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immature technology in the earlier phase, now becomes a millstone around a company's neck. Companies must open themselves horizontally by participating in the intermediate markets within the architecture. This may involve externally buying some parts that save money, reduce development time, or provide desired features to the system. It may involve offering components externally to companies that compete at the systems level.

Crafting an Architecture for the Business

Crafting connections between technologies inside a system is necessary to manage the tremendous complexity of modern-day products and services. As challenging as that is, it is only a portion of the task of the innovating firm. It is at least as important to identify how the firm is going to create and capture value from its innovation activities. In chapter 4, we will explore the business model as a construct that creates an architecture for the business through a blend of internal and external activities. As we will see, the activities of external firms can help create significant value for a firm and its customers, while the firm's own activities are central to retaining a portion of that value for itself.

The Business Model

Connecting Internal and External Innovation

Not everything we start ends up fitting with our businesses later on. Many of the ideas we work on here involve a paradigm shift in order to deliver value. So sometimes we must work particularly hard to find the "architecture of the revenues" . . . Here at Xerox, there has been a growing appreciation for the struggle to create a value proposition for our research output, and for the fact that this struggle is as valuable as inventing the technology itself.

-John Seely Brown

I CHAPTER 3, I argued that Open Innovation companies needed to combine internal research with external ideas and then needed to deploy those ideas both within their own business and also through other companies' businesses. The key for these firms is to figure out what necessary missing pieces should be internally supplied and how to integrate both internal and external pieces together into systems and architectures.

The business model is a useful framework to link these technical decisions to economic outcomes. Although the term *business model* is usually applied in the context of entrepreneurial firms, it also has value in understanding how companies of all sizes can convert technological potential into economic value. Firms can create and capture value from their new technology in three basic ways: through incorporating the to other firms, or through launching new ventures that exploit the technology in new business arenas.

One critical aspect of this process is that technology by itself has no single objective value. The economic value of a technology remains latent until it is commercialized in some way, and the same technology commercialized in two different ways will yield different returns. In some instances, an innovation can successfully employ a business model already familiar to the firm. Other times, another company will have a business model that can make use of the technology via licensing, and "hires" the technology that it will in turn commercialize.

In still other cases, though, a possible new technology may have no obvious business model. Here, technology managers must expand their perspectives to find an appropriate business model or "the architecture of the revenue," to capture value from that technology. If the managers fail to do so, these technologies will yield less value to the firm than they might have yielded otherwise. If others outside the firm uncover a better business model, they may realize more value than would the firm that originally discovered the technology. Put differently, a mediocre technology pursued within a great business model may be more valuable that a great technology in a mediocre business model.

The term business model is often used, but not often clearly defined. My colleague Richard Rosenbloom and I have developed a specific and useful working definition.¹

The functions of a business model are as follows:

- 1. To articulate the *value proposition*, that is, the value created for users by the offering based on the technology
- 2. To identify a *market segment*, that is, the users to whom the technology is useful and the purpose for which it will be used
- 3. To define the structure of the firm's *value chain*, which is required to create and distribute the offering, and to determine the complementary assets needed to support the firm's position in this chain
- 4. To specify the revenue generation mechanism(s) for the firm, and estimate the *cost structure* and *target margins* of producing the offering, given the value proposition and value chain structure chosen

- 5. To describe the position of the firm within the *value network* linking suppliers and customers, including identification of potential complementary firms and competitors
- 6. To formulate the *competitive strategy* by which the innovating firm will gain and hold advantage over rivals

Value Proposition

The process begins with articulating a value proposition latent in the new technology. This requires a preliminary definition of what the product offering will be and in what form a customer may use it. A useful way to think about a value proposition is from the intended customer's point of view: What customer problem are you solving? And how big a problem is that to the customer?

It is helpful to distinguish between small problems and large problems, through the metaphor of comparing vitamins with pain relievers. We all know that vitamins are good for us and that we should take them. Most of us, though, do not take vitamins on a regular basis, and whatever benefits vitamins provide do not seem to be greatly missed in the short term. People therefore pay relatively little for vitamins. In contrast, people know when they need a pain reliever. And they know that they need it now, not later. They can also tell quite readily whether the reliever is working. People will be willing to pay a great deal more for a pain reliever than they pay for a vitamin. In this context, the pain reliever provides a much stronger value proposition than does a vitamin because the need is felt more acutely, the benefit is greater and is perceived much more quickly.

In other cases, a seemingly modest technology advance can provide a powerful value proposition. When Japanese companies such as Canon and Ricoh began making small, desktop-sized copiers in 1976, Xerox sneered at their technology. And well it might, for the small, cheap machines could not make very many copies per minute. Moreover, the machines couldn't feed multiple sheets automatically, collate copies, or expand or reduce the size of the copy image. What Xerox missed, though, was the very different value proposition that these smaller machines offered: Instead of going to a copy center to make your copies, you could have one in your own personal office—a real convenience.²

The Business Model

Open Innovation

Market Segment

Of course, defining the value proposition depends on which customer you target, which is the second attribute of the business model definition. The business model must target a group of customers, or a market segment, to whom the proposition will be appealing and from whom resources will be received. A customer can value a technology according to its ability to reduce the cost of a solution to an existing problem or its ability to create new possibilities and solutions. What's more, different prospective customers may desire different latent attributes of the technology. Xerox's large corporate customers did not see much value in the first-generation copiers of Canon, Ricoh, and other Japanese entrants, although individuals and small businesses saw a great deal of value.

Firms need to define a set of customers so that they can decide what technological attributes to target in development. In any market of reasonable size, there will likely be many technical alternatives, target markets, and prospective competitors for developers to consider. Targeting a specific market with a clear value proposition informs choices of what must be done—and what can be omitted—in the technical domain. This targeting gives scientists and engineers signals for where they should focus their activities. With this focus, firms can resolve the many tradeoffs that arise in the course of development (e.g., cost versus performance, or weight versus power). Until you know who your customers are and what they value in your offering, you don't know what you must provide and what you can afford *not* to do. If a company fails to focus its project sufficiently, it risks burdening the resulting offering with too many features of dubious benefit: resulting in vitamins, not pain relievers.

