform program, which addresses the challenges of applied research in a technical domain. By collaborating in an IAP, companies reduce the costs and risks of applied research. IAP participation also offers companies the option to experiment with alternative technology routes to those followed by in-house applied research. Each industrial partner joins an IAP on the basis of a bilateral contract with IMEC that has a clearly defined technological scope and IP rules. As orchestrator, IMEC ensures the value appropriation potential for all partners, which is an important condition for the success of an innovation ecosystem.<sup>15</sup>

The first two IAPs were launched during the period 1992-1994 and IMEC has coordinated more than 25 IAPs since 2000.<sup>16</sup> Currently, there are 12 IAPs in operation. Since the beginning of the 1990s, 587 different companies have signed

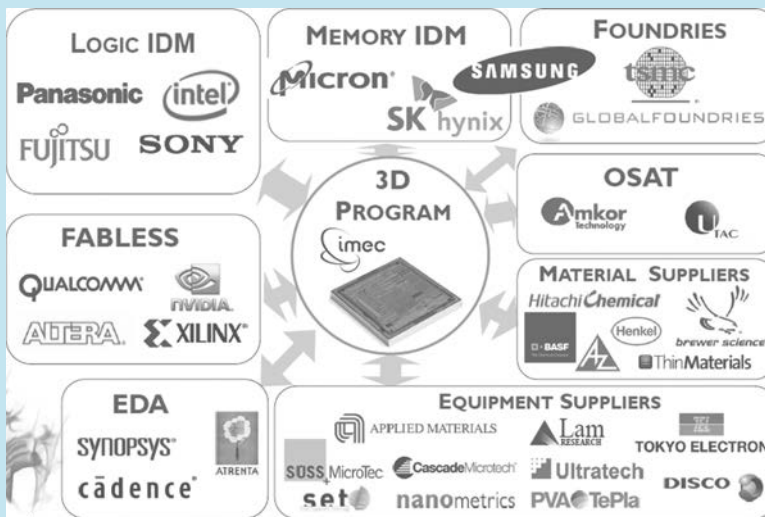
contracts with IMEC and participated in at least one IAP. As an example, Exhibit 1 gives a detailed account of the innovation ecosystem (IAP) on 3D systems integration that IMEC orchestrates.

### EXHIBIT 1. 3D Systems Integration IAP

The purpose of the 3D systems integration IAP is to conduct collaborative research on a new technology to create electronic circuits (3D integrated chips) which is expected to bring multiple benefits, such as reduced power consumption, new design possibilities, and improved circuit security due to more complex chip designs. IMEC researchers spotted the opportunity of the 3D technology through discussions with universities and companies. Preparation started in 2005 with internal experiments resulting in IP that served as background IP in the 3D ecosystem later on. At that time, IMEC mapped other research experiments conducted elsewhere to identify the most promising technological routes to advance 3D technology. The internal experiments and the mapping resulted in a research program and the set-up of an IAP on 3D systems integration in 2008.

Today, the 3D systems integration IAP brings together IMEC and 34 industrial partners in one innovation ecosystem (see Figure 1).

**FIGURE 1.** The 3D Systems Integration Innovation Ecosystem



*continued on next page*

Partners take different positions in the value chain of the nano-electronics industry:

- First, there are the end-users of the 3D technology, such as the fabless companies, Integrated Device Manufacturers (IDMs), and foundries.
- Second, the Electronic Design Automation (EDA) vendors participate in the ecosystem for the development of design software packages.
- Next, the Original Subcontract and Test (OSAT) companies are responsible for the assembly, testing, and packaging of chips.
- Finally, multiple Equipment Suppliers and Material Suppliers develop new types of equipment and materials for manufacturing 3D integrated chips.

At the start of the 3D IAP, IMEC made bilateral IP arrangements with the IAP partners, based on their IP-model and taking into account individual contributions and needs. In general terms, the technology end-users get access to foreground IP related to design and manufacturing. The other ecosystem partners get access to a smaller, more specific set of IP. For example, the equipment suppliers get access to the IP related to their piece(s) of equipment. The equipment and material suppliers typically also negotiated restrictions with respect to the access of others to knowledge on the performance of their specific pieces of equipment and materials. Most of the IAP partners negotiated the possibility to conduct a limited amount of proprietary follow-up research with IMEC on the generic technologies developed in the IAP.

Once the first contracts with key partners were signed, the IAP took off and IMEC researchers began to collaborate with industrial residents on the 3D technology. Other partners entered later on. IMEC has been orchestrating the 3D systems integration IAP for five years now. Only 2% of the turnover in this ecosystem comes from public funding, 14% from suppliers, and the remaining 84% from other partners such as foundries, fabless companies, and IDMs. The IAP has so far resulted in 13 patent filings on the 3D technology and 74 scientific papers. The IP generated in the IAP is used by IAP partners in further internal research and initial production trials. 69% of the 3D team is on IMEC's payroll, 24% are industrial residents from different partners in the IAP and 7% are PhD students conducting research in this technological area.

The third research phase is developmental research. This type of research focuses on topics that are 2-3 years ahead of market applications and is based on bilateral collaboration between an IAP partner and IMEC.



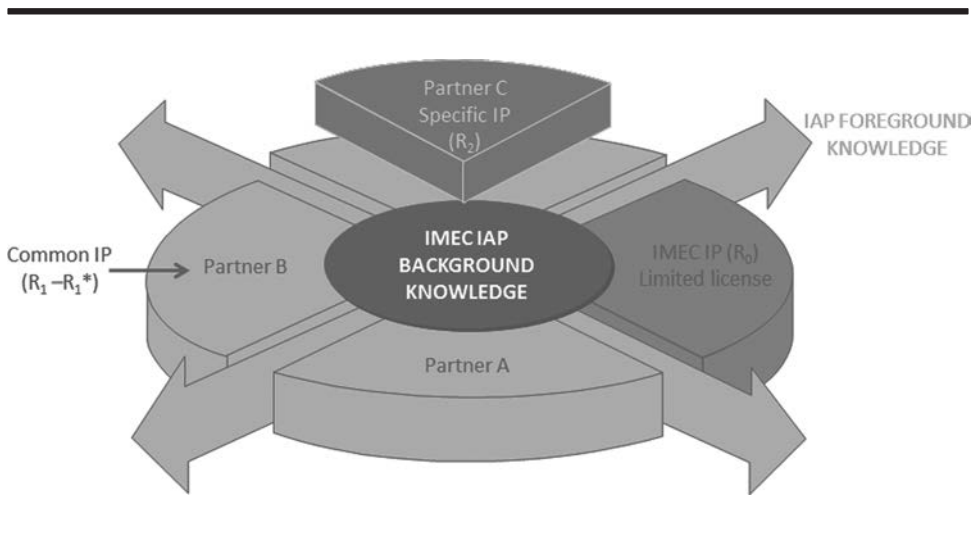
## The IP-based Orchestration Model: How IMEC's IP Management Stimulates Collaboration and Progress in IAPs

### Core Principles

Ownership of and access to the IP-protected knowledge in an IAP is determined beforehand and is part of bilateral agreements between IMEC and its partners. Several principles underlie the IAP IP-model (see Figure 2). First, IMEC's IP that is available at the start of an IAP is labeled "IAP background." It is IMEC's existing IP in science-based research and technologies that is relevant for a new IAP. Second, IP that is generated during the course of an IAP is termed "IAP foreground." Foreground IP consists of all the IP that is generated by IMEC researchers and/or residents of IAP partners at IMEC facilities as a result of the IAP. Upon payment of an entrance fee, IAP partners receive a non-exclusive, non-transferable license necessary for the exploitation of the foreground IP generated within the scope of the IAP. The scope of the license depends on the contributions and technology needs of the different ecosystem partners.<sup>17</sup> The following foreground IP categories can be distinguished:

- $R_0$ —IMEC researchers generate  $R_0$  during the course of an IAP without the collaboration of industrial residents. This IP is owned exclusively by IMEC and industrial partners have no (ownership) rights to it. IP access for an IAP partner consists of a non-exclusive, non-transferable license.
- $R_1$ —IAP partners generate  $R_1$  in collaboration with IMEC researchers.  $R_1$  is co-owned<sup>18</sup> by IMEC and the industrial partner(s) that has (have) contributed to the invention. Each co-owner can use this IP as it wishes. An ecosystem partner can get access to (some of the) IP that IMEC and other partners have developed within the IAP without contributing to it. The access for a non-contributing partner is regulated in the bilateral contract with IMEC and depends on the technological needs of the partner. For example, chip manufacturers need new developments in process technologies, while

**FIGURE 2.** IMEC's IAP IP-Model



fabless partners that rely on manufacturers to produce their chips, are mainly interested in design and application technologies or the impact of next generation process technologies on their future design strategy. They do not need access to (most of the) manufacturing and process IP. IP access for a non-contributing partner consists of a non-exclusive, non-transferable license.<sup>19</sup>

- $R_1^*$ —This IP category refers to knowledge that is not shared among all IAP partners because the partner that (co-)developed the technology does not want to share it with some others (for example, competitors). In this case, restrictions (indicated by the asterisk) are added to the knowledge that can be shared among partners. For example, the purpose of the low-K IAP was to generate knowledge on the operation and efficiency of low-K materials as isolation materials in transistors. Besides chip manufacturers, several providers of equipment to deposit low-K materials on transistors, each using a different material composition, participated in the IAP. Not all partners received access to the full equipment or materials related knowledge that was created. While all partners received access to general knowledge on the operation of low-K materials, knowledge on the performance of specific materials was only shared with the material owning company and not with other equipment companies. The general knowledge is labeled  $R_1$  and the specific knowledge is categorized as  $R_1^*$ .
- $R_2$ —An IAP partner can request to perform limited proprietary research with IMEC researchers in the margin of and in parallel with the IAP. For example, the 3D systems integration IAP (see Exhibit 1) resulted in an IP-protected TSV technology to make an interconnection between chips. To learn more about this technology, some IAP partners asked for additional proprietary ( $R_2$ ) research to apply the TSV technology to their own processes and wafers. The content and conditions of such research are agreed on upfront between IMEC and the partner. The costs for  $R_2$  results are fully borne by the partner and the IP that is generated is exclusively owned by the partner and is not shared with IMEC or others.

### ***Value Appropriation by IAP Partners***

There are different ways through which the above described IP-model set up by IMEC stimulates collaboration and ecosystem progress by allowing partners to appropriate value from their investment and participation in an IAP.

First, IAP partners obtain access to valuable IMEC background IP at an early stage. Background knowledge is scientific information resulting from Ph.D. research and basic research collaborations with academic partners or research conducted by IMEC and its industrial partners in prior IAPs. It is hard to access this knowledge outside the IAP as IMEC only selectively provide licenses on important background technologies.

Second, the majority of the foreground knowledge ( $R_0 + R_1$ ) is shared among partners through non-exclusive licensing agreements. In this way, partners obtain access to most of the program outputs while paying for only part of total

**FIGURE 3.** IP Fingerprint of IAP Partners

R&D costs. Sharing R&D costs has become more important over time as the costs of semiconductor research have soared during the last two decades. Today only the largest companies (such as TSMC, Intel, and Samsung) can afford long-term internal applied research. Through participation in IAPs, semiconductor firms can share costs of long-term applied research and can explore different technological options in cases where there is no clear up-front winner known (yet).

