Open Innovation

Where We've Been and Where We're Going

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Overview: The term "open innovation" was introduced in my 2003 book, which outlined a new model for industrial innovation. Since that time, the concept has been adopted by hundreds of academic articles and been incorporated into the innovation practices of a similarly large number of companies. At the editors' invitation, this article reviews this recent history and offers a perspective on where open innovation is going in the future.

Keywords: Open innovation; Intellectual property; Business model innovation; Innovation communities

The editors of *RTM* have offered me the chance to reflect upon the progress of open innovation since its inception in 2003 with the publication of my book *Open Innovation*. I truly appreciate the opportunity.

There has been an explosion of interest in academic circles and especially in the innovation functions of many, many companies since then. When I wrote *Open Innovation* in 2003, I did a Google search on the term "open innovation," and I got about 200 links that said "company X opened its innovation office at location Y." The two words together really had no meaning. When I conducted a search on that same term last week, I found 483 million links, most of which were about this new model of innovation. There have been hundreds of academic articles written on the open innovation approach, along with a number of industry conferences on the topic, and

there is even an annual PhD conference that trains dozens of new scholars each year, all of whom are writing dissertations on aspects of open innovation.

What follows is a personal view of this phenomenon, which must inevitably be selective, highly incomplete, and partial in its consideration.

Defining Open Innovation

Just as Eskimos have dozens of words for "snow," the term "open innovation" has acquired multiple meanings. In my own view, the open innovation paradigm can be understood as the antithesis of the traditional vertical integration model in which internal innovation activities lead to internally developed products and services that are then distributed by the firm. The vertically integrated model is what I term a closed innovation model. Put into a single sentence, open innovation is "the use of purposive inflows and outflows of knowledge to accelerate internal innovation and expand the markets for external use of innovation" (Chesbrough 2006, 1).

This is the future of open innovation, a future that will be more extensive, more collaborative, and more engaging with a wider variety of participants. As the future unfolds, I expect universities to become more welcoming of this trend. Public policies will be adapted to support this movement. And the innovation capabilities of organizations around the world will no longer stop at the boundaries of the organization. Instead, open innovation practices will extend to suppliers, customers, partners, third parties, and the general community as a whole (see Chesbrough, Vanhaverbeke, and West 2006). However, my definition is not universally accepted, a point I will return to below.

Open innovation has become a new paradigm for organizing innovation. It assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their innovations. Open innovation processes combine internal and external ideas together into platforms, architectures, and systems. Open innovation processes utilize business models to define the requirements for these architectures and systems. These business models access both external and internal ideas to create value while defining internal mechanisms to claim some portion of that value.

There are two important kinds of open innovation: outside-in and inside-out. The outside-in part of open innovation involves opening up a company's innovation processes to many kinds of external inputs and contributions. It is this aspect of open innovation that has received the greatest attention, both in academic research and in industry practice. Inside-out open innovation requires organizations to allow unused and underutilized ideas to go outside the organization for others to use in their businesses and business models. In contrast to the outside-in branch, this portion of the model is less explored and hence less well understood, both in academic research and also in industry practice.

A Schism in Open Innovation Definitions

There is another definition of open innovation out there, one that builds on the concept of open-source software. This approach ignores the business model and takes no account of the concept of false negative projects (or the inside-out half of the open innovation model I present below). The work of Eric von Hippel, for example, analyzes "open and distributed innovation," using the example of open-source software as the motivating example for his analysis (von Hippel 2005).

While I have taken care to clarify that open innovation is not synonymous with the model of open-source software, this distinction is elided in the work of von Hippel, who does not cite my work in his analysis, and his colleagues.[1] One can infer from this omission that they are philosophically opposed to the idea of a business model, and think that there should be little or no IP protection for innovation either.

There is an irony in this, because of a schism that has arisen in open-source software itself, the very phenomenon von Hippel studies. Within that community, there is a strong disagreement between the "free software" people and the "open software" people. The free software people, people like Richard Stallman and others, think that "software should be free." Projects like the GNU operating system were constructed using a "copy-left" approach, meaning that any use of the GNU code must itself be shared with the rest of the GNU development community.

