

# MANAGING OPEN INNOVATION

*In uncertain markets, new metrics can help companies to play poker as well as chess.*

Henry Chesbrough

**OVERVIEW:** *Industrial innovation is becoming more open, requiring changes in how firms manage innovation. External sources of knowledge become more prominent, while external channels to market also offer greater promise. This complicates the evaluation of early-stage technology projects, which often involve significant technical and market uncertainty. In such circumstances, companies need to “play poker” as well as chess. Measurement errors (false positives, false negatives) are likely to arise from judgments about the commercial potential of early-stage projects. Most companies’ policies consciously limit “false positives” in assessing a project’s commercial potential, but few companies take steps to manage the risk of “false negatives.” New metrics may help a firm focus more upon external sources of innovation to enhance its business model, and enable the firm to salvage value from false negatives that otherwise would be lost.*

Not long ago, internal research and development was viewed as a strategic asset, and even a barrier to competitive entry in many industries. Only large companies with significant resources and long-term research programs could compete. Research-based companies like DuPont, Merck, IBM, GE, and AT&T did the most research in their respective industries. And they earned most of the profits as well. Rivals who sought to unseat these firms had to ante up their own resources, and create their own labs, if they were to have any chance against these leaders.

Today, the former leading industrial enterprises are encountering remarkably strong competition from many

newer companies. These newcomers overtook the incumbent firms with little or no basic research of their own: Intel, Microsoft, Sun, Oracle, Cisco, Genentech, Amgen, Genzyme. These companies have been very innovative, but they achieved their innovative success with the research discoveries of others. And there is a legion of other, even newer companies waiting to supplant these firms, should the opportunity arise.

To make matters worse, some companies that made significant long-term investments in research found that some of the resulting output, however brilliant, wasn’t useful for them. They found ways to gracefully exit from further funding of these projects and moved on to more promising work. Then, to their amazement, some of those abandoned projects later turned into valuable companies. This was the experience of the Xerox Corporation, for example, with its Palo Alto Research Center. Numerous important computer hardware and software innovations were developed at PARC, but few of them made any money for Xerox and its shareholders.

What accounts for the apparent decline in the innovation capabilities of so many leading companies? We are witnessing a “paradigm shift” in how companies commercialize knowledge, from “Closed Innovation” to “Open Innovation.” Closed Innovation is a view that says *successful innovation requires control*. Companies must generate their own ideas and then develop, build, market, distribute, service, finance, and support them on their own. This paradigm counsels firms to be strongly self-reliant, because one cannot be sure of the quality, availability and capability of others’ ideas.

Increasingly, however, the Closed Innovation approach to innovation is no longer sustainable. A paradigm of Open Innovation is emerging in its place (1). The Open Innovation paradigm assumes that firms can and should use external as well as internal ideas, and internal and external paths to market, as they look to advance their technology. Open Innovation assumes that internal ideas can also be taken to market through external channels, outside a firm’s current businesses, to generate additional value.

Admitting external sources of technology into a company’s innovation process increases the number of possible sources of innovation. This greater complexity

---

*Henry Chesbrough teaches management of technology at the Haas School of Business at the University of California, Berkeley. Previously, he was a professor at Harvard Business School. He worked for many years in the computer disk drive industry, rising to vice president of marketing at a subsidiary of Quantum Corporation. He holds a Ph.D. from Berkeley, an M.B.A. from Stanford, and a B.A. from Yale. This is his third article in Research • Technology Management. It is adapted from his presentation to the Spring meeting of the Industrial Research Institute, May 2003, in Colorado Springs, Colorado. [chesbrou@haas.berkeley.edu](mailto:chesbrou@haas.berkeley.edu)*

places even greater burdens upon the ability to evaluate early-stage technologies.

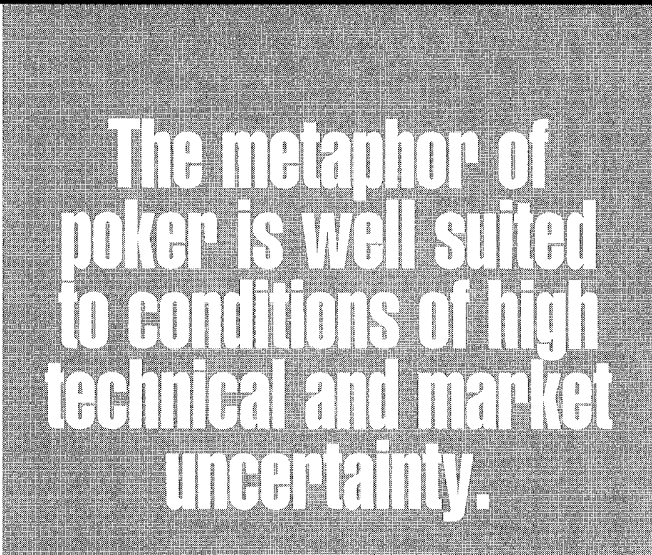
**The Problem of Technical and Market Uncertainty**

Successful commercialization of a new technology involves managing both technical and market uncertainty. The capability and performance of a fledgling technology are often poorly understood. This technical uncertainty is compounded by market uncertainty, when early-stage technology projects also address an uncertain market. How a technology might be used by customers, and what benefits it might provide to them, is far from clear. Measurement errors (both false positives and false negatives) are inevitable.

