

# **MIT**Sloan Management Review

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## How to Manage Outside Innovation

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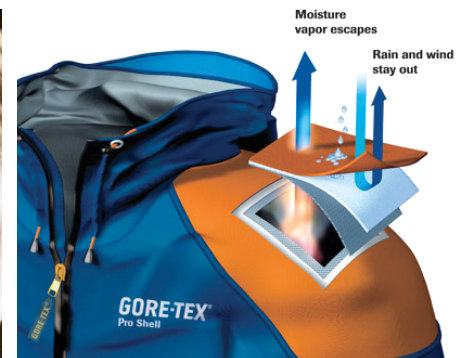
Should external innovators be organized in collaborative communities or competitive markets? The answer depends on three crucial issues.

BY KEVIN J. BOUDREAU AND KARIM R. LAKHANI

TO APPRECIATE THE important role that outside innovators can play, look no further than Apple Inc.'s wildly successful iPhone. Thousands of external software developers have written complementary applications for the iPhone that have greatly enhanced its value, transforming the product into a blockbuster that has become the center of a thriving business ecosystem. Of course, the fundamental concept of “open innovation”<sup>1</sup> — relying on outsiders both as a source of ideas and as a means to commercialize them — is hardly new, but companies have struggled with precisely *how* to open up their product development to the external world. For starters, many executives have little idea how to motivate and manage outside innovation. Specifically, should external innovators be organized as a *collaborative community* or as a *competitive market*?

Collaborative communities are perhaps best known through the Linux Foundation's Linux and through other open-source software efforts that are governed loosely by social norms and “soft” rules to encourage open access to information, transparency, joint development and the sharing of intellectual property. A remarkable aspect of communities is that members are often willing to work for free.<sup>2</sup> Competitive markets are strikingly different. Rather than collaborating, external innovators in a market will develop multiple competing varieties of complementary goods, components or services. Customers then choose from among the different offerings. The classic example here is the multibillion-dollar video game industry, where companies (Nintendo Co., for example) develop a hardware console (Wii) and encourage third-party businesses to write game software for that platform. In a market, external innovators are busy focusing on their own economic interests, which often results in fierce competition — and little cooperation — among them.

The Linux Foundation and Medtronic Inc., a manufacturer of medical devices, rely heavily on outside communities (of software developers and physicians, respectively) for their product innovations. In contrast, W.L. Gore & Associates Inc., the developer of Gore-Tex, a waterproof and breathable fabric, depends on an external market of innovators.



## THE LEADING QUESTION

Should companies organize outside innovation through collaborative communities or competitive markets?

## FINDINGS

► Communities are useful when an innovation problem involves cumulative knowledge, continually building on past advances. Markets are effective when an innovation problem is best solved by broad experimentation.

► In general, communities are more oriented toward the *intrinsic* motivations of external innovators (the desire to be a part of some larger cause, for instance), whereas markets tend to reward *extrinsic* motivations (such as through financial compensation).

Because the dynamics of communities and markets are so dramatically different (see “Markets Versus Communities”), companies need to consider carefully which approach makes the best sense for their objectives. From our research, we have identified three critical issues that managers should take into account when making that decision. Specifically, the discussion must look at: (1) the type of innovation that will be shifted to external innovators, (2) the motivations of those individuals and (3) the nature of the platform business model. An in-depth analysis of those issues reveals that the choice between collaborative communities and competitive markets is not as obvious — nor as clear-cut — as it might first appear.

**What Type of Innovation?**

When the technology and consumer preferences of a product are well understood, then a company can simply conduct internal development or engage in traditional contracting for that work.<sup>3</sup> But when the technology, design and innovation approaches have yet to be established or when customer needs are highly varied or not yet fully understood, then opening up the innovation to the external world can have considerable advantages. That is particularly so when the company can separate a distinct part of the innovation process at arm’s length for outsiders to work on in order to take advantage of the diverse

wealth of their knowledge and ideas. But the basic question remains: What’s the better way to tap into that external resource, through collaborative communities or competitive markets? The answer in large part depends on how diverse knowledge should be managed so that it can best be applied to the sort of innovation problem at hand.