Third, the IP-model allows IAP partners to conduct limited proprietary research to match individual needs ( $R_2$ ) and to protect the confidentiality of company-specific information ( $R_1^*$ ). In this way, partners can combine generic IAP results with company-specific applications that they develop in parallel with/tangential to the IAP and to which they have exclusive rights. Partners are able to build on the foreground knowledge, combine it with internal knowledge, and improve the quality of their own innovations.<sup>20</sup> Bilateral contracts between IMEC and each of its partners allow for a high degree of flexibility in IP-modulation (unlike with consortium approaches).

The combination of different types of IP enables IAP partners to build up a unique IP fingerprint in a cost effective and speedy way (see Figure 3). Such an IP fingerprint consists of a mix of background IP, foreground IP that is shared with others ( $R_0$  and  $R_1$ ), and foreground IP that is not shared with other partners ( $R_1^*$  and  $R_2$ ). This unique IP fingerprint enables IAP partners to differentiate themselves from other companies inside and outside an IAP and to provide *ex-post* a unique offer to the market hence appropriating economic value.

### ***Value Appropriation by IMEC***

There are different ways through which IMEC appropriates value from orchestrating innovation ecosystems (IAPs). From a static perspective, IMEC appropriates

value from its IAPs via the program fees that are paid by IAP partners and (co-) ownership without any accounting on foreground IP ( $R_1$ ). From a dynamic perspective, IMEC appropriates value from the orchestration of ecosystems by using the (co-owned) foreground IP of prior IAPs as background knowledge to initiate new IAPs.

Program fees (one-time entrance fee and yearly program fees) compensate IMEC for the background IP that is brought into the IAP, the provision of research facilities and researchers, and the set-up and orchestration of the IAP research programs.<sup>21</sup> IMEC obtains rights to most of the foreground IP ( $R_1$ ) irrespective of its contribution. These rights can be single IP ownership, co-ownership, or a non-exclusive license with sublicensing rights<sup>22</sup>. There are two ways through which IMEC appropriates value from foreground IP. First, and most importantly, IMEC uses such IP as background IP to launch new IAPs. IP from prior IAPs, together with IP from internal basic research, is used dynamically as background IP in new IAPs. Second, IMEC occasionally directly valorizes IP by licensing/transferring/selling technologies and by creating spin-offs. The amount of money generated via direct valorization of IP is limited to 1-2% of IMEC's revenues.

The choice between direct valorization of IP and safeguarding IP rights for future IAPs is important because the future success of the IP-based orchestration model hinges on the access of IMEC to IP that can be used as background IP in new IAPs. IMEC has thus to decide between direct IP valorization and safeguarding access to IP for its future IAPs: as IMEC first and foremost aims to define, initiate, and orchestrate innovation ecosystems, technologies (and related IP) are only transferred to external companies when they are less relevant for new IAPs or when they are mature and caught up by the market. IMEC will then license-out to manufacturers while safeguarding the IP rights of the IAP partners. Alternatively, IMEC will spin-off a technology when no external entrepreneurs are found to license-in the technology.<sup>23</sup>

### ***Ensuring Future Orchestration Success***

IMEC orchestrates innovation ecosystems in nano-electronics technologies that are pre-competitive in nature. Ecosystem orchestrators should not only focus on current orchestration success, but also seek ways to prolong their orchestration role in the future. In this respect, IMEC is exploring new applications for its IP-based orchestration model, two of which we discuss below.

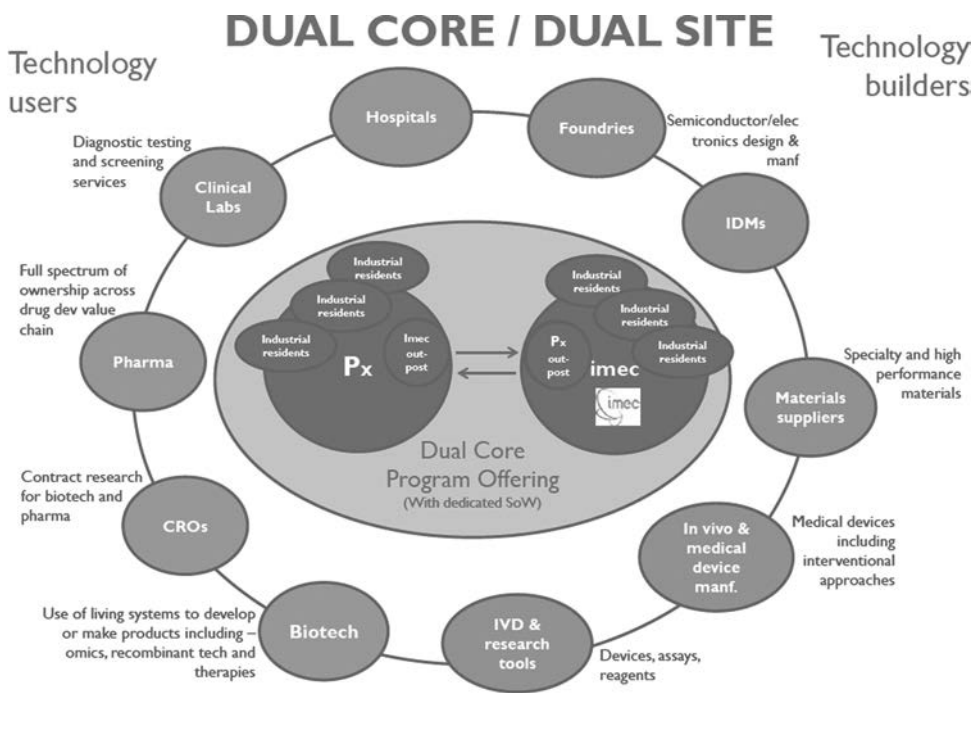
First, nano-electronics is moving away from a focus on M&M (More-of-Moore) towards MtM (More-than-Moore). M&M captures Moore's law and refers to the trend that the number of transistors that can be placed on an integrated circuit doubles approximately every two years, leading to a continuous decrease in costs and increase in performance. The M&M trajectory becomes increasingly expensive and technologically complex. MtM refers to the practice of adding functionalities on chips (systems on chips or SOCs). This shift poses some challenges for IMEC's IAP IP-model: M&M is easier to plan via long-term research projects as the industry has a common technology roadmap. MtM pushes research in the direction of more short-term and application-oriented research as market trends are volatile and less predictable. The innovation ecosystem partners will push for less pre-competitive and closer to the market research (less  $R_1$  and more  $R_1^*$  or even  $R_2$ ). The IP-based orchestration model (Figure 2) can still be used but IMEC has to find a new balance

between keeping sufficient IP in common ( $R_1$ ) and conducting proprietary research ( $R_2$ ) with each partner separately. However, this technological trend should not only be considered as a challenge; it also opens up new opportunities since the nano-electronics value chain becomes even more fragmented and many small, specialized players need an orchestrator to coordinate their innovation activities.

Second, IMEC aims to leverage the IAP model to the life sciences industry in search of nano-electronic applications in this industry. The life science industry is in transition: the pharmaceutical R&D model is under pressure as the number of newly approved drugs is declining despite increased R&D spending. The sector faces similar problems as the semiconductor sector in the late eighties when vertically integrated firms could no longer face the technical challenges and costs of R&D and gave way to a disintegrated and networked model of technological innovation. Likewise, pharmaceutical companies today are vertically integrated and research is getting more costly and complex and collaboration in innovation ecosystems may be imperative to face these challenges successfully.

IMEC is convinced that their IAP model can be leveraged into life sciences. However, nano-electronics—the expertise of IMEC—will have to be combined with expertise in life sciences. IMEC therefore will team up with a second orchestrator that has strong competences in life sciences to create a dual-core, dual-site innovation ecosystem where two innovation ecosystems are integrated. This is illustrated in Figure 4. In such a system, IMEC and its nano-electronics ecosystem partners will

**FIGURE 4.** Dual Core–Dual Site Orchestration Model



collaborate with a second orchestrator in life sciences and its ecosystem, consisting of hospitals, pharmaceutical companies, clinical labs, CRO's, and biotechnology companies.

The IP rules of the single core IP-model can be largely leveraged to the dual-core model. The IP agreements between IMEC (or the second orchestrator) and its ecosystem partners will remain the same, but additional IP arrangements between both orchestrators are needed. IP ownership will be based on contributions and location. Research developed at IMEC is owned by IMEC and the same holds for the second orchestrator.<sup>24</sup> Furthermore, contributions of IMEC at the location of the other orchestrator lead to co-ownership by IMEC and vice versa. Finally, there is the possibility to cross-license knowledge for internal use and the right for each orchestrator to grant sub-licenses to its own ecosystem partners, in line with their business, which is assumed not to interfere (substantially) with the rest of the ecosystem.

## Conclusions

IMEC is an interesting example to illustrate how a public firm can successfully orchestrate innovation ecosystems of private firms, what the role of the ecosystem orchestrator is in stimulating success, and how the IP-model is the crux in explaining how an innovation ecosystem can thrive as orchestrator and partners understand how to appropriate value from ecosystem participation. How can an IP-based orchestration model be instrumental in the success of innovation ecosystems? In industries where there is a high need to reduce R&D costs and risks, the innovation ecosystem orchestrator can stimulate the progress and success of its ecosystems by continuously investing in a strong IP base within its field of expertise and sharing this knowledge with its partners. By giving its partners maximal access to/co-ownership of the IP created within the innovation ecosystem, the orchestrator enables partners to reap the full benefits of joint research, while they only carry out and pay part of it. Furthermore, a good IP-based orchestration model leaves room for customization. This can be done by offering partners the possibility to conduct proprietary joint research with the orchestrator in parallel with the ecosystem. A successful IP-based orchestration model hinges on two important premises: the needs of partners and their contributions. Through bilateral agreements, the orchestrator has the flexibility to take partner-specific needs into account. Innovation ecosystem orchestrators can prolong their leading role in ecosystems by maintaining a learning organization that is oriented towards building up crucial technological expertise and searching for new ways to apply successful orchestration models.

Innovation ecosystems can also be organized by way of consortia such as SEMATECH<sup>25</sup> and SGC.<sup>26</sup> Consortia can achieve important results too, but work in a different, consensus-wise way, without a strong and active orchestrator that determines the direction of the innovation ecosystem, which has both advantages and disadvantages. There are also self-organizing innovation ecosystems where social norms determine to a large extent the functioning of the partners in the ecosystem. Ecosystems in the Dutch vegetables industry offer good examples.<sup>27</sup> Future research

may focus on developing a classification scheme of innovation ecosystems with different governance structures and examine the contingencies (including IP-models) under which they can deliver targeted outcomes.