Value Chain

Only now are we ready for the third attribute, the position of the firm within the value chain, which is the attribute that most people associate with the business model. Knowing the intended market, the intended value proposition, and the intended specification of the offering, you can construct the value chain that will deliver these elements. The value chain must achieve two goals: It must create value throughout the chain (delivering that value to the customer at the end of the chain), and it must allow the firm to claim some sufficient portion of value from the chain to justify its participation. The value chain coordinates the many activities needed to create and deliver the pain reliever to the intended customer.

Note that creating value is necessary, but not sufficient, for a firm to profit from its value chain. Once the firm has identified the value chain needed to deliver its offering, it must then address how it will appropriate some portion of that value for itself. As Michael Porter has powerfully demonstrated, the ability to claim value will depend on the balance of forces between the firm, its customers, its suppliers, and its competitors.³ Other research has shown that claiming value also depends on the availability of complementary goods and services, which increase the value of a company's own offerings. And within the firm, the presence of complementary assets such as manufacturing, distribution, and brand helps the firm keep some of the value it creates.⁴

Cost Structure and Target Margins

Now we are ready to define the *architecture of the revenues*—how a customer will pay, how much to charge, and how the value created will be apportioned between customers, the firm itself, and its suppliers. There are many options here, including outright sale, renting, charging by the transaction, advertising and subscription models, licensing, and even giving away the product and selling the after-sale support and services. A company also can employ more than one payment mechanism, as newspapers do when they charge readers for circulation and advertisers for ad placements.

Once you know the general specifications of the offering and the general contours of the value chain, you can then develop an understanding of its likely cost structure. This preliminary sense of price and cost yields the target margins. Target margins provide the justification for the real and financial assets required to realize the value proposition. The margins and assets together establish the threshold for financial scalability of the technology into a viable business: In order for the business to attract sufficient capital for growth, it must offer investors the credible prospect of an attractive return on the assets required to create and expand the model.

The Business Model

Open Innovation

Value Network

Creating and appropriating value also involves third parties outside the immediate value chain. Taken together, these outside parties form a value network.⁵ The value network created around a given business shapes the role that suppliers, customers, and third parties play in influencing the value captured from the commercialization of an innovation. Besides increasing the supply of complementary goods on the supply side, the value network can increase the network effects among consumers on the demand side. Building strong connections to a value network can leverage the value of a technology. Failure to construct such a value network can diminish a technology's potential value, particularly if that technology competes with a rival technology that does enjoy a strong value network.

Competitive Strategy

We are now ready for the final function of the business model: how the firm formulates its competitive strategy for its chosen market. Porter's early 1980s research in this area emphasized the need to compete on cost, on differentiation, or on a niche basis. More recent work has examined the underpinnings of what allows a company to sustain a profitable position in the market. Key factors for sustaining competitive success include the ability to gain differential access to key resources, the creation of internal processes that are valuable to customers and difficult for competitors to imitate, and the past experience and future momentum of the firm in the market.⁶

The Cognitive Implications of the Business Model

As the explanation just noted reveals, there is a lot to consider when constructing a business model. And it is this very complexity that leads to a very important, less-often-discussed aspect of a business model: its cognitive implications.

As noted in chapter 1, a company often must pursue innovation opportunities in an environment of high technical and market uncertainty. It is extremely difficult for managers to understand the myriad possible choices that they must make to connect new technologies to new markets. And the world of technical choices differs greatly from the world of economic and social choices. Because each domain is rich and complex in its own right, companies usually have specialized personnel to focus within each domain. But defining the business model requires managers to link the physical domain of technical inputs (capacity, speeds, functions, etc.) to an economic domain of outputs (value to consumers, price, warranties, support, distribution channels, etc.) in the face of great technical and market uncertainty. In truth, no one person fully understands the totality of the task the organization is performing. This is the most important role of a business model: to create a heuristic, a simplified cognitive map, from the technical domain of inputs to the social domain of outputs, as depicted in figure 4-1.

As figure 4-1 shows, the business model serves as an intermediate construct that links the technical and economic domains. While technical managers may not understand the benefit to consumers from increasing the capability and performance of their technology, they may be able to comprehend how their decisions will impact a defined value proposition to a chosen group of customers. And marketing managers will not know the preferences of their customers on many technical topics, but will have a good idea of how specific improvements in the value proposition can be converted into higher prices, greater market shares, and greater profits. In figure 4-1, the firm's realization of economic value from its technology depends on its choice of business model, rather than from some inherent characteristic of the technology itself.

FIGURE 4-1



The Business Model as a Cognitive Map Across Domains

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Constructing a business model requires managers to deal with significant complexity and ambiguity. We know from earlier research that managers cannot—and do not—exhaustively evaluate every alternative when they confront such situations. Instead, they apply cognitive filters to reduce this complexity to manageable levels.⁷ Managers include information that fits with the logic of their current business model and filter out information at variance with that model. Such selection is helpful and even necessary to make sense of the tremendous amount of information that comes in each day. But in the process of using these filters, biases creep into managers' decisions, precisely because they screen out information that conflicts with their current business model. This bias can lead to a cognitive trap, in which the firm misses a better business model because it conflicts with the firm's current model.

This process is closely related to another concept, the dominant logic of a firm.⁸ The dominant logic is the prevailing wisdom within the company about how the world works and how the firm competes in this world to make money. It is easily seen in the orientation materials that many firms give to new employees. This logic helps to reduce ambiguity and make sense of complex choices faced by firms, and helps new employees learn how the firm operates. As the term implies, the logic dominates alternative forms of logic that take a different view of the world. People within firms do not reevaluate their logical approach every time new information comes in. To the contrary, they search for ways to apply the dominant logic to interpret the new data. The shared assumptions behind the dominant logic will also help disseminate the meaning of the new information to others.

Although dominant logic is useful and beneficial in coordinating the actions of employees in a variety of situations, it comes at a cost. The choice of business model constrains other choices, removing certain possibilities from serious consideration. Over time, the business becomes more entrenched in its current model and is not able to recognize the information that may point the way to a different and perhaps better model. This is the potential trap.