If the innovation problem involves cumulative knowledge, continually building on past advances, then collaborative communities have inherent advantages. Communities are naturally oriented toward solutions that depend on integrating skills, knowledge and technologies that transcend an individual contributor’s purview. In fact, successful communities necessarily have knowledge-sharing and dissemination mechanisms designed into them.<sup>4</sup> They also tend to converge on common norms with a culture of sharing and cooperation, broad agreement on a technology paradigm and common technical jargon to support productive collaboration.<sup>5</sup>

Consider the Semiconductor Research Corp., a Durham, North Carolina-based nonprofit consortium established in 1982 to accumulate fundamental knowledge in silicon technology and semiconductor manufacturing. With members from industry, government and academia, SRC collectively sets research priorities and coordinates the collaborative work stemming from those goals, with the resulting knowledge made available to everyone in the consortium. Operating in this collaborative, community-based fashion, SRC has become the driver of research coordination and knowledge dissemination for the U.S. chip industry, and the organization has been credited with discovering many of the basic building blocks of semiconductor research that have kept the U.S. industry competitive. Other examples of community development include the Linux operating system, the Mozilla Firefox Web browser, the Apache Web server and other open-source technology projects — as well as much older successes such as the creation of cotton spinning, the steam engine and the airplane.<sup>6</sup> These disparate examples illustrate how participants can learn from and build upon the discoveries of others by “standing on the shoulders of giants” — in which the “giant” is collective knowledge. In such innovation initiatives, the community participants work with technologies or components that are closely related, thereby creating a foundation for subsequent efforts.

**MARKETS VERSUS COMMUNITIES**

The dynamics of markets and communities are inherently different. Markets, for instance, tend to be governed by arm’s-length, contractually oriented relationships, whereas communities typically consist of more informal interactions.

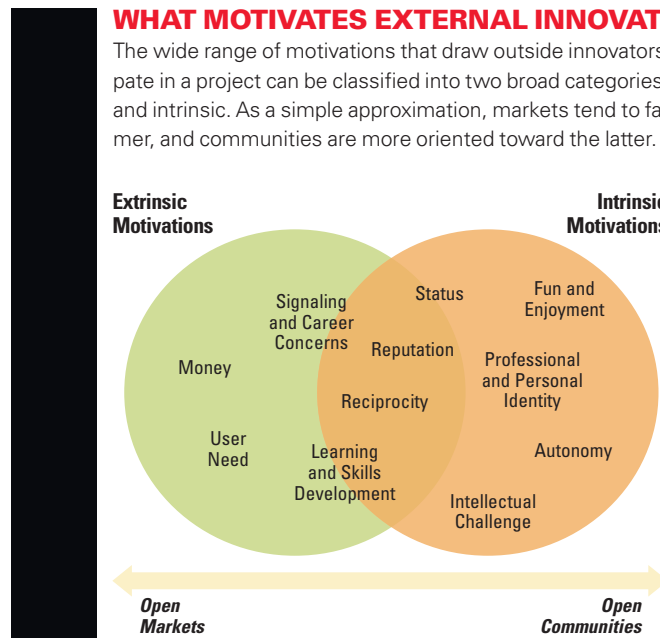
| COMPETITIVE MARKETS  | COLLABORATIVE COMMUNITIES  |
|--|--|
| <ul style="list-style-type: none"> <li>■ External innovators supply variants of mix-and-match, substitutable components.</li> <li>■ Governance is formal with orientation toward arm’s-length, rule-based, contractually oriented and market relationships.</li> <li>■ External innovators primarily have competitive relationships among one another.</li> <li>■ Profit motive is central to driving distributed innovation.</li> <li>■ Value capture by the platform owner is possible through direct contracting and licensing with external innovators.</li> </ul> | <ul style="list-style-type: none"> <li>■ Possible contributions of external innovators range from mix-and-match offerings to coproduction.</li> <li>■ Governance is informal with orientation toward highly socially embedded, norm-based interactions.</li> <li>■ External innovators primarily have cooperative relationships among one another — with a substantial amount of technology sharing and deliberate spillovers.</li> <li>■ A range of extrinsic and intrinsic motivations may drive external innovators’ activities.</li> <li>■ Value capture by the platform owner might occur only through enhanced demand for the platform that is driven by the external innovation.</li> </ul> |