## Notes

1. While early semiconductor fabrication facilities were affordable to many companies, the costs to build an advanced fab moved past \$1 billion once the features sizes dropped below 180 nano-meters.
2. P.J. Williamson and A. De Meyer, "Ecosystem Advantage: How to Successfully Harness the Power of Partners," *California Management Review*, 55/1 (Fall 2012): 24-46.
3. S. Nambisan, and M. Sawhney, *The Global Brain: Your Roadmap for Innovating Faster and Smarter in a Networked World* (Upper Saddle River, NJ: Wharton School Publishing/Pearson Press, 2007).
4. G. Lorenzoni and C. Baden-Fuller, "Creating a Strategic Center to Manage a Web of Partners," *California Management Review*, 37/3 (Spring 1995): 146-163; C. Dhanaraj and A. Parkhe, "Orchestrating Innovation Networks," *Academy of Management Review*, 31/3 (July 2006): 659-669; S. Nambisan and M. Sawhney, "Orchestration Processes in Network-Centric Innovation: Evidence from the Field," *Academy of Management Perspectives*, 25/3 (August 2011): 40-57.
5. Ibid. Recent contributions on innovation ecosystems build strongly on the platform literature where the role of the technology leader and the structure this firm puts in place to orchestrate ecosystems are considered as important factors in platform success. A. Gawer and M. Cusumano, *Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation* (Boston, MA: Harvard Business School Press, 2002); A. Gawer and M. Cusumano, "How Companies become Platform Leaders," *MIT Sloan Management Review*, 49/2 (Winter 2008): 29-30; A. Gawer, *Platforms, Markets, and Innovation* (Cheltenham, UK: Edward Elgar, 2009).
6. Information on IMEC was collected from two sources: Internal company documents; and Interviews with IMEC managers. Data through interviews were collected during the period 2010-2013 starting with exploratory and unstructured interviews providing general information about IMEC's innovation ecosystems and the IP-model applied in the IAPs. Next, we interviewed leading IP and strategy experts at IMEC using an interview guide reflecting the theoretical framework we constructed based on the information from the exploratory interviews. Finally, our understanding of IMEC's ecosystem strategy and IP-model was refined during a few focused interviews during which ambiguities about specific details of the model were clarified with IMEC's IP managers. Each of these interviews were recorded and lasted between one and two hours. We prepared transcripts of the interviews and conducted follow-up phone calls with the interviewees. R. Yin, *Case Study Research: Design and Methods* (Thousand Oaks, CA: Sage Publications, 2009).
7. Complexity relates in this case to the embryonic nature of the technologies under development, which coincides with uncertainty on the most promising technological routes to advance the technology.
8. B.A. Heiman and J.A. Nickerson, "Empirical Evidence Regarding the Tension between Knowledge Sharing and Knowledge Expropriation in Collaboration," *Managerial and Decision Economics*, 25/6-7 (September-November 2004): 401-420.
9. Besides Leuven, where the main research labs are located, IMEC has R&D centers in the Netherlands, India, and Taiwan and representation offices in China, Japan, and the USA.
10. Flanders is the Dutch-speaking region of Belgium where more than 50% of the population resides.
11. In 2011, IMEC produced 1773 publications, was granted 132 patents, and applied for 133 patents. Since 1984, the research institute has launched 35 spin-offs. In 2011, IMEC received the prestigious IEEE corporate innovation award for its contribution to CMOS technologies (i.e., scaling research) and its innovative ecosystem orchestration model.
12. R. Nelson, "The Simple Economics of Basic Scientific Research," *The Journal of Political Economy*, 67/3 (June 1959): 297-306.
13. Gawer and Cusumano (2008), op. cit.
14. Nambisan, and Sawhney (2007), op. cit.
15. Nambisan, and Sawhney (2011), op. cit.
16. IAPs typically focus on topics such as high-k dielectrics and metal gates in scaled planar devices, cleaning and contamination control for sub-32 nm process technology, carbon nanotubes

- and semiconducting nanowires, low-k Cu interconnect, photovoltaic energy, body area networks, and 3D systems integration.
17. Several researchers within the ecosystem and platform literature stress that this type of platform-specific knowledge or ecosystem-specific technological expertise contributed by the ecosystem orchestrator is crucial for ecosystem success. Not only does it allow the orchestrator to shape the direction of the ecosystem, but it also enables the orchestrator to repeatedly initiate and design new ecosystems and attract future partners based on its valuable expertise and its dynamically expanding background IP. Gawer and Cusumano (2002), *op. cit.*
  18. The standard rule is that co-ownership takes the form of co-patents. IMEC provides co-owners the freedom to license, but they make agreements on litigation as IMEC wants to limit the number of cases in which they end up as a plaintiff in a litigation lawsuit against a firm that is a partner in one of the IAPs. Collaboration contracts contain litigation clauses that state that patent co-assignees first have to try to reach a mutual agreement with a potential patent infringer before going to trial. When reaching an agreement is not possible and a co-owner initiates an infringement lawsuit, IMEC will mostly take a passive role in which they do not contribute to the costs, and do not share in the potential revenues, from the lawsuits. While co-ownership is the standard rule, IMEC prefers single-ownership coupled to a license with sublicensing rights for their partner and will try to negotiate this. There are two reasons why single-ownership is preferred. First, it gives IMEC more control over their patents. Second, it reduces the patent administration and governance costs.
  19. Non-exclusivity guarantees that the results of the IAP are accessible to all partners (in line with their bilateral agreement with IMEC). Non-transferability implies that the licensee cannot assign or otherwise convey the license to any other party beyond the IAP without IMEC and the contributing partners' consent. In this way, the new technology stays within the IAP-ecosystem.
  20. B. Cassiman, R. Veugelers, and S. Arts, "How to Capture Value from Linking to Science-Driven Basic Research: Boundary Crossing Inventors and Partnerships," Working Paper, KU Leuven, 2011.
  21. IMEC conducts different orchestration tasks within each of the innovation ecosystems (IAPs). First, it defines research programs that are attractive for different types of industrial partners. IMEC understands how to create attractive programs as it takes the bridging role between universities and industry: It understands the firms' technology needs and it stays up-to-date with respect to the latest scientific and technological developments. The drawback is that IMEC is solely responsible for setting up IAPs and consequently fully bears the risks related to establishing new IAPs. Second, IMEC makes bilateral agreements with all IAP partners on the scope of the IAP, deliverables, and IP ownership/access. Bilateral contracts have the advantage that IMEC can quickly start up new IAPs. This contrasts with the consortium approach (e.g., SEMATECH) where decisions are based on a time-consuming consensus model. Third, IMEC coordinates the execution of IAPs. This is done by splitting up the IAP in different technology building blocks, which are executed by a team of researchers and managed by an IMEC employee. The coordination of different building blocks is done by project managers and the IAP scientific director. Finally, IMEC sets up a communication structure to share research findings among partners. IMEC communicates via (bi) weekly meetings with the research teams and via biannual meetings with the senior management of the IAP partners to give an overview of the newly generated IP and to discuss the continuation of the IAP. Partners are selected to attend the meetings depending on the arrangements in the bilateral contracts.
  22. The sublicensing rights are necessary for IMEC to guarantee the freedom to use this IP when it sets up new IAPs.
  23. IMEC launches spin-offs as follows. First, a feasibility study is conducted and the IP situation is explored. An incubation period of one to two years, during which applications are developed, is necessary to prepare for the spin-off's establishment. Second, IMEC transfers or licenses-out IP to the spin-off. IMEC is actively involved in the development of its spin-offs and since it has its own seed capital it can work quickly, flexibly, and autonomously to establish spin-offs. An example of an IMEC spin-off is EPIGAN, which was established on the basis of IMEC's mature GaN IP for power electronics.
  24. The reason is that each orchestrator has a different task and work content.
  25. SEMATECH (Semiconductor Manufacturing Technology) started as a consortium of semiconductor manufacturers to develop next-generation manufacturing technology. Today, it has broader industry participation, including IDMs, foundries, fabless, OSATs, equipment, and material suppliers. Member firms participate in pre-competitive research programs on semiconductor technologies, and they get—conditional upon their membership fee—access (licenses) to all the research results of the programs. P. Grindley, D. Mowery, and B. Silverman, "SEMATECH and Collaborative



- Research: Lessons in the Design of High-Technology Consortia," *Journal of Policy Analysis and Management*, 13/4 (Fall 1994): 723-758; <[www.sematech.org](http://www.sematech.org)>.
26. SGC (Structural Genomics Consortium) is a consortium of pharmaceutical companies, universities, and public and charitable organizations that does research on 3D structures of proteins relevant for human health. The research results are made freely available by publishing and depositing protein structures in an open protein databank. M. Perkmann, "Trading Off Revealing and Appropriating in Drug Discovery: The Role of Trusted Intermediaries," *Best Paper Proceedings of the 2009 Academy of Management Meeting*, (August 2009).
  27. A-P De Man *Alliantiebesturing: Samenwerking als precisie-instrument*, Koninklijke Van Gorcum/ Stichting Management Studies, (2006), Chapter 7.

# Strategic Management of Intellectual Property: AN INTEGRATED APPROACH

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*In many organizations, the R&D, strategy, and legal functions are poorly integrated. As a consequence, firms miss opportunities to create and exploit the value of intellectual property. Functional silos are one reason for the lack of integration. More important, however, is the lack of a common framework and even language that would allow engineers, lawyers, and business executives to manage IP assets better. This article provides such a framework. There is no one best way to manage IP and many managers overestimate the attractiveness of using IP to exert market power. Rather, the value of the various means to protect and benefit from IP depends on firm strategy, the competitive landscape, and the rapidly changing contours of intellectual property law. (Keywords: Intellectual Property, Innovation Management, Strategic Management, Knowledge Management, Legal Aspects of Business, Licensing)*

**W**hen Pfizer acquired Pharmacia for \$60 billion in 2003, the company booked \$31 billion in acquired intellectual property (IP) rights. Across a broad range of industries and geographies, IP rights now constitute a significant fraction of enterprise value. Yet, in a recent survey of executives who manage IP portfolios, the respondents indicated that only one half of corporate leaders “understand the value and importance of IP and are actively involved in strategic planning related to IP.”<sup>1</sup> In our experience, this limited integration of IP management and strategic planning reflects a number of obstacles. In many companies, the responsibility for IP management is delegated to legal staff, who tend to be little involved in strategic planning and decision making. In addition, functional silos within management often impede a more strategic view of IP. The separation of IP management and strategy formulation in turn mirrors the common view that managing IP portfolios, while technically challenging, bears

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few strategic consequences. Having developed new products or services, a simple prescription reads, companies ought to obtain patent or copyright protection for them in the hopes of closing markets to competing firms and raising prices. Viewed in this way, effective IP management affords little room for strategic decision making and can easily be delegated to lower levels in the corporate hierarchy. Even in companies that perceive the need for

an integrated approach to managing IP and setting strategy, the dialog between engineers, lawyers, and business executives is often difficult. The specialists lack a common framework and even a language to develop an approach to IP that is broad in its outlook and integrated with the firm's strategy. This article offers such a framework. We provide a set of guidelines that help managers and lawyers better navigate the complex landscape of strategy and IP.

The device that we use to present our framework is a map. The heart of the map is set forth in the Appendix. A much larger version of the map, which contains many additional case studies and considerable substantive information, is available through the following website: <[http://cyber.law.harvard.edu/people/ffisher/IP/Strategic\\_Management.htm](http://cyber.law.harvard.edu/people/ffisher/IP/Strategic_Management.htm)>. The choices for companies that currently have or might obtain intellectual property rights are listed on the left side of the map. The options for firms that currently lack intellectual property rights, but are considering entering lines of business that may run afoul of rights held by others, are listed on the right. With the help of the map, we seek to advance and defend the following theses.

First, a firm holding an intellectual property right can and should choose among five main ways of extracting value from it. All too often, the managers of a firm holding an IP right assume that the best way of using it is to suppress competition—in other words, to prevent potential rivals from offering customers an identical or similar product or service.<sup>2</sup> The resultant market power, it is commonly thought, will enable the firm to raise the prices it charges for its own products or services and thus increase its profits.<sup>3</sup> Although this is indeed a potential strategy, it is by no means the only option available. In fact, in our experience many managers overestimate the desirability of this option. As the first tier of boxes on the left side of the map indicates, the firm should also consider: selling (i.e., assigning) the IP right to another enterprise in whose hands it would be more valuable; licensing the right, perhaps even to competitors; using the right as a vehicle to organize profit-enhancing collaborations with competitors, suppliers, customers, or the developers of complements; and, least obviously, even giving the right away.