For newly formed start-up companies, the six attributes above provide a perspective on the business model that must be forged at the launch of the enterprise. Start-ups must create an internal logic to make sense out of the chaos they experience. They must then strive to convey that logic throughout the firm, so that the firm can grow beyond a small number of people at a single location. For established companies, though, the business model does not emerge from a clean sheet of paper. Instead, the model that will be applied to a new opportunity will bear a strong resemblance to the established business model already in use. And the more successful the current business model has been over time, the stronger its influence over how to commercialize the new opportunity that arises. This means that the future commercial development of a firm's technology will depend on the firm's prior history and experience. And the more successful the firm has been with its business model, the more wedded to the model it will be as new opportunities arise. We will see this effect quite clearly in the experience of the Xerox Corporation.

The Xerox Model 914 Copier: A Technology Looking for a Business Model

The original Xerox copier, the Model 914, provides a great illustration of the value of a business model and how hard it can be for successful companies to identify a good one. The story started in the mid-1950s when Joe Wilson, then the president of the Haloid Corporation, met Chester Carlson, who had developed a fascinating new technology. Carlson had figured out how to use an electrostatic charge to fix a powdered toner onto a piece of paper, a technology he called *xerography*. From an original image, Carlson's technology could produce a copy that was crude, but seemed to promise greater clarity, without the messiness of earlier copying methods.

At that time, copies were made for business use either by "wet" photographic methods or by dry thermal processes. Each method yielded low-quality images that did not age well. Prevailing business models for each process involved charging for the equipment at a modest markup over cost, and charging separately for supplies and consumables, usually at a much higher markup over cost—a "razor-and-razor-blade" business model. Both copier technologies required special paper and supplies, creating an aftermarket revenue stream for vendors. Typical office machines sold for \$300. The average machine in use produced fifteen to twenty copies per day, and 90 percent of these machines were used for fewer than one hundred copies per month.

What would be the best economic use of the promising capabilities inherent in the technology of xerography? Wilson saw the potential for tremendous revenues from this new technology in office copying. As

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Carlson and Wilson pursued the technology, they developed a prototype machine that used xerography to make copies. In contrast to the prevailing technologies of the day, this technology produced dry copies of high quality without requiring thermal paper. However, Wilson estimated that the manufacturing cost of the machine would be about \$2,000. And he estimated that its variable costs per copy were roughly on a par with earlier methods.

This created a problem for commercialization of the technology. The manufacturing costs of the machine were much higher than prevailing copy technologies, while its supplies costs were about the same as these rival technologies. How could this new technology penetrate the market, given these economics? The "razor" was much, much more expensive, and the "blade" was no cheaper. How could customers be induced to pay the much greater up-front costs of the new, higher-quality technology?

Since they knew that they would need significant resources to overcome these barriers, Wilson and Haloid sought to find a strong marketing partner for the 914. They approached some of the leading companies of the day with their technology, offering to provide the technology in return for the partner's providing the manufacturing and marketing. They were rebuffed by Kodak, General Electric, and IBM. Before making its decision, IBM commissioned a careful and highly professional market analysis by Arthur D. Little and Co. (ADL), a respected consulting firm. Happily, Richard Rosenbloom later came into possession of a copy of the ADL report to IBM, written in 1959. From that report, we can reconstruct much of IBM's evaluation of the 914.

Arthur D. Little could not conceive a successful business model for the xerographic technology, in part because ADL could not identify a salient value proposition: Although xerographic technology was good at many things, it was not excellent at any particular thing. And "better quality at much higher cost" didn't seem to be a winning value proposition. As they reported: "[Because] the Model 914 . . . has considerable versatility, it has been extremely difficult to identify particular applications for which it is unusually well suited in comparison with other available equipment. . . . [P]erhaps the very lack of a specific purpose or purposes is the Model 914's greatest single weakness."⁹

Arthur D. Little analysts essentially assumed the 914 would be offered within the razor-and-razor-blade business model, the dominant logic then extant in the office copy machine industry. This model charged customers the full price of the initial equipment and charged them again for supplies as needed. The analysts doubted that customers would invest thousands of dollars to acquire a copier (which was only used to make a few hundred copies a month in those days): "Although it may be admirably suited for a few specialized copying applications, the Model 914 has no future in the office-copying-equipment market."¹⁰ Although this conclusion may seem quite myopic today, recall that Kodak and GE independently had come to a similar conclusion. None of these three leading companies saw much economic value in xerography.

Wilson sensed that they were wrong. On September 26, 1959, Haloid brought the 914 to market by itself, surmounting the obstacles of its high equipment cost by using a different business model. Instead of selling the equipment, Haloid offered customers a *lease*. A customer needed only to pay \$95 per month to lease the machine, promising to pay four cents per copy beyond the first two thousand copies they made with the machine each month. Haloid (soon to be renamed Xerox) would provide all the required service and support, and the lease could be canceled on only fifteen days' notice.

This leasing proposal surmounted the razor-and-razor-blade problem and provided an attractive value proposition for customers. The new business model imposed most of the risk on the tiny Haloid Corporation: Customers were only committed to the monthly lease payment and paid no more unless the quality and convenience of the 914 led them to make more than two thousand copies per month.¹¹ Only if the 914 were to lead to greatly increased volumes of copying would this business model pay off for Haloid. The model essentially acknowledged that the ADL analysis was right, but was incomplete. Wilson bet that there was greater potential value in xerography than ADL had judged, but that a different business model would be required to unlock that value.

It proved to be a smart bet. Once the 914 was installed on customers' premises, the appeal of the machine was intense; users averaged two thousand copies per *day* (not per month), because of the high image quality and the convenience (no more smudged fingerprints from the wet copying processes, and no more yellowed, curled-up thermal paper). This tremendous surge in usage meant that most machines were generating incremental, per-copy revenues to Haloid by the second day of the monthly lease. This business model generated revenues far beyond even Wilson's most optimistic expectations, powering compound revenue growth at an astonishing 41 percent rate for a dozen years. As a

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result, the little \$30 million Haloid Corporation turned into a global enterprise (renamed Xerox) with \$2.5 billion in revenues by 1972. Thus, the same technology that IBM, ADL, Kodak, and GE had rejected as a niche opportunity created a multibillion-dollar enterprise—through the use of a different business model.