If, however, the innovation problem is best solved by broad experimentation across a set of technical approaches or customer groups, then competitive markets have natural advantages.<sup>7</sup> In a mature collaborative community, members tend to make assumptions about what work has — and has not — been “done” (as exemplified by Wikipedia’s ongoing issues, for instance). But that’s much less the case with competitive markets, which tend to encourage experimentation, foster diversity and spur regular “creative destruction.”<sup>8</sup> Because markets foster competition, pitting participants against one another, innovators will take actions to maintain their proprietary interests as they engage in their own work. When their efforts are successful, the benefits will accrue to them as individuals. Thus, participants have natural incentives to differentiate, to search for novel solutions and to protect rather than share their knowledge — and this helps maintain heterogeneity in the pool of people working on a problem. (But this is not to suggest that communities have a limited capacity for creativity. We simply wish to emphasize that the incentive structure and institutional context of competitive markets encourages different approaches and points of view.)

Take, for example, InnoCentive.com, a so-called broadcast search Web site through which “seekers” (companies) post scientific or technical problems for “solvers” (about 150,000 scientists and other professionals from a range of disciplines and countries) to tackle. When posting a problem, a seeker stipulates a time frame for solving it and a cash prize for the winning solution. Solvers who are interested in working on the problem then do so in isolation from both other solvers and from the seeker. By the end of 2008, some 80 companies had posted more than 700 problems in biology, chemistry, physics, math, engineering, computer science, business and more; of those, about one-third were solved. Three points are worth noting here. First, a seeker typically comes to InnoCentive because it has not been able to solve a problem on its own. Second, InnoCentive works carefully with the seeker to define the problem such that a diverse set of solvers can tackle it and so that a solution *can* be identified. And finally, many winning solutions come from solvers in fields not ostensibly connected to the problem. For instance, the winning

## WHAT MOTIVATES EXTERNAL INNOVATORS?

The wide range of motivations that draw outside innovators to participate in a project can be classified into two broad categories: extrinsic and intrinsic. As a simple approximation, markets tend to favor the former, and communities are more oriented toward the latter.



solution for how to separate oil and water once they had frozen together into a viscous mass came from a scientist whose primary field was nanotechnology.<sup>9</sup>

Ultimately, the nature of the innovation (that is, the definition of the problem) and the approaches to realizing (solving) it are interrelated. Knowledge of InnoCentive’s pool of solvers enables the Web site to shape the different challenges to take advantage of the available diversity. In comparison, SRC rightly realized that its challenge was beyond the capability of any one company, university or government agency because it was seeking fundamental knowledge that would need to be aggregated by collaborative efforts. Similarly, open-source developers start projects knowing that they can integrate the knowledge and pre-existing technical solutions of a wide range of community members.

## What’s the Motivation?

Executives also need to consider why external innovators would be drawn to participate in the innovation process in the first place. Past research has shown that the motivations of outsiders who engage in open innovation can be surprisingly heterogeneous, but the wide range can be classified into two categories: extrinsic and intrinsic. As a simple approximation, competitive markets tend to favor the former, and collaborative communities are more oriented toward the latter (see “What Motivates External Innovators?”).

One of the simplest forms of extrinsic motivation is financial — a direct return on investment or money generated from sales. Third-party companies that develop software for the Nintendo Wii platform, for example, are clearly driven by the potential profits of their efforts. But motivation can also come from a less direct or obvious means. People might want to acquire certain skills by participating in the innovation process, or they could desire to advance a technology because they themselves use it.<sup>10</sup> In the medical device industry, for example, established companies like Medtronic, Stryker and Boston Scientific rely on individual physicians (that is, users) for working prototypes of new products or for concrete suggestions for improvements to existing products and treatments. Moreover, the benefits of engaging in open innovation might be more long term. Participation in open innovation can help establish one's reputation, build relationships or signal one's talents to a wide group of innovators (and potential employers). SAP Aktiengesellschaft, the German software developer, taps into that set of motivations in its open network through which volunteers provide solutions to customer inquiries. The platform now boasts more than 1 million members, and a large fraction of the problem solvers are up-and-coming consultants from emerging markets who are keen to establish their reputations and generate goodwill among SAP customers. Thus, value is generated for the customers and the entrepreneurial consultants, as well as for the SAP software.