This is very much akin to von Hippel's insistence that intellectual property protection is unnecessary and indeed, unhelpful to innovation. In the von Hippel conception of open innovation, users are expected to share their knowledge freely within the community because as users they benefit directly from innovation. Business models have no role to play in his conception. The capital that organizations may require to scale their innovations (and how they may earn a return to justify that capital) is not a question of interest.

On the other hand, a separate branch of the open-source software community uses the term "open software," meaning that the companies that use open code can make additions to that code without being obligated to share those additions with the community. Linux is organized along these lines. Companies such as Google, which makes extensive use of Linux, have developed a variety of extensions to the core code that have been kept private and are not shared back with the Linux community. Open software enables companies to build upon open or shared code, investing in proprietary extensions. Both branches of the open–source movement agree on the value of a commons from which programmers can draw useful reference designs, source code, helpful tools for coding, and testing software. But they part company when it comes time to go to market.

Linus Torvalds, the creator of Linux, is squarely in the "open" camp (rather than the "free" camp). In fact, he is rather dismissive of Richard Stallman's evangelism for "free software":

> He's too inflexible, too religious. . . . I certainly am of the opinion that *open source started working a lot better once it got away from the Free Software Foundation politics and values,* and more people started thinking about it as a tool than a religion. I'm definitely a pragmatist. (qtd. in Lohr 2001, 215; emphasis added)

Torvalds' pragmatic approach to open source is akin to my definition of open innovation, in which a company utilizes a business model to support investment in a project and allows the project to scale over time. IP is not only allowed in my view of open innovation, it actually enables companies to collaborate and coordinate, confident in the knowledge that they will be able to enjoy some protection from direct imitation by others in the community.

Both views of open innovation share the insight that being open is a powerful generative mechanism to stimulate a lot of innovation. Von Hippel rightly notes that users are a powerful

source of innovation in the early stages of a new product. The differences between "free" and "open" become apparent once the initial stage of a new product ends and the innovation begins to gain traction in the market. At this point, hobbyists give way to companies that come into the market to commercialize these innovations, business models are created, and capital investments are required to create growth. The real social impact of an innovation only arrives after it is commercialized. While Linux was created by Linus Torvalds and a small community of volunteers, it is sustained today by companies like IBM that have built business models around Linux and driven its usage in the enterprise.[3]

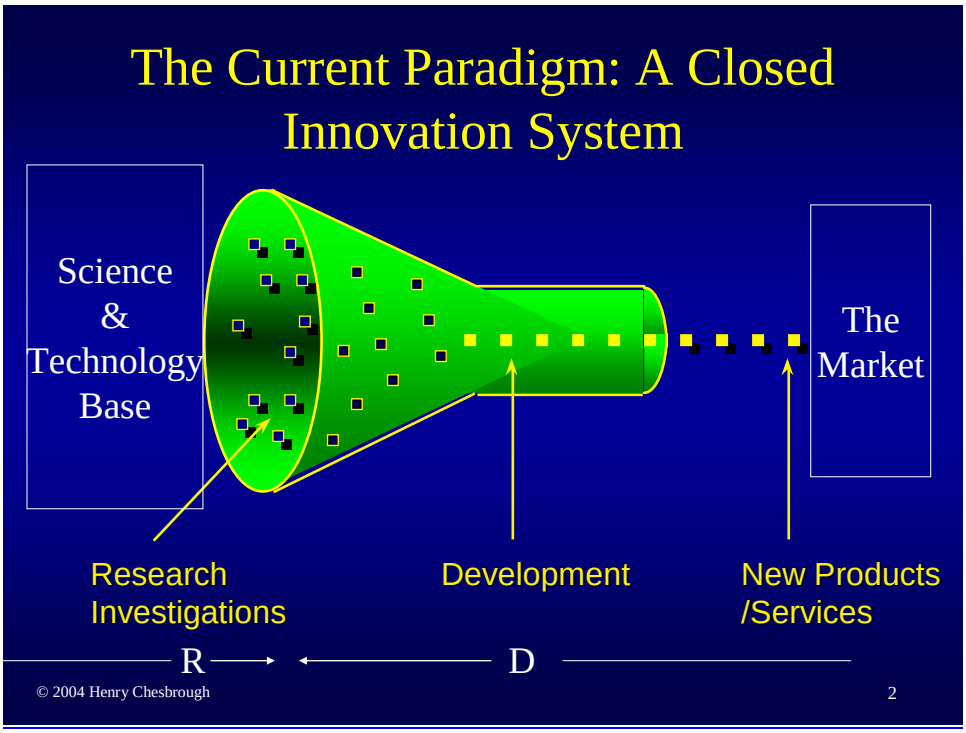
Open innovation folks like me think you can and should have legal regimes and business models to enable the open process, whereas the free (or "open and distributed innovation") people don't.