The Cognitive Effects of Xerox's Business Model

This enormous success had lasting effects on Xerox. The huge success of the 914's business model—which generated more revenues when more copies were made—established the dominant logic for Xerox's later copier business. Xerox's business model motivated the company to develop ever-faster machines that could handle very high copy volumes, with maximum machine uptime and availability. This resulted in a strong cognitive bias within Xerox, because the model discouraged development of low-speed copiers. As a later Xerox CEO observed: "[O]ur profits came from how many copies were made on those machines. If a copier was slow in generating copies, that was money plucked out of our pocket."¹²

Meanwhile, Xerox's monopoly of plain-paper copying technology ended abruptly. An antitrust action brought by the Federal Trade Commission forced the company to accept a consent decree requiring it to license its patents on a compulsory basis and to offer its machines for sale as well as on lease. Kodak and IBM entered the high end of the market, with their own high-volume, high-speed copiers, using business models very similar to Xerox's own. More challenging to Xerox, though, was the entry of a host of Japanese manufacturers at the low end of the market. They employed different pricing strategies, product configurations, and distribution channels to target a different market segment; in other words, they entered with a different business model.

Xerox's business model as of the early 1980s is summarized in table 4-1 according to the business model attributes just described. It targeted its products and sales efforts to major corporate customers and government organizations. Its value proposition was "high quality copies in high volume, at a low monthly lease rate." Xerox organized its value chain to deliver completely configured copier systems, sold through its own direct sales organization, and comprehensive maintenance services, provided by its own technicians. The company priced its products and services so that it made some money on its equipment, but made the bulk of its profits from sales of services and supplies (e.g., toner and paper).

This business model did not require partnerships with third-party organizations; indeed, Xerox chose to provide the many elements of its business model itself. Xerox conducted its own research, as we saw in chapter 1. It performed all the required product development activities to launch and support new products. Xerox manufactured its products internally. It distributed all of its products through its own channels of distribution. The company provided its own financing to customers, and its own service and support. Xerox even made its own paper, to provide the optimal feeding characteristics for its machines, though in this respect, Xerox had to be sure to operate with paper from other companies as well.

TABLE 4-1

Xerox's Business Model in Comparison with Japanese Low-End Copiers' Model

Xerox	Japanese Copiers
Corporate and government market	Individual and small business markets
High-quality copies at a low monthly lease rate	Low cost of machine, greater affordability of copiers
Developed entire copier system, including supplies; sold through a direct sales force	Internal machine and cartridge; outsourced distribution, service, support, and financing
Modest profit on equip- ment, high profit on supplies, or per "click"	Modest "box cost" for copier, higher margins on cartridges—a "razor and razor blade" model
First mover in dry-copy process; did not require or pursue partners	Recruit third-party office equipment dealers to expand to national coverage; user-serviceable cartridge
Competed on technology, product quality, product capability	Compete on lowest box cost, convenient dealer locations, machine quality/self-service
	Xerox Corporate and government market High-quality copies at a low monthly lease rate Developed entire copier system, including supplies; sold through a direct sales force Modest profit on equip- ment, high profit on supplies, or per "click" First mover in dry-copy process; did not require or pursue partners Competed on technology, product quality, product capability

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Meanwhile, the Japanese entrants identified an Achilles' heel in Xerox's model. Xerox's model performed well when applied to the largest corporations, which needed high volumes of high-quality copy output. It did not fit as well, though, with the needs of small businesses and individuals. These groups did not need such high volumes of copying, were much more sensitive to the price of the copier, and were willing to compromise on the quality of the image to save money.

The Japanese entrants attacked this segment of the copier market with a different business model (the right-hand column of table 4-1).¹³ They designed a product that could be serviced without a trained company technician. They accomplished this by making the most frequently failing parts of the copier into a replaceable cartridge. Doing so allowed the companies to reapply the earlier razor-and-razor-blade model, because the copier machines could be priced at a more modest gross margin, while the replacement cartridges could be priced with very high gross margins. They then created an indirect distribution channel of dealers and distributors to sell this equipment and to provide servicing and financing as required. An indirect distribution channel saved the Japanese companies the cost of creating a direct sales force. It also enabled them to build a nationwide distribution capability very rapidly and allowed potential customers the convenience of walking into a local storefront to try out the new machines before purchasing.

The Japanese entry proved to be a daunting challenge to Xerox. Xerox's engineers could design far more elaborate and impressive copiers, but responding to this challenge required them to abandon the dominant logic of the hugely successful company they had created. It meant that engineers who had previously excelled in moving paper faster through complex mechanical equipment now had to create much simpler products, at much lower costs. The sales department had to determine how to manage an indirect sales force alongside a direct sales force and spent countless hours arguing over whether and when a customer should be served through direct versus indirect channels. And marketing had to decide how to promote the Xerox brand at the low end of the market (which earned lower gross margins per machine) while still maintaining the high-end, high-margin sales that had catapulted Xerox to prominence. It took a decade for Xerox to cope with the threat of the Japanese entry into the home-office and small-business market. In 2001, under pressure across its copier businesses, Xerox abandoned this part of the market, deciding that it wasn't worth its effort and resources.

The effects of Xerox's business model and the dominant logic inherent within it would cast a second shadow as well, a shadow over the commercialization of new technologies in new business areas for the firm.¹⁴ In 1968, Peter McColough, who had led the sales and marketing effort of the 914, was appointed chief executive of Xerox. As the rapid rate of growth of copier revenues began to slow at the end of the 1960s, Mc-Colough knew that Xerox would need to expand its business into new areas to maintain its historic rate of growth. He set a new direction toward the architecture of information. Yet even as McColough articulated this vision for Xerox's future, its management of that future would be constrained by the logic of its successful business model from its past.

Commercializing PARC Technologies

McColough's first steps toward realizing this vision were to enter the computer business in 1969 through the billion-dollar acquisition of Scientific Data Systems (SDS). This was an astounding sum to pay for an acquisition in 1969, and it would prove later to be a disastrous move. As we saw in chapter 1, Xerox established the Palo Alto Research Center (PARC) in 1970 to lead the way technologically into the computer industry and to feed new technologies into the SDS unit. Sadly, SDS soon collapsed and was shut down in 1975.

Despite SDS's failure, the research community within PARC flourished during the 1970s, with generous budgets and few restraints on its freedom to explore new boundaries. The first commercial payoff from PARC technology emerged in 1977, as Xerox entered the electronic printing business with a high-speed laser printer. Xerox's high-speed copier business model worked beautifully with the new printer technology. Laser printing enabled Xerox to make copiers that copied even faster, with even higher image quality. These technologies created a new, large, and profitable business for Xerox. The company's business model was able to quickly convert these powerful new technologies into additional sales and enhanced gross margins.