But people can also be strongly motivated by purely intrinsic considerations.<sup>11</sup> Sometimes, the simple enjoyment of the innovation task itself can be a powerful factor, particularly when what appears to be “work” is not perceived to be work at all. Indeed, as evidenced by the success of open-source software projects, Wiki contributions, “citizen journalism” services and other similar efforts, self-determined tasks that are inherently interesting or intellectually challenging can attract tremendous participation from outsiders, especially when the contributors feel that they are part of some larger cause. In fact, a calculation of the direct and indirect monetary returns of participation reveals that such external innovators will often work for free — or for a loss for their services. In addition to the work itself, another type of intrinsic motivation is the status

and identity that participants can gain through their interactions with others in collaborative efforts.

Given that diversity of motivations, a company needs to consider carefully when deciding between a competitive market and a collaborative community because the choice will affect the types of external innovators who participate<sup>12</sup> and the level of effort and investment they devote to the innovation process. Moreover, managers must implement the right organizational mechanisms to tap into the motivations of the desired participants; otherwise, their efforts could be counterproductive. Specifically, communities require mechanisms that facilitate and encourage knowledge exchange and interactions among members, which will then engender a culture of sharing (and learning), a sense of affiliation (as well as identity and status), a norm of reciprocity (and other types of norms regarding conduct, participation, work quality and effort) and perhaps even personal relationships among the participants.<sup>13</sup>

Markets, in contrast, require the implementation of formal and competitive mechanisms that will tend to discourage most of a community's essential qualities (for instance, knowledge sharing). In one sense, markets need to discourage those external innovators who are willing to work for free; profit-seeking individuals otherwise might be dissuaded from investing and participating.<sup>14</sup> (On the other hand, communities must establish mechanisms to prevent profit seekers from skimming communal knowledge to make a buck; otherwise, the community will unravel.) In addition, markets require mechanisms to ensure the direct flow of income to external innovators. Such mechanisms do not exist in collaborative communities, but they are essential in competitive markets and should not be taken for granted.

### What's the Business Model?

Whether a company's product is a computer operating system, a social network, a motorcycle, a kitchen appliance or even a board game, the decision to open it to external innovation means that the product will be transformed into a *platform*. And to generate revenues from that platform, executives need to think about the nature of the accompanying business model. Here, a basic question affecting the choice between markets and communities is “who sells to whom?” This issue is



The Google Inc. Android relies on a competitive market of innovation for its hardware and a collaborative community for its software.

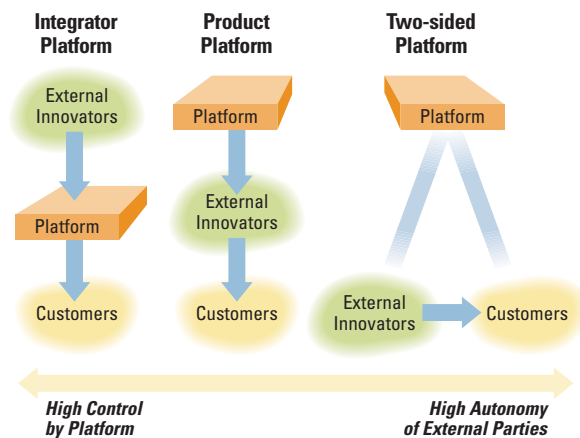
particularly important to external innovation as it determines who will typically control the direction of technology development, the income streams and the end-customer relationship (and, conversely, how much autonomy is enjoyed by the external innovators). With the who-sells-to-whom distinction in mind, platform business models can be divided into three categories: integrator, product and two-sided<sup>15</sup> (see “Three Platform Business Models”).