Open Innovation as a New Paradigm

My 2003 book *Open Innovation* is credited by Wikipedia (2012) and other observers as the first sustained analysis of this new approach to innovation. That book describes a paradigm shift from a closed to an open model of innovation. Based on close observation of a small number of companies, the book documents a number of practices associated with this new paradigm.

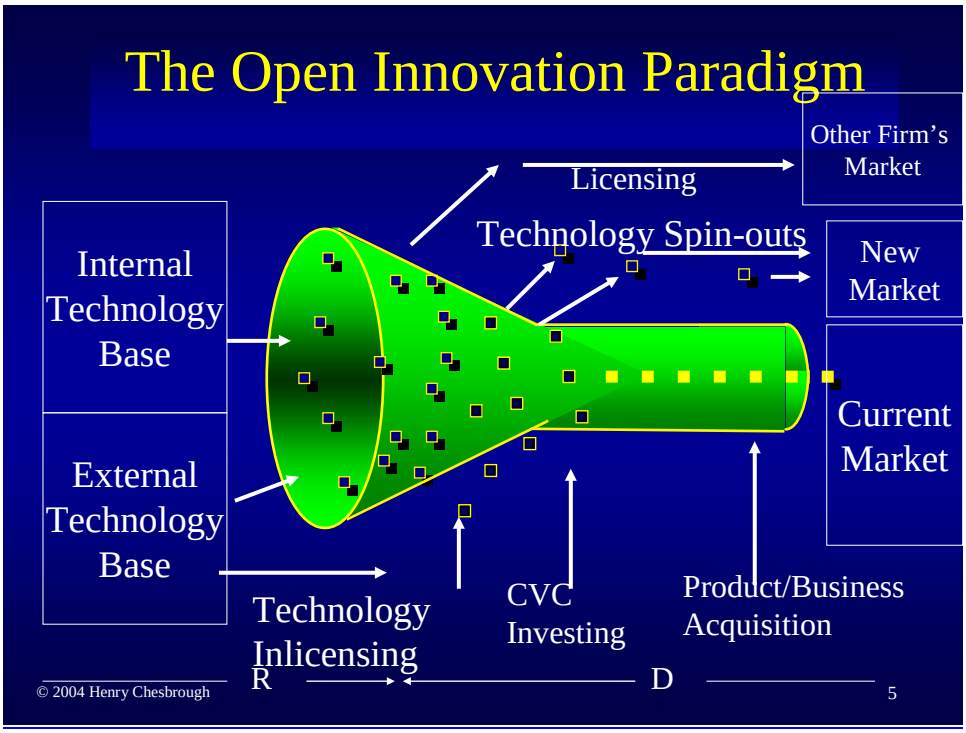
Under the closed model of innovation, research projects are launched from the science and technology base of the firm (Figure 1). They progress through the development process, and some projects are stopped while others are selected for further work. A few successful projects are chosen to go through to the market. AT&T's Bell Laboratories stands as an exemplar of this model, with many notable research achievements but a notoriously inwardly focused culture. Other celebrated twentieth-century examples of this model include IBM's TJ Watson Research Center, Xerox PARC, GE's Schenectady laboratories, Merck, and Microsoft Research. (It is worth noting that each of these storied institutions has greatly altered its innovation model in the past decade.) In other countries, such as Japan, the closed model remains quite popular to this day.