The same year, Xerox took the first steps toward building a major line of business intended to serve the office of the future. An Office Products Division, newly established in Dallas, marketed a stand-alone electronic word processor in 1977, but took this product primarily to Xerox's current customers and served them through Xerox's current marketing channels. In 1979, Xerox offered the first "office system,"

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Xerox Star Workstation Business Model versus IBM PC Business

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which used Ethernet technology to link word processors and printers. In 1981, the Star workstation was introduced as the centerpiece of an integrated system for office automation. Xerox did not offer these technologies as individual pieces; rather, they were offered exclusively as an integrated system.¹⁵

The latter move set a pattern for the business model that Xerox used to evaluate PARC's innovations in computing. Xerox applied PARC technologies to create complete computing systems, which constituted a value chain of proprietary technologies, with no option to use thirdparty equipment or software. Xerox initially offered the Star workstation for purchase at \$16,995; the requisite network facilities and shared printer raised the total cost for a three-user system to more than \$100,000. These systems were then sold primarily to *Fortune* 1,000 companies through a direct sales force and supported by a field service organization.¹⁶ Xerox took this revolutionary technology to market via the business model that had worked so well for its copiers.

It is instructive to compare Xerox's business model with that employed by IBM when it first marketed a new, microprocessor-based personal computer (PC) (table 4-2). The target market was different for the two companies. Xerox restricted its Star office systems to its customer base of large corporations and government departments. Although IBM also sold its PCs to this market, it crafted a strategy to take its PCs well beyond these traditional customers to individuals and small businesses as well. It created a very successful Charlie Chaplin-esque advertising campaign to position these machines for the individual. IBM offered a version of its PC for \$2,995 and created a retail distribution channel of over two thousand outlets through Sears, ComputerLand, and Businessland to reach individuals and small businesses. As we now know, IBM also created a technical architecture that outsourced the microprocessor and operating-system portions of the value chain-to Intel and Microsoft, respectively. The decision would change the course of the computer industry, and not to IBM's long-term advantage.¹⁷ The point here, though, is that IBM did not constrain its entry into the PC industry by slavishly extending its own hugely successful business model in its mainframe business. By contrast, Xerox's commercialization of its PARC technologies never escaped the confines of its copier business model and associated business logic.

Although Xerox had some incredible technologies in its Star networked office systems, these superior computing technologies were no

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entrality - Annual -	Xerox Star	IBM PC
Identified Market Segment	Corporate and government market	Corporate, government, individual, and small business markets
Value Proposition	Leading edge performance; high-quality documents onscreen and in print; ability to share and send docu- ments; state-of-the-art	Personal computing made affordable, from the best- known name in the industry; ability to run third-party hardware and software; ability to buy from local retailer
Elements of Value Chain	Developed entire Star system, from basic chips through manufacturing, distribution, service, financing, and support	Internal design and manu- facture of PC systems; external sourcing for microprocessor, operating system, and third-party application software and hardware; direct and indirect distribution
Defined Cost and Profit Margins	Modest volumes, high unit gross profit margins	High volumes, moderate gross profit margins
Positioned in Value Network	In order to do anything, we must do everything	Recruit third-party dealers and hardware and software developers; outsource microprocessor and operating system; allow vendors to sell to "compati- bles" manufacturers
Formulated Competitive Strategy	Win on engineering, state- of-the-art functionality and performance	Win on leading market share, control of PC architecture; ability to enlist thousands of independent developers to extend capabilities of PC

match for the vastly superior business model of the IBM PC. For example, the Star had a wonderful word processor; beautiful, laser-quality output; and an electronic mail capability far better than those available on the IBM PC. But the IBM open systems architecture enabled third parties to develop hardware and software products that greatly enhanced the value of IBM's systems. For example, the Xerox Star never developed a capable spreadsheet package, whereas IBM's PC sales were boosted

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tremendously by Lotus 1-2-3. Similarly, the IBM PC could run Ashton-Tate's dBase program, but the Star had no such database offering.

What's more, the IBM PC's own hardware capabilities were often enhanced by the addition of third-party hardware. This additional hardware greatly assisted the PC in performing useful tasks and in running some third-party software. For example, companies like Hercules extended the graphics abilities of the PC, so that it could display Lotus 1-2-3 graphs. Intel and others, like AST and Quadram, marketed boards that expanded working memory. Plus Development, a company I was involved with from its beginnings, even created an add-on board with a built-in harddisk-drive that could easily increase the hard-disk storage on a PC. The Hayes modem, 3Com's Ethernet board, and IRMA's 3270 emulation board enabled the PC to connect to a variety of other computers. The Star system, on the other hand, could only connect to another Star system.

The differences in the value chain extended to distribution as well. The Star was only available through Xerox's sales force, whereas the IBM PC could be obtained at more than two thousand retail stores around the United States, as well as from IBM's own sales force. This retail distribution channel was also available to companies who wanted to sell "IBM-compatible" hardware and software products. There was, however, no easy way for third-party developers to reach Xerox's workstation customers.

As the PARC scientists watched this competition, they sensed that Xerox could do more with the technologies they were creating than to simply commercialize them with the Xerox Star offering. They questioned the pace at which Xerox was pursuing the commercialization of their inventions, or disagreed with the company's commitment to proprietary standards and "systems" marketing.

Some of the researchers eventually chose to leave Xerox to pursue commercial versions of their ideas. Instead of applying the Xerox systems model for computing, though, they chose to start new companies to exploit individual component technologies, in a different, more open architecture of computing. The departure of some of these employees created a situation in which, during the 1980s and 1990s, several new PARC technologies were being exploited simultaneously by Xerox within its integrated systems (usually in Xerox copiers and printers) and by independent entrepreneurial spin-off companies as stand-alone innovations.

This natural experiment afforded an unusual opportunity to compare commercialization practices in a setting where similar technologies were taken to market with sharply different business models. These models provide a comparison between a Closed Innovation paradigm (within Xerox) and an Open Innovation paradigm (the spin-off companies). Chapter 1 discussed some aspects of this co-evolution, with the example of SynOptics. Here, we will examine three other spin-offs and compare them explicitly with Xerox's business model.

