

CORE CURRICULUM



Strategy

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READING + INTERACTIVE ILLUSTRATIONS

Technology Strategy

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This reading contains links to online interactive illustrations and video, denoted by the icons above. To access these exercises, you will need a broadband Internet connection. Verify that your browser meets the minimum technical requirements by visiting <http://hbsp.harvard.edu/list/tech-specs>.

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1 INTRODUCTION

“Humans are distinguished from other species by our abilities to work miracles. We call these miracles *technology*.”¹

— Peter Thiel, PayPal co-founder

New technology can change the world. Bone marrow transplantation technology enables people to survive cancers that would have been fatal only a few decades ago. *Innovations* in horizontal drilling have doubled oil production in the United States, earning the country the nickname Saudi America.² The invention of air conditioning in 1902 was critical to the population growth of regions such as Arizona and Florida.³ Internet-based videoconferencing applications such as Skype and FaceTime facilitate global collaboration and help dispersed families and friends maintain rich relationships.

Economists define *technology* as the way an organization produces outputs from inputs.⁴ The technology used by a bakery, for example, determines the maximum amount of bread of a specified quality that it can produce with a given set of inputs: labor, ingredients, and equipment. The word *technology* comes from the Greek word *tekhnē*, meaning “art” or “craft.”⁵ The bakery’s technology includes everything about the way it produces the bread, including the skills of its workers; how the workers are organized, trained, and motivated; how the bakery selects which equipment to use; where it places the machines; how it develops recipes; and so on. Technology does not have to be high-tech.

For businesses, selecting a technology is one element of choosing how to compete. An artisanal bakery and the maker of the mass-produced Wonder Bread use different technologies to suit their very different competitive positions. The artisanal bakery’s technology produces premium loaves with a limited shelf life at a relatively high cost. The makers of Wonder Bread use automated production to deliver pre-sliced loaves with added preservatives at a low per-unit cost.

Mass-produced bread is now common, but when it was introduced in the United States in 1921, Wonder Bread was the product of a new technology. Pre-sliced bread became so popular in the 1930s that it established a colloquial benchmark: “The greatest thing since sliced bread.”⁶

Because new technology can create a new way to compete—as the Wonder Bread example shows—it can represent an enormous opportunity and a potent threat. It can create competitive advantage, undermine existing competitive advantage, radically reshape an industry, and even threaten an industry’s very existence. Portable music players, for example, have been rendered nearly extinct by music apps on smartphones. New technology can have a profound impact on how firms compete.

That is why a firm’s competitive strategy must include a *technology strategy*: an integrated set of choices about how to use new technology to produce superior financial returns in the long run. Whether introducing a new technology or responding to one developed by someone else, *every* firm needs a technology strategy.

For the strategist, what matters is technology *change*. If all firms serving a market are using the same technology, technology ceases to have a strategic impact. But a new technology can redraw the playing field. Joseph A. Schumpeter was the first economist to emphasize this point. In *Capitalism, Socialism and Democracy*, published in 1942, he challenged economists' focus on firms using similar technologies:

It is still competition within a rigid pattern of invariant conditions, methods of production and forms of industrial organization in particular, that practically monopolizes attention. But in capitalist reality as distinguished from its textbook picture, it is not that kind of competition which counts but the competition from the new commodity, the new technology, the new source of supply, the new type of organization . . . competition which commands a decisive cost or quality advantage and which strikes not at the margins of the profits and the outputs of the existing firms but at their foundations and their very lives.⁷

Schumpeter argued that the essence of capitalism is the creation and destruction of businesses through revolutions in technology, which he famously called the process of **creative destruction**.⁸ This competition between old technologies and new ones is one of the most important drivers of economic growth and wealth creation. Economist William Baumol argues that the principal benefit of capitalism—which he calls “the free market innovation machine”—is speeding the spread of new technology.⁹

Every technology is born, grows, matures, and dies when a new technology supersedes it. Bulky cathode ray tube (CRT) display technology has been replaced by flat-screen liquid crystal displays (LCDs) and light-emitting diodes (LEDs). Typewriters have largely been superseded by computer printers and word-processing software.

Although technology change is constant, it is usually characterized by long periods of incremental change (evolution) punctuated by radical performance improvements (discontinuities, or “revolutions”).¹⁰ The strategic impact of a new technology is generally influenced by the size of the functional improvement it creates. Incremental technology change, which usually yields small improvements, may have little or no strategic impact. In the automobile industry, for example, cars become a little safer, more reliable, and more fuel-efficient each year, without substantially affecting the competitive positions of the major manufacturers. Technology discontinuities, on the other hand, can dramatically affect a firm's competitive position. Google's search technology, for example, represented a performance improvement large enough to enable the firm to displace incumbents and dominate the market. The widespread adoption of digital photography destroyed Kodak's film business and drove the company into bankruptcy.¹¹ But as we will see later, some firms can survive even major technology changes.