~~--Figure 1 near here--~~



This traditional innovation process is closed because projects can only enter it in one way, at the beginning from the company's internal base, and can only exit in one way, by going into the market. In the open innovation model, by contrast, projects may enter or exit at various points and in various ways (Figure 2). Here, projects can be launched from either internal or external technology sources, and new technology can enter into the process at various stages—the outside-in portion of the model. In addition, projects can make their way to market in many ways as well, such as through outlicensing or via a spin-off venture company, in addition to going through the company's own marketing and sales channels. This is the inside-out part of the model. I labelled this model "open" because there are many ways for ideas to flow into the process, and many ways for them to flow out into the market. IBM, Intel, Philips, Unilever, and Procter & Gamble all exemplify aspects of this open innovation model.

~~**---Figure 2 near here---**~~



The growing acceptance of the model is due to its ability to explain phenomena that the closed model could not. For instance, open innovation explains the surprising ability of Cisco to keep up with Lucent and its Bell Labs in the 1990s:

> Though they were direct competitors in a very technologically complex industry, Lucent and Cisco were not innovating in the same manner. Lucent devoted enormous resources to exploring the world of new materials and state of the art components and systems, to come up with fundamental discoveries that could fuel future generations of products and services. Cisco, meanwhile, did practically no internal research of this type.
>
> Instead, Cisco deployed a rather different weapon in the battle for innovation leadership. It scanned the world of startup companies that were springing up all around it, which were commercializing new products and services. Some of these startups, in turn, were founded by veterans of Lucent, or AT&T, or Nortel, who took the ideas they worked on at these companies, and attempted to build companies around them. Sometimes, Cisco would invest in these startups. Other times, it simply partnered with them. And more than occasionally, it would later acquire them. In this way, Cisco kept up with the R&D output of perhaps the finest industrial research organization in the world, without doing much internal research of its own. (Chesbrough 2003, xviii)

My conception of open innovation began from close observation of what companies were actually doing and then trying to reflect on what they were doing in relation to what I'd read as a PhD student and then as a professor. Michael Porter's work on business and corporate strategy was very powerful and influential in the 1980s and 1990s, and remains so to this day. It is really a model of closed innovation, where you figure out what your key strategic assets are and you either go for low cost or go for differentiation or you find a niche. You're constantly looking for ways to compete against the other guy. As I saw what was going on in the industry labs, it was

clear that a lot of that was happening, but there was a lot of other stuff going on that Porter's model didn't really explain very well at all.

As part of my research, I spent a significant amount of time at Xerox and its Palo Alto Research Center, popularly known by its acronym, PARC. I tracked 35 projects that started inside of Xerox's labs and got to a certain level of development, when internal funding was stopped. I was curious about what happened to these projects subsequently, because in many cases Xerox encouraged the employees working on them to leave and take them to the external market. Once these people left the lab, budget was freed up for something that was more strategic and promising for the company's core business.

One of the things I discovered was that most of the 35 projects subsequently failed. But a few of them succeeded and actually became publicly traded companies; the combined market value of those publicly traded spin-off entities substantially exceeded Xerox's own market value. That discovery really made me think about how to better understand what was happening here and how it would work both in a large corporation like Xerox and in a small corporation. How could we think about a system that was more open? At Xerox, their core business models were doing a good job of commercializing certain technical projects that fit well with its business model. But other projects that didn't fit with the core found different business models that made them much more attractive as standalone entities.

I have come to think of these misfit projects as "false negatives," projects that lacked value in the context of the company's current business model but might have significantly more value if they could be commercialized through a different business model. Innovation researchers have long recognized these "false negatives," characterizing them as spillovers from industrial R&D. In the closed paradigm, these spillovers were regarded as a cost of doing business. Open innovation treats spillovers as a consequence of the company's business model—and sees them not as a cost but as an opportunity to expand the business model or spin off a technology outside the firm to a different business model. These spillovers are at the heart of the inside-out part of the model.