3Com

3Com Corporation was the first of several highly successful spin-off companies based on technologies created at Xerox PARC. Robert Metcalfe was a young computer scientist at Xerox PARC when he invented the Ethernet local area network (LAN) technology.¹⁸ Used within PARC as early as 1975, this technology connected different parts of Xerox's computers and its copiers. Sensing the latent opportunity of Ethernet and impatient with Xerox's indecision about commercializing PARC's pioneering technologies, Metcalfe left PARC in January 1979. He formed 3Com Corporation ("computers, communication, compatibility") in June of that year.

While pursuing his vision for 3Com, Metcalfe had to find ways to support himself. He was soon engaged as a networking consultant to Digital Equipment Corporation (DEC) by Gordon Bell, then the leading technical figure at DEC. In 1980, with Bell's encouragement, Metcalfe successfully persuaded Xerox to grant him a nonexclusive license to the Ethernet technology, on which Xerox held four strong patents, for the sum of \$1,000.

Xerox's agreement to this proposal reflected a strategic choice rather than an oversight. Xerox was a large user of DEC computers and was eager to promote a technology to link Xerox printers and workstations to DEC minicomputers. DEC's help would be vital to accomplishing that.¹⁹ By licensing the Ethernet technology, Xerox could promote its Star systems products. Spurred by Metcalfe's efforts, Digital, Intel, and Xerox formed an alliance (DIX) to define a standard for Ethernet LAN communication and to promote its widespread adoption as an "open standard" by the computer industry.²⁰ By comparison, the IBM PC would not be announced until August 1981.

Armed with the DIX alliance, 3Com began to seek venture capital in October 1980 in order to begin developing hardware products. In the absence of established markets for either PCs or workstations, the busi-.ness plan for 3Com was necessarily vague. The search nonetheless paid

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off in February 1981, with first-round funding of \$1 million from VC investors who looked beyond the formal plan and were attracted by Metcalfe's vision and charisma, as well as his team's strong technical talents.

Metcalfe's venture was hardly an instant success. 3Com's first products connected DEC minicomputers to Ethernet LANs, using Intel chips. This was a market in which a company sold primarily to scientists and engineers who used Unix operating systems and who did much of their own programming. Distribution was accomplished through direct sales or value-added resellers. Ungermann-Bass was the leader in this market, with 3Com lagging behind, partly because of 3Com's much smaller direct sales force.

3Com realized much greater success in the IBM PC marketplace, selling its Ethernet adapter cards to be installed inside IBM-compatible PCs in corporate networks running Novell's operating system. The core value proposition became the ability to share files and laser printers (which in those days were very expensive) via an Ethernet network protocol that was compatible with the nascent IBM PC standard. Later, Ethernet would also enable companies to use e-mail within their LANs, and still later, Ethernet helped networks connect to the Internet.

Once the PC business began to boom and 3Com had shifted away from its initial focus on workstations, 3Com began to take off as well. 3Com stock was first sold to the public in 1984, and the company was still operating as an independent company in 2002, with a market value at the end of 2001 equal to one-third of Xerox's market value.

Did Xerox make a mistake by licensing Ethernet for a mere \$1,000? As this account shows, the latent economic potential of Ethernet was far from obvious at the time that Xerox decided to grant the license. In fact, Xerox was advancing its own strategy for its Star networked systems by agreeing to the license, in order to connect its equipment more effectively with DEC minicomputers.

Ethernet's value arose because the technology was commercialized in a new business model outside of Xerox workstations, DEC minicomputers, and the Unix operating system. The key ingredients of that model stood in sharp contrast to the business model of Xerox, which exploited unique proprietary technologies and sold them through a direct sales system to its leading office equipment customers (table 4-3). The latent value in the Ethernet technology did not materialize until the technology was targeted at a different market, which offered a different value proposition, utilized an open-technology platform populated by many third parties, and was sold through a new set of distribution channels. It seems reasonable to infer that a business model similar to 3Com's would not have evolved had the technology remained within Xerox. And Xerox could not have anticipated the value latent within the technology, unless it had conceived of a radically different way to take that technology to market.

TABLE 4-3

Summary Evaluation of Xerox and Selected Spin-Offs on Key Business Model Attributes

	Xerox	3Com	Adobe	Metaphor
Identified Market Segment	Corporate and government market	Corporate PC market	PC, MAC, and laser printer market	Knowledge workers in corporations
Value Proposition	High-quality copies at a low monthly lease rate	Establishes file and printer sharing between IBM PCs	Enables output of richer document types	Enables nontechnical queries of corporate databases
Elements of Value Chain	Developed entire copier system, including supplies, sold through a direct sales force	Focused on Ethernet protocol and add-on boards	Focused on supplying fonts to laser printer manufacturers and software firms	Developed and sold entire systems, from hardware to software to distribution
Defined Cost and Margins	Modest profit on equipment, high profit on supplies, or per "click"	High volume, low unit cost	Very high fixed cost, very low variable cost	High fixed costs, high margin, low unit volume
Positioned in Value Network	First mover in dry-copy process; did not require or pursue partners	Set the IEEE 802 standard; utilized PC distribution channel	Defined the PostScript standard for scalable fonts	No third parties or complemen- tors utilized
Formulated Competitive Strategy	Competed on technical product quality, product capability	Compete on standard, new channels	Strong network externalities, high switching costs	Compete on superior technology, usability

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Adobe

The spin-off of Adobe from Xerox followed a path similar to that taken by 3Com. Adobe's founders, Charles Geschke and John Warnock, left PARC in 1983 to commercialize a page-description language that became their first product, PostScript. PostScript allows printers to use digital fonts to reproduce a wide variety of characters generated from a PC.

The technology embodied in PostScript came from Interpress, a page-description software project developed while Warnock and Geschke were at Xerox PARC. (The project had drawn on earlier work they had done at Evans and Sutherland—this would later complicate Xerox's ability to control the ideas exclusively for itself.) Interpress was an internal, proprietary protocol used to print fonts generated from Xerox workstations on Xerox printers. This was an effective usage of the technology, because it linked tightly with Xerox's own business model and gave Xerox's products a competitive edge over other systems. But the potential value of the technology was limited to that of an important proprietary component in a larger Xerox system.