Although new technologies appear in every industry, technology strategy is most important where performance improvements due to new technology are larger or more frequent. Such industries include biotechnology, life sciences, optoelectronics, information and communications, electronics, flexible manufacturing, advanced materials, aerospace, weapons, and nuclear technology.¹² It is important to note that even apparently stable industries such as stockbroking, travel, and book retailing can be challenged by a new technology. In the late 1990s, many such businesses that thought they understood their competitive environments were shaken by new threats enabled by the Internet.

Firms that wish to create and exploit a new technology must also address a host of other questions: What process will help us innovate? How do we create an organization that is

capable of creating and exploiting new technologies? How should we manage the financing of a technology startup? Such issues are beyond the scope of this reading. For some answers, we refer you to the literature on the innovation process and to the Core Curriculum series on Entrepreneurship.¹³

In this reading, we focus on how to use new technology to compete successfully. We start by explaining why technology strategy is different from “conventional” competitive strategy. We then describe how innovators (technology leaders) can develop strategies to manage technology risks, identify market needs, commercialize new technologies, and compete successfully in the product market. Next, we explore the question of timing: When introducing a new technology to a market, is it better to be a leader or a follower? We describe strategies for two situations: where a new technology creates an entirely new offering for a new industry, and where a new technology affects an existing industry. We then discuss how to position a business to exploit the next new technology. A Supplemental Reading explains the importance of platform technologies and the strategies to succeed in platform competition.

2 ESSENTIAL READING

2.1 What’s Different About Technology Strategy?

A strategy of any sort is a series of choices. When developing a “conventional” competitive strategy—one based on a company’s use of existing technologies—strategists try to choose a competitive position that neutralizes the unattractive features of their industry and exploits its attractive features, and they attempt to develop a competitive advantage by doing something uniquely well for a particular market segment. (For more on the fundamental concept of competitive advantage, see *Core Reading: Competitive Advantage* [HBP No. 8105]). For example, in the book-retailing industry, some firms chose to establish small specialty bookstores in affluent and educated communities, while others set up large stores carrying a wide range of books in high-traffic locations. Recall that we define technology as the way a firm produces outputs from inputs. In both cases, the principal inputs are wholesale books, retail property, and retail staff, and the outputs are retail book sales. The firms in this example have chosen different competitive positions while using essentially the same technology.

However, competing using a new technology opens up a new set of choices—choices that may enable firms to create new value by targeting customer needs they could not meet before or to achieve lower costs than were previously possible, permitting a new range of competitive positions and new types of competitive advantage. Jeff Bezos, the founder of Amazon, realized that he could produce the same output—retail book sales—with a different set of inputs: wholesale books, a website, a warehouse, and a delivery service. This new book-retailing technology enabled Amazon to occupy a new competitive position as a purveyor of the widest range of books at the lowest prices, a position made possible by a competitive cost advantage due to the elimination of expensive retail store locations and retail staff. The new technology also gave Amazon a competitive advantage in helping customers find books by generating recommendations based on a buyer’s history and by providing a way for customers to both read and write reviews.

Technology strategy, then, differs from “conventional” competitive strategy because it requires strategists to understand the competitive implications of a new technology. The technology strategist needs to recognize the potential for new competitive positions and new

sources of competitive advantage, and to perceive the most profitable opportunities and the most potent threats. Because a new technology may allow a firm to target the customers of multiple industries, a technology strategy has to go beyond choosing a position in an industry to choosing an industry. Consequently, a technology strategy influences *corporate* strategy because it addresses the question: What business should we be in? Bezos, for example, considered music and software retailing and other industries before deciding to enter the book-retailing industry.¹⁴

Although we have focused so far on producing an existing offering in new ways, one of the most striking and important aspects of new technology is that it can create an entirely new offering. The genius of Facebook, for example, is that it allows advertisers to do something they couldn't do before: insert their messages into people's social communications.

Technologies that create an entirely new offering can lead to the formation of new industries. The advent of the smartphone, for example, led to the creation of a mobile apps industry. Genetic engineering technology led to the formation of the biotechnology industry. Instead of competing to capture a share of the value in an existing industry, a new technology can allow a firm to create and capture value in an entirely new industry.

When competing in a new industry, however, the strategic challenges multiply. Initially, positioning may be impossible because there may be no suppliers, no customers, and no clearly identified competitors. It may not be apparent who the potential entrants are or which products customers consider to be necessary complements and acceptable substitutes. In a new industry, technology strategy is highly dynamic; it's about moving quickly to create value, adapt to others, deal with uncertainty, influence the evolution of the industry, and shape the competitive landscape.