The open innovation model also offers a second set of insights around the treatment of intellectual property. In the closed model, companies historically accumulated intellectual property to provide design freedom to their internal staff. The primary objectives were to obtain freedom to operate and to avoid costly litigation. As a result, most patents were actually worth very little to these companies, and the vast majority were never used by the business that held them. Lemley (2001, 11–12) cites studies that report a large fraction of patents are neither used nor licensed by firms. Davis and Harrison (2001) report that more than half of Dow's patents were unutilized, and Sakkab (2002) states that less than 10 percent of Procter & Gamble's patents were utilized by one of P&G's businesses. In open innovation, by contrast, intellectual property represents a new class of assets that can deliver additional revenues to the current business model and also point the way toward new businesses and new business models. Open innovation implies that companies should be both active sellers of IP (when it does not fit their own business model) and active buyers of IP (when external IP does fit their business model).

To assess the value of this insight, consider your own organization and evaluate its patent utilization rate. Think of all the patents that your company owns. Then ask yourself, what percentage of these patents is actually used in at least one of your businesses? Often people don't

even know the answer, because no one has ever asked the question. In cases where companies have taken the trouble to find out, the percentage is often quite low, between 10 and 30 percent. This means that 70–90 percent of a company's patents are not used. In most companies, these unused patents are not offered outside for licensing either. In an open innovation model, IP does not languish; it creates value, either directly or via licensing or other inside-out mechanisms.

Innovating the Business Model

As the Xerox PARC analysis and the IP discussion show, the business model plays a critical role in the innovation process. As I reflected further upon this point, I realized that it warranted an entire book in its own right. This became the motivation for my second book, *Open Business Models*, published in 2006. Instead of treating the business model as fixed, as I did in the first book, I examined the implications of being able to innovate the business model itself.

Making business models more adaptive, I reasoned, might allow companies to obtain more value from innovation, from those false negative projects. Had Xerox, for example, been willing to experiment with alternative business models, some of the value built by 3Com, Adobe, VLSI Technology, and other spinoffs might have accrued directly to Xerox. Some of these experiments can even be done with "other people's money." If Xerox were willing to sell some of its technologies on an OEM basis, for example, those technologies might have become industry standards while being housed within Xerox. And the experiment would have been whether external companies were willing to buy the technology or not. In other cases, technologies that were licensed out went to companies that employed those technologies in very different business models. Xerox could have selectively emulated some of those models with other technologies in its possession.

The book also presented a maturity model for business models, from commodity-type business models (offering undifferentiated products) to the highest, most valuable kind of business model, a platform model. Platform models are more open, because they entice third parties to innovate on your architecture, your system, your platform. And they often enable others to license unused technologies from you to place into other business models. This makes continued investment in R&D more sustainable and can even confer competitive advantage. P&G, for example, is best known for its embrace of outside-in open innovation via its Connect+Develop initiative. But P&G also opens up its business model to license out technologies for others to use. This isn't as weird as it might seem, because P&G is strategic about how, when, and on what terms it licenses those technologies. As Jeff Weedman of P&G put it to me:

> The original view [of competitive advantage] was: I have got it, and you don't. Then there is the view, that I have got it, you have got it, but I have it cheaper. Then there is I have got it, you have got it, but I got it first. Then there is I have got it, you have got it from me, so I make money when I sell it, and I make money when you sell it. (Chesbrough 2006, 201)

While *Open Business Models* received substantial recognition, it has not had the impact of the first book. However, business model innovation is becoming a growing area of interest for many authors (see, for instance, Baden-Fuller, Lecoq, and Macmillan 2010; Johnson 2010; Osterwalder and Pigneur 2010). While my book was among the first to link innovation results to the innovation's fit with the prevailing business model, this is an area that is developing rapidly.

However, most organizations still treat R&D activities separately from the design and improvement of business models. This has likely held back progress in this area.

Open Innovation for Services

A more recent development is the consideration of how innovation occurs in services. Most of the top 40 economies in the OECD get half or more of their GDP from services. And many companies are witnessing a shift to services as well. Xerox now gets more than 25 percent of its revenues from services. IBM is another classic case, along with GE and Honeywell.