In the *integrator* platform model, the platform is wedged between external innovators and customers. In other words, the platform’s owner sells to customers, conferring upon the company a relatively high degree of control. For example, by inserting itself between iPhone software developers and consumers, Apple is able to monitor and directly control transactions with customers, taking 30% of revenues. The company is also in a position to shape development, for instance, by vetoing applications that it considers to be “off-brand” or otherwise undesirable. Moreover, Apple’s iTunes Store is itself a means of regulating and “owning” interactions with iPhone users. Given this position of considerable power, Apple could, in theory, go even further by assuming outright possession of externally developed innovations (that is, taking 100% control of the income stream) or by dictating technical specifications while directly integrating software into the iPhone, thus acting as a systems integrator.<sup>16</sup> (This was, in fact, Apple’s original strategy.)

Companies have less control with the *product* platform model, in which external innovators build “on top” of a foundation technology and then sell the resulting products to customers. The platform owner might directly contract with the external innovators and have some additional control over them through the technical design of the core technology, but it is the external innovators (and not the platform owner) who directly transact with the end-users. Thus, the external innovators typically have more control than they would in the integrator business model. They generally have, for instance, greater freedom to set prices and to retain the residual rights of control over their technical developments, thus providing them with more entrepreneurial autonomy. Consider Gore-Tex, a waterproof and breathable fabric developed by W.L. Gore & Associates Inc. More than 89 companies have licensed the core technology and brand to create

### THREE PLATFORM BUSINESS MODELS

When a company opens up its product to outside innovation, the product becomes a platform. To generate revenues from that platform, executives need to think about what type of business model makes the most sense. In the integrator platform model, the company incorporates outside innovations and sells the final products to customers. In the product platform model, external innovators build “on top” of the platform and sell the resulting products to customers. Finally, in the two-sided platform model, external innovators and customers are free to transact directly with one another as long as they also affiliate with the platform’s owner. For examples of each type of business model, see “Examples of Alternative Platform Business Models,” p. 74.



hundreds of products for a variety of applications, including outerwear, shoes and medical implants. Similar to Intel Corp.’s “Intel Inside” strategy for its microprocessors, Gore provides the core technology (and rules for its use), and the licensees innovate on that platform and sell their applications to customers.

In the *two-sided* (or multisided) platform model, external innovators and customers are free to transact directly with one another as long as they also affiliate with the platform owner. In such cases, the platform facilitates the transactions and interactions between the two parties, although the external innovators do not need to interact directly with the platform owner during the design, development and manufacturing of a new product. Nevertheless, the platform owner can still impose some degree of control over external innovators by, for instance, issuing to them various rules and regulations as a condition for their affiliation.<sup>17</sup> Users of Facebook.com, the social networking Web site, for example, interact directly with third-party applications (called “widgets”) that might reside on a separate technical infrastructure even though the interactions are enabled by the Facebook platform. Here, external innovators are free to determine the revenue

model that best supports their investments, whether it's advertising supported or fee based. Nonetheless, the widget developers must still abide by certain contractual and technical rules imposed by Facebook Inc., such as limiting access to user information.

All three types of platform business models can succeed with either a market or community (see "Examples of Alternative Platform Business Models"), but executives should remember that *both* of those approaches are inherently predisposed to platforms of minimal control. External innovators prefer autonomy, discretion in design and direct customer access so that their distributed knowledge, entrepreneurial energy and initiative can be applied in ways that they deem best. In a competitive market, profit-seeking innovators might be particularly wary of getting locked into a platform whose owner could later change the rules of the game

(for instance, by charging higher licensing fees or commissions).<sup>18</sup> In a collaborative community, members might be concerned that their work could be coopted or used in ways that they did not intend.

Collaborative communities have the clearest disadvantages in working with a high-control platform. Communities often reject the concentration of power and control per se as part of their norms. Furthermore, they frequently resist the very types of ad hoc formal contracting mechanisms that might otherwise serve to protect them from expropriation.<sup>19</sup> Instead, they tend to favor self-organization, informal relationships and transactions based on reciprocity and fairness. Of course, those attributes encourage information sharing and aggregation, but they are less effective for offering formal protections. The risk is that community members might be more reluctant to participate and share their efforts if they have to live in the shadow of a large, powerful, profit-seeking platform vendor.