When strategizing using existing technologies, firms usually choose among well-understood customer segments and proven products and services. But technology strategy must deal with the risk and uncertainty that are inescapable aspects of new technology. There is always a risk that a new technology will not work. And there can be uncertainty about how to create value, or for whom. As Nathan Rosenberg observes, there has been "a remarkable inability to foresee the uses to which new technologies would soon be put." One of the problems, he suggests, is that "new technologies typically come into the world in a primitive condition." When the first electronic digital computer "contained no fewer than 18,000 vacuum tubes, was notoriously unreliable, measured more than 100 feet long, and filled a huge room," it was difficult to envisage a time when people would be carrying computers in their pockets. New technologies can also require long gestation periods and complementary inventions. As Rosenberg puts it, "The impact of invention A will often depend on invention B—which may not yet exist."¹⁵ The potential of laser technology for communications, for example, did not become apparent until optical fiber technology was developed. Technology strategists must attempt to forecast new technologies and choose how and when to respond to unpredictable developments.

The choice about how to **commercialize**—make money from—a new technology is another important aspect of technology strategy. A new technology is essentially an idea. In some cases, a firm can sell the idea for close to its true value—for example, by licensing the technology or by being acquired. For innovators, a technology strategy must specify whether they will attempt to sell their technology idea to another firm or enter a market with it themselves.

Many new technologies cannot reach their potential—or create value for customers—on their own. To do so, they require **complementary assets**. In 1979, Godfrey Hounsfield shared the Nobel Prize in Physiology or Medicine for developing the computer tomography (CT) scanner, yet his company, EMI, was overtaken in the market by General Electric (GE) and eventually exited the industry. GE had the complementary assets—the manufacturing,

technical service, and sales infrastructure—that were needed to get hospitals to adopt the new technology.¹⁶ For Sony, a lack of complementary assets (a wide range of e-books) explains why the Sony Reader was eclipsed by the Amazon Kindle, introduced a year later, even though the Kindle “was larger than the Reader, weighed more, and had an inferior screen . . . [and] was a very closed platform that was able to load content only from Amazon.”¹⁷ While complementary assets also influence strategy for firms competing using existing technologies, they are frequently a vital factor in technology strategy.

To gain access to valuable complementary assets, a firm with a new technology may need to create or cooperate with an *ecosystem*—a set of mutually dependent suppliers, customers, and *complementors* that work together to create value. Most firms exist in an ecosystem. For example, smartphone manufacturers are part of an ecosystem that includes mobile application developers and wireless carriers, both of whom own complementary assets that are essential to delivering customer value.

Becoming part of an ecosystem presents a range of challenges for the technology strategist. How should developers of a new technology induce partners to work with them? Providing an incentive for customers to buy the product or for partners to collaborate in producing it will require surrendering value and sharing proprietary information. Suppliers, customers, and complementors may require additional compensation for the perceived risk of working with an innovator. How do innovators avoid surrendering too much value? Sharing information may turn suppliers, complementors, or even customers into competitors.

Because competitive strategy emphasizes performance over the long run, it rarely emphasizes timing. Timing, however, is a critical aspect of a technology strategy. Strategists must choose whether to attempt to innovate (lead) in the development and commercialization of a new technology or whether to follow and adopt a new technology developed by someone else. A technology strategy must be dynamic, capable of dealing with changing circumstances. Amazon’s technology strategy, for example, had to deal with imitators and other evolving threats and opportunities as online retailing technology became widely adopted.

The importance of timing choices in technology strategy is magnified by *increasing returns to scale*, which exist when a firm’s profitability increases disproportionately with its customer base. *Economies of scale* and network effects are two sources of increasing returns to scale, and both can create *first-mover advantages*. Although the existence of increasing returns to scale often affects strategy, it is particularly important for new technologies. *Network effects* mean that the value a customer can get from choosing a technology depends on how many others make the same choice. When combined with *switching costs*—the cost to switch from one product to another—network effects can make customers reluctant to adopt a new technology until a standard product design emerges. This can lead to a *standards war*, in which firms with different product designs compete in a winner-takes-all battle to become the standard. In such situations, technology strategy involves choosing how to fight and win a standards war.