Similarly, the managers of a firm considering entering a line of business that may implicate IP rights held by other firms too often assume that their best (or only) course of action is to challenge the validity or scope of those rights through litigation. Again, although this is indeed a possible and sometimes attractive strategy, it is not the only option. Others, indicated on the right side of the chart, include: developing an alternative, non-infringing technology; securing a license from the holder of the IP right; building a portfolio of IP rights sufficiently substantial and credible to deter litigation; and, least obviously, deploying a potentially infringing product or service

so widely and rapidly that, by the time it is challenged through litigation, the firm can either persuade the IP holders to grant them licenses or, better yet, can persuade a judge or jury to declare it to be lawful.

No one of these strategies is optimal under all circumstances. Which is best varies by context. Not surprisingly, choosing among them requires weighing their relative costs and benefits—both short term and long term. All too often, however, managers called upon to make such assessments fail to appreciate the high degree to which those costs and benefits are influenced by the details of the laws governing patents, copyrights, trademarks, and trade secrets.

Our final thesis flows naturally from the previous one. Wise strategic decisions arise out of consultation among managers, lawyers, and the creators of new products and services.<sup>4</sup> Conversations among managers and creators are, of course, already common. Too frequently, however, lawyers are brought into the mix much too late. The product or service has been designed, a tentative marketing plan is in place, and the lawyers are then asked: May we do this? With distressing frequency, the lawyers (most of whom are temperamentally risk averse) answer: No. This sequence is, at a minimum, wasteful. If managers and lawyers engaged earlier with one another, products and services could be designed in a way that reflects not just market demand, but also the legal opportunities to exploit the resultant IP.<sup>5</sup> To facilitate this collaboration, managers need a keener sense of the legal opportunities and constraints, and lawyers must become more aware of the strategic considerations that arise out of their specialized body of knowledge. Everyone, in short, must learn a new language—and must speak it more often.<sup>6</sup>

Stated thus broadly, these theses may seem banal. Their force becomes apparent, however, through the examination of case studies (given as grey boxes in the map) that illustrate the conditions under which a given path does or does not make sense. The online version of the map contains a wealth of additional case materials that can help illustrate the costs and benefits of specific avenues to capture value from IP.

## Offense

Using IP protection to prevent imitation and exercise market power is the most common approach to thinking about IP.

### *Exercising Market Power*

#### *Choosing Among the Potential Sources of Market Power*

The first strategic decision confronted by firms that develop new products or services is which form of IP protection they should seek.<sup>7</sup> Patents, copyright, trademarks, and trade secrets have different advantages and drawbacks. Sometimes the choice among them is clear. For example, a firm that has synthesized (or purified from naturally occurring substances) a new drug should strive, if possible, to obtain a product patent on it. A film studio that produces a movie should be sure to register a copyright in the audiovisual work.<sup>8</sup> In these cases, the cost of seeking protection will typically be smaller than the discounted value of market power, making the choice simple.

In other situations, however, the best option will not be so obvious.<sup>9</sup> For example, a firm that develops a consumer product whose structure or composition is not apparent has the option of either: keeping its composition secret and relying on trade-secret law to reinforce the precautions the firm takes against industrial espionage; or seeking a patent on the product itself or the process by which it is made. Each approach has distinct advantages and costs.<sup>10</sup> Five considerations appear to be particularly important. First, trade-secret protection is potentially infinite in duration (and indeed, Coca-Cola seems to have kept its formula secret for over a century<sup>11</sup>), whereas a patent lasts only for 20 years from the date the patent application is filed. Second, maintenance of trade-secret protection will require the firm to impose confidentiality obligations on its employees whose aggregate costs may well exceed the costs of obtaining a patent.<sup>12</sup> Third, licensing the use of a trade secret is logistically more difficult than licensing the use of a patent because the latter poses a smaller risk that the innovation will be inadvertently released into the wild. A fourth consideration is of particular importance for entrepreneurial firms that seek external finance. Through disclosure, patents help to signal credibly the quality of the venture to potential investors. There is strong empirical evidence to suggest that patents help improve the terms of external finance available to entrepreneurs.<sup>13</sup> Finally, the choice between trade-secret protection and patents also hinges on the strength of property rights. Because patenting involves the (partial) disclosure of information, the likelihood of rival firms imitating a patented product increases if property rights are weak and the innovation is particularly valuable. As a consequence, it can be optimal to patent little ideas but keep the most promising innovations secret.<sup>14</sup>

Weighing the choice between secrets and patents intelligently is only possible if one is familiar, not merely with the technology (e.g., its susceptibility to reverse engineering, which is a permissible way for competitors to ferret out a trade secret), but also with how the rules pertaining to each type of protection are interpreted in the country or state in which protection is sought. For example, much will hinge on the stringency of the “nonobviousness” (a.k.a. “inventive step”) requirement for patent protection<sup>15</sup> and the degree to which trade-secret law restricts the ability of employees to move laterally between firms and then make use of knowledge acquired in their former job.<sup>16</sup>

Whether to keep IP secret is one important consideration in choosing between the four potential sources of market power shown in the map. The choice between patents and copyright is another. Consider, for instance, the case of software. All member countries of the World Trade Organization are now obliged to extend copyright protection to computer software.<sup>17</sup> Although they are not required to extend patent protection, many do so. Software firms doing business in countries where both forms of protection are available can, if they wish, rely on both copyright and patent law to shield innovative programs. Should they? At first glance, the answer would seem to be no. Patents are both more expensive and harder to obtain than copyrights. Why pursue a patent if copyright protection is readily available? In part, the choice depends on the nature of the imitation managers would like to prevent. If the activity consists of verbatim replication of the object code in which the program is embodied, patents offer few advantages over copyrights.<sup>18</sup> By contrast, if the activity

the firm anticipates and wishes to block is the development of another program that performs the same function in a similar way without using any of the same code, then obtaining a patent *might* be worth it, because on this axis copyright protection tends to be weaker than patent protection.<sup>19</sup>

To decide whether the potential advantages of a patent justify its costs, managers and lawyers will also want to take into account the detailed rules that govern IP cases in their jurisdiction. Specifically, they will consider: how courts determine whether two programs are “substantially similar” for the purposes of copyright law; how courts decide whether one program infringes the patent of another (either under the doctrine of literal infringement or under the doctrine of equivalents); and whether, when applying for a patent, the firm would be obliged to reveal the source code for the program, thereby ironically facilitating the development of competitive products.<sup>20</sup> As in the case of trade secrets, the nature of the available protection and nuances in the law will often tip the balance in favor of one of the four potential sources of market power.

### *The Cost of Exercising Market Power*

Companies that employ IP protection to exercise market power typically hope to raise prices above their competitive level, thereby increasing profitability. In many circumstances, IP holders also rely on market power in order to price discriminate among customers. This broad ambition can have serious strategic drawbacks. Our discussion focuses on three mechanisms that can turn exclusive rights into a liability for the innovative firm: changes in the nature of competition, rivals’ increased incentives for innovation, and smaller markets for complements. When present, each of these three mechanisms can raise the attractiveness of sharing IP with rival companies through licensing, collaborating, or even donating IP.

IP rights grant exclusive market opportunities, but the value of these opportunities often depends on the strategic actions of rival firms. Their response is important because they often have the ability to influence the overall value of a market. For example, if a firm terminates a joint marketing campaign because its competitor secured an important patent, the market share of the competitor might increase but the overall value of the market can decline. This mechanism is quite general. To the extent that investments in the value of a market represent a public good—the company that makes the investment bears its full cost, but the returns to the investment spill over to other firms—companies with a larger market share have stronger incentives to contribute to the public good. Consider a campaign to educate consumers about the benefits of electric cars. A Nissan advertisement for its Leaf model benefits the company, of course, but it also educates consumers about the advantages of electric vehicles more generally, benefitting rival producers such as Chevrolet and Tesla. The larger Nissan’s expected share of the market, the stronger are its incentives to invest in consumer education, but the weaker are the incentives of Chevrolet and Tesla. In settings such as this one, exercising significant market power with the help of strong IP rights can undermine the value of the market as a whole, which in turn hurts the dominant firm as well as the subordinate firms. The history of the at-home teeth-whitening industry provides an interesting illustration.<sup>21</sup>

Procter & Gamble Company (P&G) revolutionized the at-home market when it introduced Crest Whitestrips in 2000, offering consumers a far less expensive method to whiten their teeth. P&G patented the strips, an adhesive material that guaranteed the whitening agent would remain in contact with the teeth for an extended period of time. The cleverly designed patenting strategy made it close to impossible to invent around P&G's product. Because the new product shed a favorable light on the Crest brand more generally, P&G gained market share broadly across its oral care products. Colgate-Palmolive Company, desperate to stem the adverse trend, eventually launched a largely ineffective product at a low price, expecting to undermine the profitability of the at-home category and curtail the umbrella-branding effect from which Crest benefitted. The ensuing competition led to a steep decline in prices from which the market never recovered. Back-of-the-envelope calculations show that a less aggressive exploitation of P&G's patent would likely have served the company better. For instance, had P&G licensed Whitestrips to Colgate—a decision that is arguably legal because the patent made effective competition very unlikely<sup>22</sup>—stable prices could easily have improved the bottom line of both P&G and Colgate.

As the example shows, the desirability of exploiting a monopolistic position hinges on rival firms' incentive and ability to influence the overall value of the market. With few spillovers to other market segments and a limited ability to influence demand or the IP holder's cost, rivals may not care much about a market with high barriers to entry. If any one of these conditions is violated, however, exploring avenues of collaboration may well be in the interest of the rights-holder. At a minimum, the ubiquity of joint marketing agreements and other forms of collaboration suggests that the gains from cooperation can be substantial.

A second mechanism by which an exercise of market power can undermine the longer-term profitability of the innovative firm is by increasing rivals' incentive to innovate. As the flow of profits to an innovative company increases, so do the incentives of other companies to "invent around" the innovator's IP. As a result, it can be desirable for an innovator to license its patented product, making the market more competitive but reducing the incentives for entrants to engage in R&D.<sup>23</sup> A classic example of this strategy is the decision by Standard Oil and Farben, two leading companies in the synthetic oil and rubber markets during the 1940s, to license broadly their process technology in an attempt to discourage independent research.

Similar considerations apply when companies lobby for changes in patent protection. At first blush it would seem that extending the life of patents is always in the interest of patent holders. While this may be true for marginal extensions that have a limited impact on rivals' incentive to invest in R&D, more significant changes in patent duration increase the incentives of competitors to invent around existing patents. As a result, innovative companies ironically might be better off with a shorter patent life.<sup>24</sup>

The value of many products and services depends heavily on "network effects." Such effects are conventionally divided into two subcategories. *Direct network effects* exist if the value of a product increases with the number of users. Consider social networks such as Facebook: As the number of individuals using Facebook grows, joining the site becomes more attractive. *Indirect network effects* similarly

enhance the value of a product. As the number of users grows, a greater number of complements becomes available. A complement is a product or service that increases the demand for another product or service. Indirect network effects are critical for products such as gaming consoles. Consider the Sony PlayStation as an example. Developers will produce a larger number of games for this specific console if more people own it. In this example, games are a complement to the console. The value of owning a PlayStation also increases if these games become less expensive, thereby increasing the number of games that a console owner can purchase.