But there are exceptions. For example, a company might be able to get away with imposing tight controls over external innovators (even a collaborative community of them) when its platform has a monopoly position in the market, leaving people with little choice but to comply. And past studies have shown that control and power can be successfully wielded over outside innovators *if* credible commitment mechanisms can be put into place to convince them that their efforts won't be exploited. A company could, for instance, open its platform by transferring key intellectual property into the public domain or by making the platform compatible with competing systems. Of course, measures that relinquish control could undermine a company's ability to wield control constructively in the first place. For that reason, a business might prefer to use other mechanisms (for example, relying on trust, a reputation for fairness, contractual commitments and a variety of organizational practices<sup>20</sup>) to assure external innovators that it will not abuse its power, all while retaining the discretion to exercise some control for constructively orchestrating the surrounding innovation ecosystem.

### The Next Generation

In developing an open strategy, executives will often have to reconcile tensions that emerge in trying to address each of the three basic issues: What's the

## EXAMPLES OF ALTERNATIVE PLATFORM BUSINESS MODELS

Markets and communities can both be effective with all three types of platform business models (integrator, product, and two- or multisided).

|                                  | INTEGRATOR PLATFORM   | PRODUCT PLATFORM  | TWO-SIDED (OR MULTISIDED) PLATFORM   |
|----------------------------------|---|---|--|
| <b>COMPETITIVE MARKETS</b>       | <ul style="list-style-type: none"> <li>■ Apple Inc. iPhone (application store)</li> <li>■ InnoCentive.com (scientific problem solving)</li> <li>■ Local Motors Inc. (car design)</li> <li>■ Ryz (shoes)</li> <li>■ TopCoder Inc. (software code)</li> </ul> | <ul style="list-style-type: none"> <li>■ Cloud computing initiatives (Amazon.com Inc. and Google)</li> <li>■ Gore-Tex</li> <li>■ Personal computer platforms and hardware "OEMs"</li> <li>■ Google Android (hardware development)</li> </ul>  | <ul style="list-style-type: none"> <li>■ SAP (third-party applications)</li> <li>■ Facebook Inc. (advertisers and widget developers)</li> <li>■ Most Web portals, yellow pages</li> <li>■ eBay Inc., Craigslist Inc.</li> <li>■ Big Idea Group (innovation hunts)</li> <li>■ Video games on consoles</li> </ul>    |
| <b>COLLABORATIVE COMMUNITIES</b> | <ul style="list-style-type: none"> <li>■ Threadless.com (T-shirts)</li> <li>■ Google Android (software development of operating system)</li> </ul>  | <ul style="list-style-type: none"> <li>■ Video game "modders" (such as Valve Corp.'s Half-Life platform)</li> <li>■ Linux and open-source development (such as TiVo Inc. and Motorola Inc.'s use of Linux)</li> <li>■ Medical device companies and physicians (user innovators)</li> <li>■ Wikipedia</li> </ul> | <ul style="list-style-type: none"> <li>■ Apple Inc. iPhone ("jail breakers")</li> <li>■ Big Idea Group (insight clubs)</li> <li>■ Communispace Corp. (product feedback and innovation communities)</li> <li>■ SAP (developer network)</li> <li>■ Statacorp Lp (statistical software module development)</li> </ul> |

innovation, what's the motivation of external innovators and what's the business model? One advanced solution is to apply a market model to certain external innovators and a community design to others. In such a "mixed" approach, the challenge is to determine how the principles of open innovation described earlier might apply to individual groups of external innovators in different ways and then to construct the appropriate business model and open strategy accordingly. Take, for example, Microsoft Corp., which has traditionally been hostile to the entire open-source model. But Microsoft now realizes that important technological innovations can be developed in conjunction with the open-source community. So the company has assigned formal executive responsibilities for open-source strategy and has established a staff to assist with outbound and inbound open-source software. A recent effort that illustrates the mixed approach is Microsoft's SharePoint, a server product that has traditional market-based competitors working on certain segments while an open-source community addresses other segments.