While at PARC, Warnock and Geschke had argued repeatedly with Robert Adams, then the head of Xerox's printing division, over whether to make Interpress into an open standard. Adams had strongly resisted, contending that he couldn't see how Xerox would make any money if the company "gave away" the font technology and weakened one of the most distinctive features of Xerox's own systems. After debating this inside Xerox for more than a year, they agreed to disagree, and Warnock and Geschke left PARC. As Geschke remembered it, "Certainly, within Xerox, none of this was going to happen. They wanted to have an industry standard, but they wanted to control everything at the same time."²¹

Arguably, Adams was at least partly right: It may well have been that Xerox's business model could never have benefited from making the technology an open standard. The business model that eventually realized significant economic value for Adobe differed substantially—both from Xerox's business model *and* from Warnock and Geschke's original intentions when they left. Indeed, Adobe's initial business model had contained many elements that were similar to the model then dominant at Xerox, but subsequent events persuaded the founders to change it. As Geschke recalled, Our original business plan was different. We were going to supply a turnkey systems solution including hardware, printers, software, etc. With this in hand, we were then going to build a turnkey publishing system. It turns out other people were trying to do this at the same time—there would have been a lot of competition if we had gone this route....

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In many respects Steve Jobs and Gordon Bell (my teacher in graduate school) were key ingredients in getting things going the way they did. Gordon said, "don't do the whole system," and Steve came to us and said, "we don't want your hardware, just sell us the software." We said, "No!" Later Steve came back and said, "OK, then just license it to me." That's how the business plan formed. It wasn't there in the beginning."²²

Selling and supporting a turnkey publishing system, complete with its own hardware and software, would have required a direct sales force and a field service network very much like the one Xerox managed in its copier business. In Geschke's view, such a system would have taken a long time to be developed and would have encountered a lot of competition. The font technology on its own might not have been that valuable in this configuration, since it was merely a component in a larger system—as Ethernet originally was inside of Xerox.

Instead, selling font libraries to original equipment manufacturers (OEMs) allowed the font technology to capture significant value by leveraging the efforts of computer OEMs like Apple and IBM and printer OEMs like Canon and Hewlett-Packard (HP) to create a new value network around desktop publishing. Adobe occupied a single important piece of this value chain, focusing on supplying the digital font libraries to laser printer and software manufacturers. As the manufacturers of PCs, printers, and software made faster and more powerful products, Adobe's position became increasingly valuable.

This very different approach to commercializing its technology also made Adobe a valuable company. Adobe Systems went on to become a public company in 1987 and continued to operate as an independent company in 2002. At the end of 2001, its market value was approximately equal to that of Xerox.

As with 3Com, the business model that eventually created significant economic value out of PostScript for Adobe differed greatly from

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the Xerox business model. Had Adobe persisted with its initial intentions, which had strong similarities to Xerox's model, that latent value might never have materialized.

Metaphor: A Xerox Spin-Off with a Xerox Business Model

3Com and Adobe created value from Xerox technologies only after they transformed their business models substantially from the one that Xerox usually employed. In contrast, the founders of Metaphor commercialized some promising user interface and database query concepts developed at Xerox PARC through a business model quite similar to the one at Xerox. Metaphor is thus an important contrasting case of how effective Xerox would have been if it had pursued its technologies further through its own business model.

Metaphor was created by David Liddle and Donald Massaro in 1982. It developed a series of technologies that allowed nontechnical users to create sophisticated queries of large databases. This enabled a new group of users to mine corporate data for a variety of new purposes, such as market research, pricing analyses, or analyzing trade-offs between possible new product features. Before, users would have to rely on corporate programmers to write report generators to extract data from a mainframe to get the data they needed. Because the programmers had many projects to perform for mainframe users, these requests typically landed in a large queue. Users were frustrated by the long lead time it took to get the requisite mainframe data they needed to do their jobs, and the technical programming required to generate the data was too arcane for them to access the data directly. Metaphor's technology let knowledge workers utilize a point-and-click graphical user interface to construct their own database queries directly to the corporate databank. The ability to extract useful corporate data directly was a potentially powerful value proposition. The technology would allow users to bypass the report-generation programming queue, would create faster access to data, and would empower the users with the ability to experiment with new combinations of data. It was one of the first true clientserver applications, employing the graphical user interface technology out of PARC to construct previously arcane and complex database queries in an intuitive fashion.

Metaphor's ambitious technical approach was accompanied by a business model that would have been familiar to Xerox. This included the development of a proprietary software product and the sale of that software bundled in with proprietary hardware as a turnkey solution for the customers. Metaphor intended to reach customers through its own direct sales force. As with Xerox's business model, Metaphor had a strong systems approach to commercializing its technology and a similar approach toward proprietary technology. Essentially, it built an internal value chain and eschewed an external value network. Liddle defended this approach as the only viable means at the time to implement the company's product strategy: "The problem wasn't one of a business model. When we started Metaphor, standards weren't available and the only choice was to do the entire system—that's the way every body did it then. It's not like today. What's more, this kind of product couldn't be sold at a retail level. The only way to sell it was with a knowledgeable sales force. . . . There was no packaged software at the time; we had to make our own equipment."²³

While Liddle's defense seems plausible, many aspects of Metaphor's circumstances appear to be similar to those facing Adobe. In 1983, when Warnock and Geschke left PARC (a year after Liddle and Massaro left), there were no standards for fonts or for generating computer characters mathematically on laser printers, either. Nor was there an obvious way to distribute such a product. And, as noted previously, Adobe's initial plans were to develop the entire system as well. Its value network had to be constructed *de novo*. Warnock and Geschke believe that, in hindsight, they would not have succeeded had they continued with their initial business plan. They were also aware of Metaphor's situation and felt that Metaphor employed this approach as a direct result of their experience in Xerox. In the words of John Warnock, "Metaphor took the Xerox business model with them."²⁴

This probably was a mistake. Despite its innovative technology and its potentially powerful value proposition, Metaphor was not one of the great commercial successes spun out of PARC. The company did manage to survive from 1982 until its sale to IBM in 1991, but its financial performance was meager, and it burned through a great deal of venture capital. Although the amount that IBM paid in 1991 was confidential, it did not reach the amount of capital cumulatively invested in the company. While there are undoubtedly many explanations for Metaphor's performance, its failure to explore alternatives to the Xerox business model stands as one plausible explanation—particularly in comparison with the value network that Adobe erected for its font technology.