Evaluating the commercial potential of a new technology is less subject to measurement error when it addresses a current market with a known set of customers. Xerox had little apparent difficulty dealing with even high degrees of technical uncertainty, for example, when those projects directly addressed its copier and printer markets. The company managed to convert its entire technology base from a mechanical base in its early years, to an electro-mechanical base in its high-growth years, to a fully electronic and digital platform in the 1990s (2).

Where the innovation challenge frustrated Xerox was when the company had to apply its promising technologies *outside* of its current markets and customers. Here, the technical uncertainty that Xerox had to contend with was joined to a new market uncertainty: which customers and which uses of its technology would be most valuable? The personal computer industry had to be invented in order for these PARC technologies to become valuable.

Coping with market uncertainty greatly complicates the already difficult challenge of managing technical uncertainty, because resolving the technical uncertainty depends on which market the technology is intended to serve, and vice versa. One cannot anticipate the best path forward from the very beginning. Not only is this path unknown, it is *unknowable*. No amount of planning and research can reveal the facts, because they simply don't exist yet. Instead, a firm must experiment, adapt and adjust in response to early feedback. This is a fundamentally different process from the usual one of advancing the current business, more akin to a game of poker than of chess.



**Playing Poker: Managing False Negatives**

A large number of false negatives have emerged over the years, where projects that initially looked unpromising later turned out to be commercially valuable:

- When Intel first obtained its design win for the 8088 microprocessor for the IBM PC, it did not regard this as even ranking among the top 50 prospects for the chip (3).
- IBM almost abandoned a software project that today forms the centerpiece of its WebSphere Internet services strategy.
- The compound UK-92480 under development as a treatment for hypertension within Pfizer did not achieve sufficiently positive clinical results to warrant further development. Due to a rather unusual side effect, however, UK-92480 gave rise to one of Pfizer's most profitable compounds today—Viagra.
- Similarly, Thalidomide, which was driven from the market in the 1960s due to the large number of birth defects encountered by pregnant women taking the drug, has re-entered the market in the late 1990s as a treatment for myeloma, a fatal form of cancer in bone marrow.

How can firms manage these false negatives? By their very nature, false negatives are projects that seem unpromising inside a company due to the lack of fit with the company's business model. As a result, these projects receive no further support. This is as it should be; one cannot continue to support unpromising initiatives, or else nothing will get out into the market. How then, can

*Table 1.—Managing Innovation: Chess vs. Poker*

**CHESS**

- Must plan several moves ahead.
- Your resources are well defined.
- Your competitor's resources are well understood.
- No new information arrives during game.

**POKER**

- Must adapt and adjust as new information arrives.
- Your resources emerge over time.
- Your competitor's resources emerge over time.
- New information arrives regularly.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.

one determine whether or not an unpromising project truly lacks value?

In these situations, a company must develop a second process for managing innovation, a process for playing poker (Table 1). The analogy was made for me by Jim McGroddy, the former head of IBM's Watson Research Center:

*When you're targeting your technology to your current business, it's like a chess game. You know the pieces, you know what they can and cannot do. You know what your competition is going to do, and you know what your customer needs from you in order to win the game. You can think out many moves in advance, and in fact you have to, if you're going to win.*

*In a new market, you have to plan your technology entirely differently. You're not playing chess any more; now you're playing poker. You don't know all the information in advance. Instead, you have to decide whether to spend additional money to stay in the game to see the next card.*

The metaphor of poker is well suited to conditions of high technical and market uncertainty. Not all the information is known in these situations, yet companies often manage them as though they were just like situations in the main business, where they are playing chess. Xerox was actually very good at chess, at finding technologies to advance its copier and printer business. However, it was a poor poker player, unable to explore the potential options of computing technologies in new markets (1,2).

To play poker, companies need to meter their capital carefully and to stage their investments in projects upon the receipt of new information. Projects still have to have funding terminated. But now the company must observe what happens after that decision. How are the researchers responding to the decision to terminate further support? Have they moved onto the next project, or are they still committing time to the terminated one? If the latter, have they found any external customers for the project?

A process for playing poker is to expose the "failures" to outsiders, to gain their perspective on the potential of these projects. (After all, once you have decided to discontinue their funding, there is little at risk for you.) When IBM placed its XML Parser software on its external AlphaWorks website back in 1998, it had discontinued internal funding for the project. However, the number of people who downloaded this particular code from the website was ten times the usual number. To IBM's credit, it took note of this high interest level, and began to probe the technology more closely. It reconsidered the earlier decision, and today the XML Parser is a core element of IBM's WebSphere Internet services initiative (4).

A third approach is to out-license the rejected project, which allows another firm to utilize the ideas and see if they are valuable. This not only provides additional funds to the licensing firm, it can allow that licensor to watch and learn from the experience of the licensee.