A company might also choose to implement a "nested" strategy, in which aspects of markets and communities are combined to achieve certain trade-offs. Consider TopCoder.com, a Web site that hosts ongoing competitions to connect talented programmers with companies that need software modules developed. On the one hand, TopCoder's network of more than 180,000 developers competes fiercely to win the prize money associated with particular software modules. But after a competition is over, members collaborate actively in teaching one another the ins and outs of various successful approaches that can be used to solve tough programming problems. Given the inherent conflicts that can arise between markets and communities, mixed and nested approaches typically come with significant costs and considerable risks, and they should be deployed only with much caution and the appropriate attention to governing mechanisms.

A crucial thing to remember is that a company's innovation strategy does not have to be cast in stone. That is, managers can evolve the strategy in ways that make the most sense for their particular business. Consider, again, the dramatic success of the iPhone. At its launch, the iPhone had just a few software applications that were either designed by Apple or by a

small, select group of trusted partners. Company executives claimed at that time that they had no plans to allow others to create new features and applications. Soon, however, outside innovators had self-organized on the Internet to share tips on how to hack into the iPhone in order to create all of the "missing" applications. In a matter of just a few months, this community had written more than 100 applications that were not originally anticipated by Apple. Execs of the company wisely decided not to squash that external (and unauthorized) innovation but instead to evolve it by implementing a formal "third-party development" program. In addition to establishing the tools and interfaces that the outside innovators should use as well as facilitating the technology, Apple defined a set of licensing terms and a revenue-sharing plan. Moreover, the company augmented its iTunes Store to act as the exclusive distribution channel. The original community of external innovators was thus transformed into a highly centralized marketplace — under Apple's control.

The key lesson is that a company should develop a strategy that, at a given time, matches the nature of its innovation, the motivations of the innovators and the business model of its platform. A late entrant in a market might, for example, choose to establish a collaborative community of external innovators simply because most capable profit-seeking individuals have already been locked into an incumbent platform. Or managers at a company in a mature market might decide at some point to collaborate with "user innovators" in order to push further the technical frontier of their platform. In other words, a company needs to tailor its particular approach to the context of its specific business. "Opening up" the innovation process is necessarily about carefully designing a set of mechanisms to govern, shape, direct and even constrain external innovators; it is not about blindly giving up control and hoping for the best.

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**The multibillion-dollar video game industry would not exist without a thriving market of third-party businesses to write game software for particular hardware platforms.**



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**14.** Apple, for example, has been under significant pressure to limit the number of "free" or low-priced applications at the iTunes Store because many of the professional application developers are finding that they cannot economically compete with similar free applications.

**15.** Hagiu discusses the two-sided and integrator cases, referring to the latter as "merchants"; Rochet and Tirole provide a formal definition of two-sidedness. See A. Hagiu, "Merchant or Two-Sided Platform?," *Review of Network Economics* 6, no. 2 (June 2007): 115-133; and J.C. Rochet and J. Tirole, "Two-Sided Markets: A Progress Report," *RAND Journal of Economics* 37, no. 3 (autumn 2006): 645-667.

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**17.** For a detailed discussion of the "regulatory" role played by multisided platforms, see K. Boudreau and A. Hagiu, "Platform Rules: Regulating the Ecosystem Around a Multi-Sided Platform," chap. 3 in "Platforms, Markets and Innovation," ed. A. Gawer (Northampton, Massachusetts: Edward Elgar, in press).

**18.** See J. Farrell and M.L. Katz, "Innovation, Rent Extraction and Integration in Systems Markets," *Journal of Industrial Economics* 48, no. 4 (December 2000): 413-432.

**19.** As a matter of open community norms, community licenses such as the Berkeley Software Distribution, the General Public License or Creative Commons license need to be applied broadly rather than as a matter of nuanced application of contracting instruments to attend to particular governance challenges.

**20.** See, for example, A. Gawer and R.M. Henderson, "Platform Owner Entry and Innovation in Complementary Markets: Evidence from Intel," *Journal of Economics & Management Strategy* 16 (spring 2007): 1-34; and T.R. Eisenmann, G. Parker and M.W. Van Alstyne, "Opening Platforms: How, When and Why?" working paper 09-030, Harvard Business School Entrepreneurial Management, Boston, Massachusetts, Aug. 31, 2008, <http://papers.ssrn.com>.

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