In some cases, what's really happening is the business model is shifting, which can turn a product business into a service business. For example, a GE aircraft engine can be sold for tens of millions of dollars to an airframe manufacturer. That same engine can also be leased to that airframe manufacturer through the company's Power by the Hour program. In the first case, it's a product transaction. In the second case, it becomes a service. What benefits GE in the service transaction is the aftermarket sales and service, spare parts, and other ongoing costs that accrue over the 30-year operating life of the engine. With a Power by the Hour offering, all of that value comes back to GE.

More generally for services, innovation must negotiate a tension between standardization and customization. Standardization allows activities to be repeated many times with great efficiency, spreading the fixed costs of those activities over many transactions. Customization allows each customer to get what he or she wants, for high personal satisfaction. The problem is that standardization denies customers much of what they want, while customization undermines the efficiencies available from standardization.

The resolution to this dichotomy is to construct service platforms. These platforms invite others to build on top of your own offering (the platform), allowing for economies emerging from the standardization of the platform along with customization created by the additions of many others to the platform. A fundamental premise of open innovation is "not all the smart people work for you." That means that there's more value in creating the architecture that connects technologies together in useful ways to solve real problems than there is in creating yet another technological building block. System architecture, the system integration skill to combine pieces in useful ways, becomes even more valuable in a world where there are so many building blocks that can be brought together for any particular purpose.

Platform leadership to me is the business-model side of systems integration. A successful platform requires a business model that can inspire and motivate customers and developers and others to join the platform. The model must be designed to allow those third parties to create business models that work for them, even while the business model works for the platform creator. In that way, their activities increase the value of the core business—their investment makes the platform business more valuable. These ideas are explored in greater length in my most recent book, *Open Services Innovation* (2011).

The Boundary Conditions for Open Innovation

The question of boundary conditions for open innovation is one area where we need a lot more work. For the most part, academics are still publishing open innovation success cases.

Companies are trumpeting their successes. Consulting firms are packaging open innovation services for interested clients. None of these groups have had much to say about open innovation failures. To move beyond simply celebrating successes, we must consider some underlying conditions that need to be satisfied for open innovation to be successful.

One would be workforce mobility. To move knowledge, you need to move people. To take full advantage of the inside-out branch of open innovation, one or more people often need to move with the project for some extended period of time to transplant the project effectively in the new firm. This is hard to do in some environments. In Japan, for example, there's a two-tiered labor market: in the first tier, people join a company when they graduate college and stay with that company for most of their career. There's a second tier that's much more temporary, with people moving from company to company. Those people are typically in lower-status jobs and in a few of the more artistic kinds of industries as well. Within that first tier of the market, labor mobility remains very low. That really impairs open innovation, because even if you bring in external ideas, the same people that you had last year or the year before or the year before that are dealing with them. The idea might come in but the people with those ideas don't come in.

Another boundary condition is the presence of internal R&D. Some consider open innovation to be a rationale for outsourcing R&D. But this misunderstands the nature of innovation. To transfer knowledge effectively so that companies can really make use of it, you need a certain amount of creative abrasion and a certain amount of time together working on the problem. Open innovation works best when people are collaborating side by side, with people moving from one organization to another. A truly successful open innovation effort also requires people who operate in a boundary-spanning role, who can connect knowledge from different sources and find ways to mash it all together in new combinations. Such people are sometimes called "T-shaped managers" (Hansen and von Oetinger 2001).

Yet another condition is the need for some basic IP rules to enable open innovation, particularly in situations where capital-intensive investments have to be made. In the earliest phase of a nascent industry, users and hobbyists can do a lot by modifying the technologies already available to them. But once the industry reaches some sort of dominant design, where it really begins to get to scale, a significant capital investment will be required to stay in the game. You're going to need some IP protection in order to offer a return to your investors to pay for that capital.

The Way Forward

While open innovation has had a strong reception since its initial launch almost a decade ago, there is certainly more work to be done. Open innovation was first understood and implemented as a series of collaborations between two organizations to open up the internal innovation process. Today, though, we see many instances in which the concept is being used to orchestrate a significant number of players across multiple roles in the innovation process. Put simply, designing and managing innovation communities is going to become increasingly important to the future of open innovation.