A distressingly common mistake made by firms holding strong IP rights is to leverage the resultant market power in ways that neglect opportunities for network effects—or, worse yet, enable competitors to capitalize on network effects. The history of Apple Inc. illustrates this hazard—and the catastrophic results it can generate. In the late 1980s, Apple was the most profitable company in the personal-computer business. Apple offered consumers a superior graphical user interface, plug-and-play performance, and stylish design.<sup>25</sup> The company's products were protected by patents and copyrights,<sup>26</sup> allowing Apple to raise prices and earn generous profits. However, those profits came at a significant long-term cost. While Apple's market share remained small, the producers of IBM compatible machines fiercely competed for customers, driving down prices, increasing sales, and soon establishing Wintel as the dominant standard.<sup>27</sup> Buying a Wintel machine allowed consumers to share documents seamlessly with many others—an instance of direct network effects—and IBM compatibles offered a far more varied and attractive set of software—an example of indirect network effects. By 2003, Apple's worldwide market share stood at 1.9%, and many analysts expected the company to go out of business.<sup>28</sup>

IP rights again played a critical role in saving Apple. In 2001, the company brought to market the iPod, an innovative portable player of digital music files. In this instance, Apple stood to benefit from weakening IP rights for the iPod's most important complement—recorded music. With the advent of file-sharing in the early 2000s, many customers began to share music files illegally, reducing the effective price for music close to zero.<sup>29</sup> By 2006, an estimated 60% of Internet traffic was due to the transfer of copyrighted materials for which the owner of the copyright did not receive compensation.<sup>30</sup> Lower prices for content were bad news for the entertainment industry. However, Apple produced a complement to recorded music, the iPod. In the presence of free content, consumers were willing to pay a premium for the device. By some estimates, piracy increased Apple's iPod sales by 20%.<sup>31</sup>

While network effects and the role of complementary products and services are particularly strong in the computer and communications industries, there are many segments in the economy that benefit from the presence of complements. Consider the nascent electric car industry (where charging stations are an important complement) or medical devices and prescription drugs. In all these industries, market power due to IP rights should be exercised cautiously.

In the previous paragraphs we discussed the longer-term strategic cost that can arise when firms use IP rights to exercise market power. The mechanisms that can turn exclusive rights into a liability for the innovative firm include changes in the nature of competition, rivals' increased incentives for innovation, and the weakening of markets for complements and network effects. In our experience, managers



who overlook these potentially serious drawbacks often exhibit a mindset that is exclusively focused on value capture, the share of industry rents that goes to their firm. However, value capture alone is a poor guide to strategic decision making. It overlooks the often more important opportunities for value creation—business transactions rarely need to be zero-sum—and it fails to see how aggressive moves to capture value change the incentives of rival firms, suppliers, and customers—often to the detriment of the company. For these reasons, sharing value from IP can be attractive.<sup>32</sup>

### *Selling*

In its intended consequences, the sale of IP is no different from the sale of other assets. Selling is advantageous for the firm and society if the assets are more valuable in the hands of the new owner.<sup>33</sup> With respect to IP, this will be the case if the innovator lacks the manufacturing or marketing capacities to exploit the asset fully. The process of selling IP, however, is often fraught with difficulty, both because the potential buyer will have limited information about the value of an innovation, and because the seller, concerned about misappropriation, will have limited incentives to disclose his or her idea fully. As Kenneth Arrow famously pointed out, it is challenging to sell innovative products and services in the presence of buyer uncertainty and incomplete property rights.<sup>34</sup>

Companies can benefit from the sale of intellectual property if they address these two obstacles. For instance, in a strategy sometimes called “block to fence,” firms acquire a large number of patents not only for their core innovation, but also for related processes and substitute products, hoping to drive up the cost of “inventing around.”<sup>35</sup> As the cost of imitation rises, the innovative firm can more easily disclose information, thereby reducing buyer uncertainty. Similarly, there are various ways to send signals about the value of the innovation to potential buyers. For example, companies can fully disclose the novel product to a single buyer, threatening to sell the idea to others should the buyer attempt to misappropriate the innovation.<sup>36</sup> In this setting, the threat to destroy monopoly profits serves as the mechanism to enforce weak property rights. Companies can also partially disclose valuable IP and offer to retain some “skin in the game,” for instance by accepting the buyer’s stock options as a form of compensation. Because the unobserved value of the innovation influences the cost of partial disclosure and the cost of keeping “skin in the game,” the chosen combination of disclosure and “skin” allows buyers to infer the value of the idea.<sup>37</sup>

While techniques such as “block to fence” and partial disclosure facilitate the sale of valuable IP, they remain costly to the seller. In view of the substantial transaction costs of selling IP, there is a role for specialized intermediaries that serve as market makers. These include live auctions, online platforms, “non-practicing entities,” and IP brokers.<sup>38</sup> Which type of intermediary is most promising will vary with the nature of the technology at issue, whether the IP in question is “standalone” or is valuable only as part of a larger portfolio, and so forth. As yet, the set of IP intermediaries remains small—compared, for example, to the set of intermediaries that facilitates real-estate transactions. However, as it grows and matures, transaction costs might diminish, making the option of selling IP increasingly attractive.

## *Licensing*

Instead of selling, an innovating firm may retain ownership of the IP but give one or more licensees the right to use it. More specifically, the IP holder may grant the licensee(s) the right to engage in one or more of the activities that patent, copyright, or trademark law would otherwise forbid. In the most basic licensing decision, companies compare the revenue they could earn in license fees with the cost of increased competition.<sup>39</sup> In settings where market power is particularly valuable (in other words, where the innovation shielded by the IP is said to be “drastic”), companies typically refuse to license. Licensing is more attractive and likely in situations in which rival firms are more efficient than the innovator or in which rivals have resources and capabilities that the innovator lacks. For instance, licensing IP might help an innovative firm to increase capacity or to augment the demand for its products. A powerful example is Monsanto, the globally dominant agricultural biotechnology company.

Much of Monsanto’s success is founded upon two related technological innovations. The first is “Roundup,” a potent herbicide whose principal active ingredient, glyphosate, is nontoxic to animals but kills most plants until it is dissolved by rainwater. Monsanto secured a patent on Roundup, but it expired in 2000. The principal benefit of Roundup is that it sharply reduces the cost to farmers of weed control. Its principal disadvantage is that its use requires careful timing to avoid killing valuable crops along with the weeds. Monsanto’s second innovation addresses that disadvantage. Through genetic engineering, the company developed so-called “Roundup Ready” seeds, which contain a gene that makes the crops they produce resistant to Roundup. The technology used to produce these seeds and the seeds themselves are protected by patents, which will expire in 2014. Recently, Monsanto has developed an improved system of genetic engineering, which, it claims, produces even more resistant crop strains. That technology is also protected by patents, which will expire in 2020.

Monsanto could have used its patents to exclude competitors from the rapidly growing industry of genetically modified crops (the most important application of which involves soybeans). Perhaps surprisingly, it has not. Instead, it has entered into licensing agreements of two sorts. First, it has granted licenses (on reasonable terms) to several hundred seed companies, authorizing them to develop and sell seeds embodying the “Roundup Ready” technology. Second, it has granted licenses to its principal rivals (DuPont [Pioneer Hi-bred], Bayer, Syngenta, Dow AgroSciences, and BASF) to combine the Roundup Ready genes with other modified genes to produce seeds with multiple advantages—drought resistant, insect resistance, and so forth.

Adoption of this strategy has benefitted Monsanto in three ways. First, by capitalizing on the production capacity and marketing abilities of other firms, Monsanto spread the technology faster than it could have done on its own—and thus not only increased total industry revenues (much of which Monsanto is able to garner through license fees), but also corroded popular resistance to genetically modified crops, which has been based in part on unfamiliarity. Second, the “technological lock-in” achieved through licensing seems to have enabled Monsanto to engage in a novel form of “evergreening”—the popular term for extending the effective duration of

a patent or other IP right. Specifically, Monsanto has (allegedly) pressured licensees to switch from the initial Roundup Ready technology to the slightly improved version by threatening to terminate their licenses to use the first-generation system prior to 2014, when the patent thereon is scheduled to expire. The result, arguably, has been to compel the licensees who are now heavily dependent on the technology to shift to the slightly improved version, the patent on which will last until 2020. Third and finally, the critical importance to farmers of Roundup resistance enabled Monsanto to charge its rivals license fees for producing composite genes—high enough to enable Monsanto to extract some of the value of its rivals' technological innovations.<sup>40</sup>

Two lessons emerge from this example. First, the apparent effectiveness of Monsanto's approach nicely illustrates how differences in firm capabilities and resources can be made profitable with the help of extensive licensing.<sup>41</sup> Second, some of Monsanto's alleged tactics have brought the firm close to the edge of anti-trust law, triggering both an investigation by the Justice Department and a civil suit by a competitor.<sup>42</sup>

Exploiting differences across firms is a powerful rationale for licensing, but not the only one. Managers can also use licensing to shape competition.<sup>43</sup> We already discussed how licensing can discourage rival firms from investing in R&D that threatens to imitate protected products. In addition, licensing can also be an attractive option for companies with weak property rights. By making a product available at a reasonable cost, rival firms have reduced incentives to challenge the validity of a patent. The wide variety of ways in which licensing can be beneficial help to explain the rapidly increasing popularity of this option.<sup>44</sup>

### ***Collaborating***

There are myriad ways to enhance the value of a firm's innovations and its associated IP assets through collaboration. The potential benefits of these strategies are large. However, some of them will bring the firm into close proximity with anti-trust law or other legal reefs.

One of the most important of the collaborative strategies is participation in standard-setting organizations (SSOs). Agreements among competitors to adhere to common standards when designing and manufacturing their products often sharply increase the value to consumers of those products (by catalyzing network externalities, reducing information costs, and so forth), which in turn benefits all of the competitors. However, this socially benign process can become malign in two ways—by enabling a small group of existing firms to raise barriers to entry, or by enabling one of the participating firms to manipulate the standard-setting process so as to take unfair advantage of its own patents or other IP. The latter hazard is especially serious when patent applications have not yet been made public at the time the standard is set. To mitigate these risks, both the United States and the European Union have developed an elaborate set of rules governing the structure and conduct of SSOs and the terms on which each participating firm not only may but *must* license its patents to the other participants.<sup>45</sup> (The result is that this particular variant of the “collaboration” option and one variant of the “licensing” option, considered in the preceding section, are inextricably linked.) To complicate matters further, the rules

vary across jurisdictions. Generally speaking, they are most strict in Europe, but not invariably. Violation of any of the rules can have serious consequences.<sup>46</sup>

The connection between this strategy and the overall theses of this article should be apparent: in the SSO context, the gains to a firm from participating in a collaborative process that increases the value of the market as a whole typically exceed the losses the firm suffers from being forced to license its IP to its competitors on less-than-profit-maximizing terms. In other words, partial sharing is superior to single-minded exercises of market power.