Metaphor's lack of success does not seem to reflect the limitations of its technology; rather, its disappointing fate lay in its inability to find the model that would unlock the latent value embedded in that technology.

Implications of the Business Model for Open Innovation

Chapter 3 argued that firms that wish to employ an Open Innovation approach need an architecture to integrate internal and external technologies and to fill in the missing pieces. The analysis in this chapter shows that this architecture extends far beyond the traditional boundaries of technical management to encompass marketing, sales, support, and even finance. The customer segment chosen and the value proposition offered have important ramifications for the particular attributes of a technology being developed. The value chain that is constructed around the offering determines the value being created and the ability of the firm to claim a portion of that value for the firm. The resulting margin structure casts a long shadow over future initiatives, which are judged in part on whether they can continue or enhance these margins.

These issues imply that R&D managers must play an important role in the development and execution of the business model. As John Seely Brown noted in the introduction to this chapter, these managers must regard "the architecture of the revenues" as a vital element of capturing value from technology. These issues also imply that R&D managers cannot abdicate their part of the responsibility for crafting an effective business model. Just as the business model itself must span the technical and economic domains, so must technical and business managers themselves reach outside their areas of responsibility to work toward an effective model.

Technology managers need to include experiments in alternative business models. This is as important as the experiments they conduct inside their labs to evaluate technical risks. While it is certainly valid to consider making all the elements of the value chain to deliver a new innovation internally, it is equally valid to explore the possibilities of focusing on one or more pieces of that chain, and possibly utilizing external elements for the rest of the chain. This will also require technology managers to create processes to explore the social domain far more thoroughly, from customers to third parties, and the surrounding elements of the value network. It is vital for business managers to create mechanisms to expose technologies to external companies and to imbue technology developers with greater understanding and empathy for the social context in which their ideas will ultimately be applied.

Venture Capital:

A Benchmark for Business Model Innovation

This expanded role for technology managers might seem to be a hopelessly ambitious task. In fact, though, the search for a viable business model happens quite regularly at many early-stage companies in the commercialization process funded by venture capitalists. Venture capitalists necessarily invest to commercialize technology in environments of significant technical and market uncertainty. Their portfolio companies also deploy business models that implicitly map between the technical and social domains. Indeed, the very term business model is commonplace in that community.²⁵ Many venture capitalists even conceive of their investment decisions as investments in business models. Instead of operating under a dominant logic from a successful corporation's business model, though, venture capitalists give active consideration to a variety of possible models and work with their portfolio companies to adopt one that seems to fit well in a particular venture.

Once invested in a venture, venture capitalists do not necessarily stick with the initial business model of that venture. They force a change in the venture's business model when it becomes obvious that the assumed model is not working. They then provide strong incentives to motivate entrepreneurs to run the risks involved in developing a new business model. And venture capitalists provide careful governance and oversight to select a more promising model, rejecting models that no longer seem likely to be effective. In contrast, corporate governance tends to reinforce the corporate business model and inhibit a venture's ability to adapt to a different business model, even if it might work better for that particular situation.

Companies would do well to understand these VC processes far better than they typically do. Although corporate processes do an effective job of leveraging the corporation's current business model, these same processes impede the company's ability to envision and execute different business models. In some cases, it may well make sense for a company to partner with VC firms if the company wishes to commercialize technologies that do not seem to fit with its own business model.

The Business Model: A Double-Edged Sword

A business model is a double-edged sword for the corporation. It unlocks the potential value in a new innovation, but its very success can create a subtle, cognitive trap for the company later. An effective business model creates an internal logic of its own for how value is created and claimed. Every subsequent opportunity is evaluated in the context of this dominant logic: its target market, its market size, its margins, its value chain, its distribution channels, its use or neglect of third parties. Xerox's tremendously successful business model for its Model 914 copier later impeded its response to Japanese copier manufacturers. The strong internal logic of deep vertical integration, which worked so well for Xerox in the copier and printer business, cast a long shadow over the computer technologies developed at PARC. Xerox commercialized its PARC technologies through its copier and printer business model and lacked effective processes to create different business models for technologies that did not fit with that business model.

The separate spin-off examples reviewed here, with the exception of Metaphor, evolved their business model away from the proprietary value chains of Xerox toward models that made far greater use of external players and technical standards. Of course, the spin-off companies had to fill in many missing pieces to make their technologies work effectively as part of overall systems, but they did not strive for exclusive control over the entire system.

The success of 3Com and Adobe is ironic, because both spin-off companies had many fewer resources than did Xerox to commercialize their technologies. Yet they pursued business models that created much more value from those technologies than Xerox could. 3Com and Adobe created more value because they found a way to leverage these external resources. And each company's business model determined which internal elements were needed to connect with external technologies to capture a portion of that value, and what revenue mechanism would yield attractive returns for commercializing the technologies.

Metaphor serves as an illustrative failure in this context. The venture was built on a technology that seemed to embody an attractive value proposition. The leaders of this venture, however, failed to discover an appropriate business model capable of realizing the latent value in the technology. Like Xerox's managers, the leaders of Metaphor felt that in order to do anything, they had to do everything. They could not envision a business model for their offering that would harness the innovations of other firms as well as their own.

Crafting the Right Business Model for Promising Technologies

Xerox, in managing its own labs, sought to extend its current business model rather than create a different one to respond to latent market opportunities in the PARC technologies. But a company like Xerox will not realize the value of its innovation investments at places like PARC until it learns how to craft business models to exploit the potential of the technologies it creates.

Crafting an appropriate business model may seem a daunting task for corporate managers, and Xerox's otherwise capable management team never did "get it." Yet, although it is indeed challenging, we will explore in chapter 5 how a very large, very successful company—the IBM Corporation—has managed to transform its approach to innovation. IBM now innovates with a very different business model than the one it used to pursue. Although it used to rely entirely on its own internal R&D, IBM today makes extensive use of others' technologies in its business. Its evolution points the way forward for many companies seeking to come to terms with the issues and opportunities posed by Open Innovation.