## Companies will need to alter their usual metrics for managing innovation.

When Intel originally invented the microprocessor, it did so under a contract from Busicom in Japan. As Intel saw what Busicom was doing, it realized that the microprocessor had great potential, and bought back the license.

Forming an external spin-off venture is yet another approach that allows the technology to develop further outside the originating firm. If the venture becomes profitable, the equity owned by the originating firm may become valuable. Moreover, having an external venture spin-off enables new learning to occur. When Lucent's New Ventures Group formed Lucent Digital Video as a separate company, it judged that digital video was far from being ready for the market. Once LDV got going, though, it became clear that the market was closer—and bigger—than Lucent originally judged. Lucent ended up reacquiring the rest of the venture, and hastened its own entry into digital video (5).

### Metrics for Managing Open Innovation

If the context of industrial innovation is shifting from Closed to Open, and if there is latent value in managing false negatives, companies will need to alter their usual metrics for managing innovation. These metrics will help companies play poker as well as chess (Table 2).

This was the subject of a workshop held at the Industrial Research Institute's Spring Meeting in May, 2003. In response to the challenges of managing innovation within an open system, and to monitor the opportunities offered by that system, a number of metrics were identified across multiple small groups within the workshop. These metrics included:

Table 2.—Different Processes, Different Metrics

CHESS	POKER
• Fit with roadmap of future projects	• Create options for future businesses
• Fit with current business model	• Leverage or extend business model
• NPV > 0	• Option value > 0
• Minimize false positives	• Manage false negatives

### Implications for R&D Leaders

- Redefine the role of research.
- Redefine the metrics for innovation performance.
- Startups can be sources of learning for your corporate innovation processes.
- Business models are too important to be left to the “suits.”

1. What percent of your sales of products and services last year came from externally licensed technologies? Is this percent increasing or decreasing from 2–3 years ago?
2. What percent of your net income last year came from technology licensed out to other companies? Is this percent increasing or decreasing from 2–3 years ago?
3. How long does it take for patented ideas inside the company to be put into use via a company’s own products or services (i.e., taken to market via a new product or service)? Has this time interval changed in the past five years? In what direction?
4. What percent of your internal ideas are offered for external license? How much time elapsed between the patenting of ideas and their external licensing?
5. How many projects were terminated in the past year? How many were reviewed at a later date? How many subsequently were offered to external parties for further development?
6. Of the projects tracked in No. 5, are any developing faster technically and/or growing faster in the market than expected? Are any projects able to raise external capital for further development? Have they signed any major customers?

### Focusing Attention

Metrics 1 and 2 focus management attention on the *outputs* of the Open Innovation process, whether that be growth in product sales or growth in licensing activity. Workshop participants felt that the senior leadership within their own companies needed their R&D organization’s metrics to connect directly to corporate sales and profit measures.

Metrics 3 and 4 focused on a second “currency” for R&D; namely, time-to-market for new products and

services, either internally as in No. 3 or externally as in No. 4. Shortening the time required for products and services to get to market was viewed as important, as this increased the rate of learning from R&D for the company and increased the productivity and effectiveness of R&D as well.

Participants felt that metrics for managing “false negatives” were at an early stage of understanding. No participants reported any internal tracking system that actively monitored the occurrence of false negatives. The typical pattern was that, once a decision was taken to terminate funding support for a given project, no further tracking of that project was done.

Initial metrics to manage false-negative projects in No. 5, therefore, should focus on recording their incidence and build a tracking system to follow them after the initial decision to terminate further support. Metrics like No. 6 should evaluate any further progress of potentially false-negative projects against the expectations of the company that terminated funding for the project. Most projects will likely cease at this point.

When a project continues on, and makes further progress that significantly exceeds expectations, a re-assessment of its technical and/or market potential is warranted. The ability of a project to raise external capital or sign a major customer should send a strong signal that a false negative may exist. A poker-playing company may reverse itself at this stage and find a way to get back into the game. ☉

### References

1. Chesbrough, Henry. *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Harvard Business School Press: Boston, MA, 2003.
2. Chesbrough, Henry. “Graceful Exits and Foregone Opportunities: Xerox’s Management of Its Technology Spinoff Organizations.” *Business History Review*, vol. 76 (4) Winter, 2002, pp. 803–838.
3. Moore, Gordon. “Some Personal Perspectives on Research in the Semiconductor Industry.” In Rosenbloom, Richard and Spencer, William. *Engines of Innovation: Industrial Research at the End of an Era*. Harvard Business School Press: Boston, MA, 1996.
4. Chesbrough, Henry. “AlphaWorks: IBM’s Technology Talent Agents.” Harvard Business School case #9-601-001, 2000.
5. Chesbrough, Henry, and Socolof, Stephen. “Creating New Ventures from Bell Labs Technologies.” *Research • Technology Management*, March–April 2000, pp. 13–17; “Sustaining Venture Creation from Industrial Laboratories.” *Research • Technology Management*, July–August 2003, pp. 16–19.

## Subscribers Read RTM OnLine . . .

. . . as soon as the issue is printed, at <http://www.iriinc.org/webiri/rtm.cfm>. Full text, electronic version is searchable within text and across other journals.