A second form of potentially profitable collaboration involves working with the developers of complements to one's product or service.<sup>47</sup> Some versions of this strategy are simple and obvious. For example, most software firms nowadays make their APIs (application programming interfaces) freely available to firms interested in creating compatible programs. Other versions are more complex. For example, Apple attempted simultaneously to encourage the development of applications compatible with its mobile-phone and tablet products while exercising veto power over which of those applications were available to consumers and the prices that consumers were obliged to pay for them. The ways in which Apple tried to reconcile these goals evolved over time. When it first introduced the iPhone, it sought to prevent independent software developers from creating applications that could run on the device.<sup>48</sup> Later it relented, but only partially. It made the technical specifications of the device available to independent developers, but required developers to submit their programs to Apple for approval. Only if they received Apple's imprimatur could their products be loaded on the phones. The primary criteria that the company applied when reviewing proposed applications were: an application could not touch or enhance the functionality of either the phone itself or the iPod media player that the iPhone housed; no processes could run in the background of the iPhone operating system; and no application was allowed to facilitate copyright infringement. Thousands of proposed programs failed these tests—among them, for instance, *Instinctiv Shuffle*, a clever application that, unlike Apple's proprietary "Shuffle" system, selected songs that matched the user's current mood by analyzing the songs he or she skipped; and third-party instant-messaging and cut-and-paste systems.<sup>49</sup> The "App Review" system remained in place through 2013, but the criteria used to screen applications, as well as the review process itself, continue to evolve. For example, Apple now places more weight on the "professionalism" and utility of applications, their suitability for children, and the degree to which their user interfaces comport with Apple's aesthetic—and it has added an appellate process for developers whose submissions fail these admittedly subjective tests.<sup>50</sup> Apple's policies provide a good illustration of the tensions that often arise between complementors. Applications developers have long chafed under the restrictions imposed by the review process.<sup>51</sup> However, in some instances, these restrictions are in the best interest of developers and consumers. Closing out inferior applications, for example, tends to be welfare enhancing. At the same time, limiting the applications store to software that in no way substitutes for any of Apple's proprietary functionalities and products hurts developers and consumers, the (temporary) removal of the popular Google map application from the iPhone being a recent example.<sup>52</sup> As we have seen, Apple's preference for closed systems has gotten it into trouble before—and may do so again.

A third form of strategic collaboration consists of encouraging and then capitalizing upon innovations by independent developers and even customers through models of “open innovation” and “innovation platforms.”<sup>53</sup> For example, patentees frequently insert in license agreements terms that require the licensee to “grant back” to the licensor the rights to any improvements the licensee makes to the technology at issue. Antitrust hazards lurk here,<sup>54</sup> but if they can be skirted, this technique frequently benefits both licensor and licensee. Less common and well charted is a strategy that has come to be known as “user innovation.” With surprising frequency, the purchasers of consumer products modify them to suit their needs.<sup>55</sup> Traditionally, manufacturers have either paid no attention to this phenomenon or sought to suppress it. Recently, however, a growing number of firms have begun actively cultivating this behavior. Examples include innovation platforms and more general efforts by manufacturers to encourage independent developers and customers to modify their products and then share the modifications;<sup>56</sup> selling or giving customers “toolkits” that assist them in modifying products;<sup>57</sup> sponsoring “idea competitions”;<sup>58</sup> and the so-called “collaborative customer co-design” innovation model.<sup>59</sup> In most of these contexts, the manufacturers enjoy IP rights that they could employ, if they wished, to prevent the innovations. Instead, they do the opposite. Many companies that have adopted this approach report substantial gains.<sup>60</sup>

### ***Donating***

Perhaps the least intuitive of the offensive strategies displayed in the map is the option to give away a company’s IP. Many instances of donation are non-strategic. Web-based peer production in organizations such as Wikipedia and Slashdot are prominent examples.<sup>61</sup> A growing number of companies are also making their IP available, directly or indirectly, to the residents of developing countries—initiatives that can have large humanitarian benefits.<sup>62</sup>

However, there are solid strategic reasons to give away IP as well. For example, making information publicly available so that it cannot be patented can help reduce the risk of future holdup. Consider Merck’s decision to put the Merck Gene Index, a database of expressed human gene sequences jointly developed with Washington University, into the public domain. The pharmaceutical company enjoyed a strong competitive position in cardiovascular disease and cholesterol-lowering drugs, and it had invested heavily in its sales and marketing capabilities in these categories. Making its research publicly available produced two advantages for Merck. The move could potentially lead to faster scientific progress, which would make the company’s marketing and sales capabilities more valuable. In addition, keeping the knowledge of gene sequences in the public domain reduced the risk of rival firms patenting research that was important to Merck’s efforts.<sup>63</sup>

Donations can also be motivated by capital market concerns. By disclosing a part of its knowledge, a firm can signal its value to capital markets and obtain lower-cost equity financing for its innovation efforts.<sup>64</sup> In this example, financing works as a complement to innovation. Similarly, firms can also signal their capabilities to the market for talent.<sup>65</sup>

As our discussion of the five options for rights-holders illustrates, there is no one best way to manage IP. In fact, the most often considered opportunity, using

IP protection to preclude competitors from gaining access to these assets and drive up prices, is often less desirable than more inclusive arrangements in which value is shared more broadly.

## Defense

Companies that compete with rivals who own important IP assets also have a range of options to meet this challenge. In fact, as the map suggests, the options for IP non-holders mirror the choices available to companies who own and control IP.

### *Asserting Legal Privilege*

Firms often assume that entrance into a field already occupied by an incumbent firm holding IP rights will require litigation. To create room to operate, the newcomer must secure permission from a court. This can be achieved in one of two ways. First, the newcomer can challenge the validity of the incumbent's rights. Some examples: in the United States, a generic drug manufacturer can use the so-called "paragraph IV" ANDA certification procedure to challenge the validity of an incumbent's pharmaceutical product patent;<sup>66</sup> a newcomer wishing to deploy a database that mimics or resembles the database of an incumbent may claim that the information in question lies outside the scope of copyright law<sup>67</sup> (or, in Europe, database-protection statutes); or a manufacturer interested in entering a field dominated by a single firm may assert that the trademark employed by the incumbent (e.g., "thermos" or "Murphy bed") has become generic and thus that the newcomer may use it with impunity.<sup>68</sup> Second, the newcomer may acknowledge the validity of the incumbent's IP rights, but contend that the product or practice that the newcomer wishes to deploy would not run afoul of those rights. Some examples: a company hoping to sell an improved version of a patented product (e.g., an air brake for railroad cars) may assert that its version is sufficiently different to fall outside the scope of the incumbent's patent;<sup>69</sup> the operator of an image-based search engine may contend that the "fair-use" doctrine in copyright law excuses the practice of making without permission so-called "thumbnail" digital copies of copyrighted photographs;<sup>70</sup> or a newcomer may contend that its use of an incumbent's descriptive trademark (e.g., "micro color" for permanent makeup) to describe a characteristic of the newcomer's own product is justified by the quite different version of the "fair use" doctrine in trademark law.<sup>71</sup>

Lawsuits of these two general sorts are common, and the newcomers sometimes prevail. However, victory typically comes at a large cost. The recent spate of litigation in the United States concerning "RS-DVR" technology provides an illustration.

To understand the litigation requires a bit of background. The practice of recording video programming lawfully received at one time and then replaying it at a later time is commonly known as "timeshifting." Several generations of technology—"video tape recorders" (VTRs) in the 1950s and 1960s; "video cassette recorders" (VCRs) in the 1970s, 1980s, and 1990s; and set-top "digital video recorders" (DVRs) after 1999—gradually increased the convenience and decreased the cost of this practice.<sup>72</sup> By 2002, 91% of American households owned at least one VCR; today, 40% of households own DVRs, and the number is increasing rapidly.<sup>73</sup>

The legal status of these technologies was initially uncertain. In 1978, the owners of the copyrights in many of the television shows and movies that were being copied using VCRs contended that the making of the recordings violated the copyright laws—and that the manufacturers of VCRs were secondarily liable for the illegal behavior of their customers. In 1984, the Supreme Court resolved this issue against the copyright owners.<sup>74</sup> Since then, the copyright owners have tacitly accepted the legitimacy of in-home timeshifting, but have successfully challenged ancillary innovations that would make it easier for consumers to delete embedded advertisements or share their recordings with their friends.<sup>75</sup>

In 2006, Cablevision, a cable company serving customers in the New York City metropolitan area, recognized that timeshifting could be performed more efficiently using “cloud-based” technology. Instead of relying upon consumers, many of whom are technologically unsophisticated, to operate the set-top DVRs in their homes, Cablevision could invite them to make and store recordings of broadcast programs on sectors of hard drives maintained by Cablevision in a remote facility.<sup>76</sup> When a customer wished to watch a program pre-recorded in this fashion, she would send a signal to the facility, which would then transmit the program to the subscriber’s home.

Cablevision’s announcement of its plan to deploy this technology provoked, as Cablevision expected, fierce resistance from the owners of the copyrights in movies and television shows. The copyright owners did not wish to prevent the recordings; they just wanted to be paid an additional licensing fee. Cablevision did not want to pay them. The copyright owners initiated litigation; Cablevision responded with a declaratory-judgment suit of its own.<sup>77</sup> Two years later, the Court of Appeals for the Second Circuit finally resolved the case in Cablevision’s favor. A year after that, the Supreme Court, acting partly on the advice of the Solicitor General, declined to review the decision.<sup>78</sup> Then and only then did Cablevision begin to roll out the service.<sup>79</sup>

In two senses, this is a success story. First, Cablevision won in the end and cleared the way for its new service, which consumers reportedly find highly attractive. Second, the clarification of the law that resulted from Cablevision’s initiation catalyzed a surge of investment in similar technologies.<sup>80</sup> In other respects, however, this is a cautionary tale. The lawsuit—and Cablevision’s understandable desire to avoid catastrophic damages if it lost—caused a four-year delay in the deployment of the new system. The attorneys’ fees and court costs were very large. None of those costs were shared by other cable companies, which are now free to deploy similar systems in competition with Cablevision. This is a general drawback of litigation that opens up business opportunities for companies that challenge IP rights: Success is a public good from which everyone in the industry can benefit. In short, even in the Cablevision case, litigation may not have been the most sensible approach. In many other analogous situations, the outcome of defensive intellectual-property litigation is far worse. Before proceeding down this path, firms lacking IP rights should at least consider other options.

### ***Develop an Alternative Technology***

One such option is the development of a technology that avoids the territory already claimed by the incumbent. To determine whether pursuit of this strategy

would be effective and sensible, managers must weigh several variables. The most obvious are the nature of the ensuing competition—it will be fiercest if the two companies offer close substitutes—and the technological opportunities available in the relevant field of science, engineering, or art. How much would it cost to “invent around” the incumbent’s right, and what is the probability of success? These numbers will vary sharply by industry and—less often recognized—by the thickness of the buffer that the IP right creates around the incumbent’s product or service. How close can the newcomer come before triggering a violation? Generally speaking, the buffer will be thickest if the incumbent holds a well-crafted patent portfolio and can invoke the benefit of the doctrine of equivalents; a bit thinner if the incumbent is relying on copyright law and thus must satisfy the legal standard of “substantial similarity”; much thinner if the incumbent is relying on the special kinds of copyrights (or “neighboring rights”) that shield sound recordings. These broad generalizations are subject to many qualifications. For example, the kinds of considerations that courts consider when deciding whether a trademark or form of “trade dress” comes too close to the zone already occupied by another mark are radically different from the “element-by-element” approach used in patent cases, and the “total look and feel” approach used by some courts when applying copyright law.