Let me illustrate this point with two distinct examples of different kinds of community-level open innovation across a broad spectrum of activities. My first example comes from Taiwan Semiconductor Manufacturing Corporation (TSMC), a foundry operating in the semiconductor

industry. TSMC provides manufacturing services from its manufacturing facilities (foundries) to its clients, who design new semiconductor chips. The customers take these chip designs to TSMC, and TSMC fabricates the designs onto silicon wafers and gives these back to its customers. The customers then package them into individual chips and sell them. This saves TSMC's customers from having to invest in expensive manufacturing plants to manufacture chips. Instead, they rely on companies like TSMC to do the fabrication work for them.

Designing chips requires customers to use a variety of tools, such as reference designs and process recipes. With the growth of TSMC's business ecosystem, many of the third-party companies who make these tools began to take steps to assure their customers that their offerings would run on TSMC's processes. This expansion in third-party tool offerings creates more design options for TSMC's customers—a clear benefit. However, these new offerings also increase the complexity TSMC's customers must manage, and this complexity risks causing new chips to require redesigns or other expensive modifications to be manufactured correctly—a clear risk.

TSMC has addressed this risk with its Open Innovation Platform (their term, not mine!). The Open Innovation Platform starts by combining TSMC's many design and manufacturing services with those provided by many third-party companies and then testing these all together. TSMC then certifies to customers of those third-party offerings that these tools can be used with confidence that the chip will turn out properly the first time through the process. In this way, the Open Innovation Platform helps TSMC's customers get their designs manufactured on the first pass. This avoids very expensive "turns" of the chip design, in which the chip must be redesigned in order to be manufactured properly in volume. The result is faster time to market for TSMC's customers, at a lower cost of design. So TSMC uses open innovation to manage a complex ecosystem of internal and external design sources, simplifying the design process for customers by guaranteeing compatibility, provided they stick to validated resources when designing their chips.

My second example comes from GE and its recent ecomagination challenge. While GE has a very large energy business of its own, with revenues of nearly $40 billion annually, the company has noticed a great deal of venture capital and startup activity in green and renewable energy technologies. Recognizing its own limits, GE sought to establish a process to tap into the ideas out there that had the potential to become promising new ventures in renewable energy and green technology.

But GE did this in an open way. Instead of doing all the work themselves, they enlisted four active venture capital firms who already had experience investing in this space. Together, the four venture capitalists and GE pledged a total of $200 million to invest in attractive startup ventures. The ecomagination challenge was born. In July of 2010, the challenge was launched to the world, and everyone was invited to submit potential project ideas for consideration for investment. More than 3,800 venture proposals were submitted. As of this writing, 23 ventures have been funded, with 5 other projects receiving other awards; a people's choice award has been given as well. While the ventures are quite young, the venture capital firms and GE are all enthusiastic about the experience. GE's level of enthusiasm has led them to adapt the model to the healthcare space (a Healthymagination challenge was launched in 2011) and also to China's growing market (a challenge is under way there as well).

And one need not be a large company to open up the innovation process to the community. A small firm in Florida, Ocean Optics, has instituted a community innovation challenge on a much smaller scale.[3] They received dozens of responses, and ended up funding 20 different researchers on projects that might be of great value to them in the future. So this is a game that many organizations can play, if they have the vision and determination to do so.

And that is where we're going. Open innovation's effectiveness is not restricted to a few select corporations. It is a process that makes more effective use of internal and external knowledge in every organization. While we have much to learn about its problems, boundary conditions, and critical success factors, open innovation is going to be a part of the future for all of us.

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Notes

1. James Euchner has usefully distinguished open innovation from what he calls “open-source innovation,” with the latter corresponding to von Hippel’s treatment of the concept (Euchner 2010).

2. The Linux Foundation, the governing body for the Linux kernel, these days is comprised of companies like IBM, Intel, Oracle, Dell, Nokia, and others. Membership on the foundation’s board requires an investment of $500,000, well beyond the financial capacity of any hobbyist. These inconvenient facts are ignored by the adherents of “open and distributed” open innovation.

3. The initial Blue Ocean proposals and recipients are described at http://blueoceangrants.com/.

figure captions

Figure 1.—A closed innovation system

Figure 2.—The open innovation model