Generic pharmaceutical firms (if they are unable or reluctant to challenge the validity of the patents on the drugs with which they hope to compete) have especially strong incentives to develop alternatives. Unfortunately, the legal waters that the generics must navigate are especially perilous. The danger arises from the proximity between two competing sets of rules: the doctrine of “equivalents,” which is used to determine patent infringement, and the doctrine of “bioequivalence” or “bio-similarity,” which determines the height of the regulatory hurdles that new drugs must clear before they can be marketed. Generic drug manufacturers hoping to enter established markets try to avoid two hazards. On the one hand, they attempt to modify the composition of the drugs already present in that market enough to avoid infringing the patents on those drugs held by the incumbent pharmaceutical firms. On the other hand, they strive not to alter the composition of the extant drugs so much that the altered versions behave significantly differently in patients’ bodies—thus forcing the generics to undergo prohibitively expensive forms of clinical testing and regulatory review. Sometimes they succeed, but sometimes they veer too far in one direction or the other and thus come to grief. The amounts of money at stake ensure that litigation arising out of generics’ efforts of this sort has been intense—and will further intensify with the increased usage of “biologics,” which are subject to different regulatory standards than so-called “small molecules.” If they hope to navigate in these waters successfully, the generic manufacturers must have skilled lawyers on the bridge, not in the engine room.<sup>81</sup>

### *Getting Permission*

“Inventing around” an incumbent’s technology is socially wasteful, at least if the non-infringing technology developed by the newcomer offers no functional advantage. That fact creates an opportunity for licensing. If the incumbent is aware that the newcomer is capable of inventing around its technology, then the incumbent should be willing to license its technology to the newcomer, leaving both better off.



Licensing is also potentially beneficial to both parties in other ways. Licensees gain from reduction of the time necessary to bring their products to market, the ability to produce standardized products and thus reap the benefit of network effects, and perhaps avoidance of liability for unintended violations of IP rights (especially important in fields characterized by dense patent “thickets”). Licensors, as indicated above, stand to gain through avoidance of challenges to shaky IP rights and through inhibition of profit-sapping competition.<sup>82</sup>

Should the newcomer, aware of these incentives, eschew inventing around and seek a license? Perhaps—but not necessarily. There are three factors a newcomer should consider when weighing this option. First, incumbents sometimes refuse (rationally or not) to consider licensing their technologies. The behavior of Apple, discussed above, provides one example. There are many others.<sup>83</sup> Second, both licensor and licensee risk antitrust liability if they structure their deal inappropriately, particularly if they are competitors.<sup>84</sup> Finally, even if licensing is feasible and lawful, the newcomer may substantially improve its bargaining position when negotiating such a license by at least partially developing an alternative technology.<sup>85</sup> If the newcomer can credibly contend that a non-infringing technology is both technically possible and affordable, the incumbent is likely to agree to better licensing terms.

The general lesson: the array of defensive options set forth on the right side of our map should not be regarded as mutually exclusive alternatives. Sometimes the best strategy involves combining them.<sup>86</sup>

### ***Detente***

To ward off patent infringement suits and gain access to rivals’ technology, companies can opt to build large patent portfolios of their own. The ability to threaten countersuits may dissuade competitors from aggressively asserting their legal privileges. For example, in the early automobile industry, Ford, and later General Motors, amassed large patent portfolios without ever asserting them. In addition, large patent portfolios often lead to a mutual dependence that encourages broad cross-licensing. Canon, for example, uses its extensive patent portfolio to gain access to critical technology. When the company encounters a patent that blocks one of its own R&D efforts, it first checks whether the patent holder infringes any of Canon’s rights. If this is the case, Canon notifies the company and proposes a cross-licensing agreement. Canon management believes that its approach is faster and more cost effective than efforts to invent around existing technology or unilateral licensing.<sup>87</sup> Access to technology also appears to be one explanation for the large patent portfolios observed in the semiconductor industry.<sup>88</sup>

### ***Rapid Dissemination***

Companies considering entering a line of business that may implicate IP rights held by other firms have one last and least intuitive choice: they can choose to disregard the potential claims of rivals and instead disseminate a potentially infringing technology in rapid fashion. The goal is to deploy the technology so quickly and widely that, by the time it is challenged through litigation, the firm can either persuade the IP holders to grant them licenses or, better yet, can persuade judges or a jury to declare it to be lawful. Like “shooting the moon” in the game of hearts, when

executed successfully this strategy can be hugely advantageous, but when attempted unsuccessfully it can be extremely costly.

An example of success is Sony's deployment of VCR technology. As we noted above, six years elapsed between the introduction of VCRs and the final decision by the United States Supreme Court concerning their legality. By that time, approximately 11% of American households (and some of the Supreme Court justices) owned VCRs.<sup>89</sup> Familiarity with the technology and its benefits undoubtedly contributed to the willingness of a bare majority of the justices to stretch the doctrines of secondary liability in copyright law enough to legitimate the machines. Sony, the company that took and won this gamble, stood to benefit enormously (although it subsequently forfeited its leading position by underestimating the importance of a crucial complement to VCR technology, the broad availability of recorded movies).

An equally dramatic example of a failure of the strategy is the Napster file-sharing service. The founders of Napster hoped to obtain licenses from the owners of the copyrights in the musical works and sound recordings embodied in the digital files whose dissemination the service facilitated. However, instead of seeking such licenses prior to launching the service, they deployed the service and then asked for permission. The copyright owners refused, and instead sought through litigation to shut down the system. By the time the courts addressed their challenge, the Napster service had over 80 million users throughout the world. However, in this instance, the judges were unmoved by the popularity of the new entrant. Their adverse ruling concerning copyright infringement not only was fatal to Napster itself, it also proved extremely costly to Bertelsmann, AG, the German company that had invested \$85 million in Napster in hopes of converting it to a licensed and thus lawful service. After prevailing against Napster, most of the copyright owners brought suit against Bertelsmann, arguing that it should share responsibility for the injuries they had sustained. The potential damage award faced by Bertelsmann was very large. Rather than run the risk of incurring it, Bertelsmann settled the cases—for several hundred million dollars.<sup>90</sup>

In sum, this fifth defensive option is highly risky. When it works, it can generate enormous gains; when it fails, it can be disastrous.

## Managing IP Across Functional Silos

A recurring theme in this essay is the significant benefits of the close and early collaboration between creators, managers, and lawyers. In order to benefit to the greatest possible extent from novel technologies and products, managers need to collaborate across functional silos. This is particularly important during the research, development, and design phases. Asking IP specialists to determine the best means of protecting *a given design* is less than optimal because even small tweaks in product design can often have a significant impact on the available legal forms of protection. The design of Ferrari automobiles is a good example.

Ferrari's products are prestige goods.<sup>91</sup> As a result, the price that Ferrari can charge for them depends in part upon their scarcity. Recognizing that, Ferrari intentionally limits production, thus forcing potential customers to wait for years before they can obtain cars. In the 1980s, this business model was threatened by Roberts

Motor Company, the brainchild of Carl Roberts. Recognizing that some car buyers either were impatient or could not afford the price of a Ferrari Testarossa (at the time, roughly \$230,000), Roberts manufactured and sold “one-piece body shell[s] molded from reinforced fiberglass” that looked remarkably similar to Testarossas. Customers could buy one of Roberts’ “shells” for roughly \$8,500, remove the body from a modestly priced American sports car, such as a Chevrolet Corvette or Pontiac Fiero, replace it with Roberts’ product, and have a car that, from a distance, appeared to be a Testarossa. For obvious reasons, Ferrari wished to stop Roberts. However, its options were limited. It had no utility patent or design patent on the shape of its cars. Copyright protection was unavailable.<sup>92</sup> Because Roberts did not employ Ferrari’s name or famous “stallion unreined” logo, trademark law in the ordinary sense was not implicated. Nevertheless, Ferrari argued that the shape of a Testarossa was protected against imitation by the little-known doctrine of “trade dress.” In brief, the law of trade dress shields against imitation the packaging or the design of a product if and only if it has come to be associated in the minds of consumers with a particular manufacturer. To prevail under this theory, Ferrari had to establish that the shape of its cars is “primarily nonfunctional.” This might seem a hard row to hoe. After all, aren’t Testarossas designed to go fast? If so, their body shape would be plainly “functional.” Ferrari was able to overcome this formidable barrier by offering the “testimony of Angelo Bellei, who developed Ferrari’s grand touring cars from 1964-75, that the company chose the exterior designs for beauty and distinctiveness, not utility.” Persuaded, the courts granted an injunction against the continued manufacture and distribution of the Roberts replicas.<sup>93</sup>

This case and others like it generate some surprising opportunities for companies when developing what they hope will become popular and distinctive consumer products. If and only if the shape of those products can be plausibly characterized as “nonfunctional,” the company may be able to rely on trade-dress law to suppress competition or to demand license fees from would-be competitors. However, what exactly does “nonfunctional” entail? The answer is subtle and evolving, implicating some esoteric legal doctrines such as what, if anything, “aesthetic functionality” means.<sup>94</sup> As the Ferrari case illustrates, even the seemingly minor decision to make aspects of a product’s design functional can have significant implications for the company’s ability to protect it from imitation. The broader point of the case is straightforward: Unless R&D, marketing, and IP decisions are tightly integrated, the company is unlikely to reap the full benefits of its IP.<sup>95</sup>

For a recent example of such tight integration, consider Microsoft’s development of its Kinect entertainment system.<sup>96</sup> Kinect allows individuals to interact with the company’s gaming console Xbox 360 without a game controller, using only gestures and spoken commands.<sup>97</sup> Microsoft sold 8 million units in the first 60 days following Kinect’s launch, making it one of the fastest-selling consumer electronics devices. Throughout the development of Kinect, IP specialists worked closely with technology leaders and business executives to position the device in the marketplace.<sup>98</sup> The team started out by producing a map that showed potential points of differentiation for the new product. In evaluating each of these points, the company considered both the benefits created for consumers as well as the IP implications.

Would the company be able to protect legally a specific point of differentiation? Was it likely to infringe on rivals' patents?<sup>99</sup> Points of differentiation that created both substantial benefits for consumers and valuable IP were considered particularly attractive. By the time the product was launched, Microsoft had filed 600 patents to protect Kinect-related innovations. Perhaps as importantly, the company had been able to avoid areas with an abundance of existing patents, reducing the likelihood of future legal disputes.

Similar to its integration of IP and R&D activities, Microsoft's trademark, copyright, and trade secrets group worked closely with the marketing function to develop the new brand.<sup>100</sup> One important question was the name of the new product. The company initially considered 90 names, testing them with consumers and conducting worldwide trademark searches at the same time. Business and legal considerations eliminated most candidates. For a short list of eight names, Microsoft completed an international trademark clearance process, seeking around 100 independent legal opinions from multiple jurisdictions. The company eventually filed trademark applications for four names. Marketing research indicated that "Kinect" would receive the best response.

The tight integration of IP management with R&D and marketing is critical for companies that develop significant technologies in-house. In fact, one of the reasons why R&D activities are less globalized than one might expect is the difficulty of replicating this tight integration in foreign markets.<sup>101</sup> The functions that benefit from integration will vary with firm strategy. For instance, companies that acquire technology from the outside might want to integrate closely IP management and M&A activities.

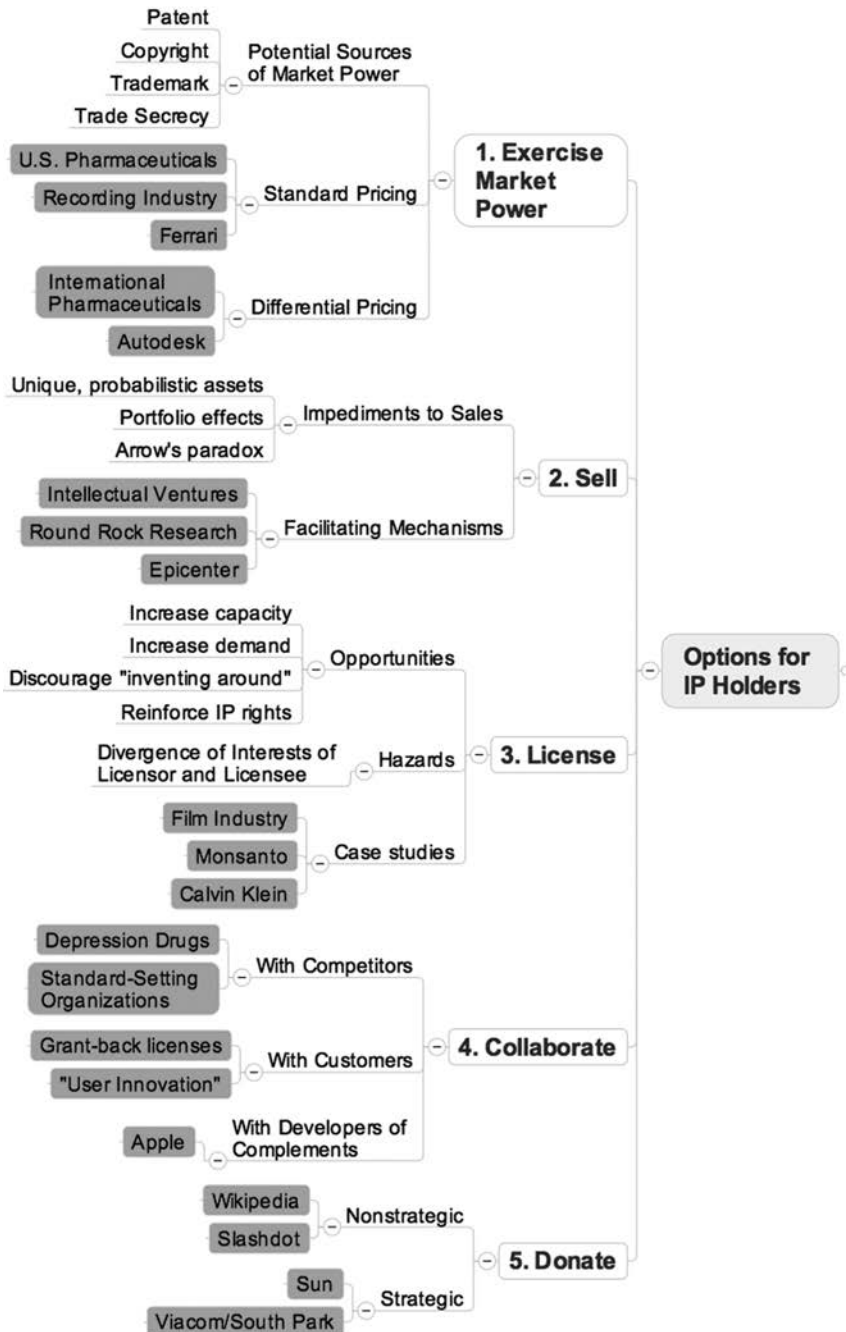
## Conclusion

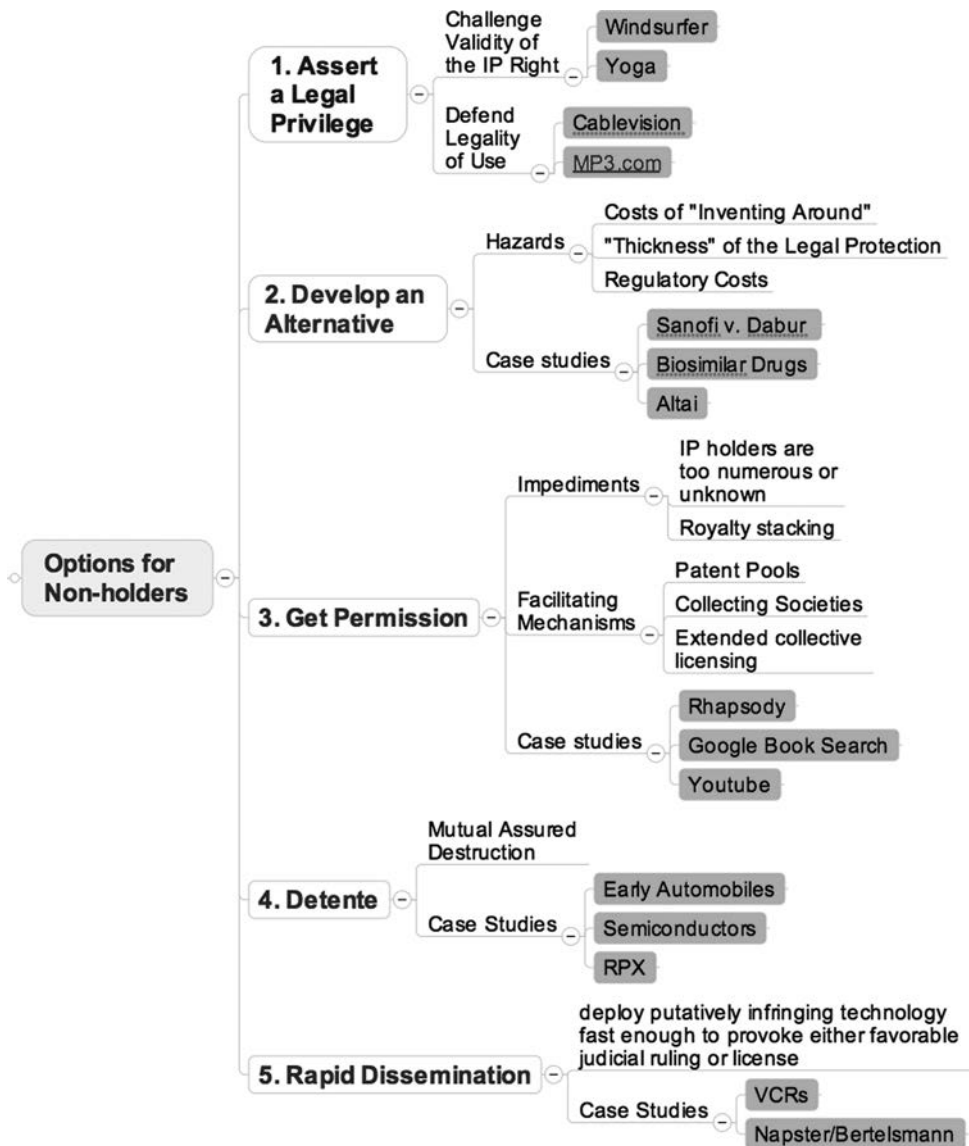
A glance at the map will make clear that this article by no means offers a comprehensive comparative evaluation of the strategies available either to firms holding IP rights or to firms considering entering fields already occupied by IP holders. Our ambition, rather, has been to illustrate companies' principal choices in a systematic manner. We encourage readers to examine additional case studies and arguments by exploring the online version of the map.

From our analysis, three broad conclusions emerge. First, many IP-related decisions are of strategic importance, and they must not be delegated to specialists who tend to be little involved in strategy formulation and implementation. Second, early and continuous interactions between business executives, lawyers, and engineers are critical to identifying the best opportunities for deploying IP. Companies that design products first and then search for ways of protecting them face a far narrower set of options than the one shown in the map. Third, managers assume all too often that the best way of using IP rights is to suppress competition. As the range of options captured in the map and the case studies show, this view of IP is too narrow, and it can have detrimental longer-term consequences. Remarkably often, sharing the value of IP is in the best interest of companies and society.

## APPENDIX

### Map of “Intellectual Property and Business Strategy”





## Notes

1. J. Wild, "The State of Play," in J. Wild, ed., *IP Value 2011: Building and Enforcing Intellectual Property Value—An International Guide for the Boardroom* (London: Globe White Page, 2010), pp. 10-14.
2. The relation between the presence of IP rights and entry is more complex than this simple argument suggests. See I.M. Cockburn and M.J. MacGarvie, "Entry and Patenting in the Software Industry," *Management Science*, 57/5 (May 2011): 915-933.
3. For empirical evidence supporting this view, see J. Lerner, "," *RAND Journal of Economics*, 25/2 (Summer 1994): 319-332; H. Ernst, "Patent Applications and Subsequent Changes of Performance: Evidence from Time-Series Cross-Section Analyses on the Firm Level," *Research Policy*, 30/1 (January 2001): 143-157; S. Shane, "Technological Opportunities and New Firm Creation," *Management Science*, 47/2 (February 2001): 205-220.

4. Several papers in this issue address the challenges associated with organizing IP activities. Cesaroni and Piccaluga (in this issue of *CMR*) analyze the organizational consequences of firms shifting from a reactive to a more proactive IP management approach. Holgersson and Granstrand (in this issue of *CMR*) discuss how corporate entities can maintain access to relevant IP in the wake of spinouts. Fabrizio Cesaroni and Andrea Piccaluga, "Operational Challenges and ST's Proposed Solutions to Improve Collaboration between IP and R&D in Innovation Processes," *California Management Review*, 55/4 (Summer 2013); Ove Granstrand and Marcus Holgersson, "Managing the Intellectual Property Disassembly Problem," *California Management Review*, 55/4 (Summer 2013).
5. Indeed, lawyers should be actively involved, not merely in the design of particular products or services, but in the most fundamental choices made by a firm, including the initial selection or subsequent revisions of the firm's business model. The reason: the relative merits of alternative business models may depend in part on the available opportunities for deploying the firm's intellectual property. Moreover, before choosing any of the options shown in the map, companies will want to develop a good sense of the relevant IP landscape. This can be accomplished with the help of freedom-to-operate studies and searches for patents and prior art.
6. Languages, of course, are best learned early in life. In this context, "early" likely means during the course of professional education. Thus, the best way to address the concerns outlined in this essay would be through greater integration of the curricula of law schools and business schools.
7. While we focus on companies' legal means to protect and exploit IP assets, firms also have at their disposal a broad set of market-based strategies that reach similar goals. See B. Anand and A. Galetovic, "How Market Smarts Can Protect Property Rights," *Harvard Business Review*, 82/12 (December 2004): 73-79.
8. William Fisher, *Promises to Keep: Technology, Law, and the Future of Entertainment* (Stanford, CA: Stanford University Press, 2004), pp. 59-70.
9. For examples of how knowledge-intensive business-services companies choose among the available forms of protection, see N. Amara, R. Landry, and N. Traoré, "Managing the Protection of Innovations in Knowledge-Intensive Business Services," *Research Policy*, 37/9 (October 2008): 1530-1547.
10. For an analysis comparing patents and trade secrets, see A. Arundel, "The Relative Effectiveness of Patents and Secrecy for Appropriation," *Research Policy*, 30/4 (April 2001): 611-624.
11. "Two Sentenced in Coke Trade Secret Case," *CNN Money*, May 23, 2007, <<http://money.cnn.com/2007/05/23/news/newsmakers/coke/>>.
12. R. Bone, "Trade Secrecy, Innovation, and the Requirement of Reasonable Secrecy Precautions," in R. Dreyfuss and K. Strandberg, eds., *The Law and Theory of Trade Secrecy* (Northampton, MA: Edward Elgar Press, 2010). There are also interesting interactions between trade secrets and patents. For example, firms with a reputation for toughness in patent enforcement can successfully reduce the outward flow of knowledge through labor markets. See R. Agarwal, M. Ganco, and R.H. Ziedonis, "Reputations for Toughness in Patent Enforcement: Implications for Knowledge Spillovers via Inventor Mobility," *Strategic Management Journal*, 30/13 (December 2009): 1349-1374.
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