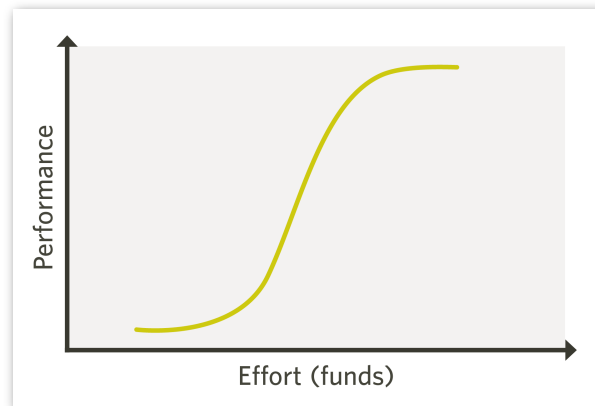
2.2 Technology Strategy for Innovators

An innovator is a firm that introduces a new technology into a market. An innovator may be an existing firm or a startup, and it may target an existing market or an entirely new one.

An innovator's technology strategy is influenced by two types of change: the evolution of the technology's performance and the development of the market for the new technology. Although the convention is confusing, both technology and market change are characterized by S-shaped curves.

Richard Foster describes the evolution of the performance of a technology using an *S-curve*, as shown in **Figure 1**. In the beginning, performance improves slowly. Then, as problems are solved, performance improves rapidly. Finally, the technology reaches its performance limit, and additional expenditure to improve it is unproductive.¹⁸

FIGURE 1 The Technology S-Curve



Source: Richard Foster, *Innovation: The Attacker's Advantage* (New York: Summit Books, 1986), p. 31. Reprinted by permission.

Rather than being adopted by everyone at once, an offering based on a new technology *diffuses* through a market.¹⁹ As shown in **Figure 2**, market penetration increases slowly at first and then tends to grow rapidly before leveling off as the market reaches saturation.

FIGURE 2 The S-Shaped Market Diffusion Curve



Source: *The Economics of Technological Diffusion* by Paul Stoneman. Reproduced with permission of Blackwell Publishers via Copyright Clearance Center.

The innovator’s technology strategy varies with the stage in the technology’s evolution and the stage in the market’s development. At the birth of a new technology, the innovator’s strategy must answer three questions: Does it work? Who will adopt it? How do I commercialize it (that is, make money from it)? After the technology has been commercialized, the strategic questions focus on the product market: How will I grow the market? How will I capture a share of the value? As the market matures and the performance of the technology plateaus, the question is one of sustaining value: How should I respond to the challenges from (and opportunities of) the next new technology? (See **Table 1**.)

TABLE 1 Technology Strategy Issues for Innovators

Stage of Market Development	What the Innovator Has to Sell	Innovator’s Technology Strategy Issues
Introduction	Technology idea	Does it work? Who will adopt it? How should I commercialize the idea?
Growth	Product	How should I grow the market? How will I capture a share of the value?
Maturity	Business	How should I respond to new technologies?

Even before figuring out how to make money from a new technology, an innovator must address two key questions: Does the new technology work? and Who will adopt it?

In established industries, in which all competitors use the same proven technology, there is little technology risk and the market is understood. Companies need a competitive strategy that positions them to meet the needs of a customer segment better or more cheaply than other players, but they already know how to produce a working product and who is likely to be interested in buying it.

New technologies are different. The technology strategy has to manage the risk that the technology may fail to live up to its promise. Making a technology work is a task for the technologists, but managing its risks is the job of the technology strategist.

Even if a technology works, its value may not be apparent to customers. Geoffrey Moore explains that a new technology needs to enable something that “has an intrinsic value and appeal to the non-technologist,” such as a flagship application.²⁰ An innovator needs to develop the value proposition and identify the customers who will benefit most.

Managing Technology Risks

All technology innovators must manage risk. A failed technology may harm an existing firm’s reputation and damage its customer relationships. For a startup, capturing value depends vitally on the ability to reduce or eliminate technical risk cheaply. Otherwise, investors who bear most of the risk will demand most of the equity.

The biotechnology company Genentech provides an example of how to manage risks in introducing a new technology. Genentech was founded “to develop the new science of recombinant DNA into viable therapeutic products with mass market appeal, something that most scientists agreed was at least a decade away.”²¹ That “at least a decade” forecast reflected a

level of uncertainty that represented a significant risk for investors. Yet investors were essential for developing the technology.

Genentech decided to manage the risk by conducting an experiment. Before attempting its real objective, which was to make insulin, researchers at the company would produce a simple human protein as a proof of concept. As Genentech co-founder Herbert Boyer explained, “What we needed to do was show that we could actually make a human protein in bacteria, and that was key to the next level of funding. . . .”

But venture capital investor Tom Perkins saw risk in the experiment. He described his concerns to one of the company’s founders:

[W]e’ve got to figure out a way to take some of the risk out of it—something instead of me giving you all the money, then you renting the facility, buying the equipment and luring the people. With that approach you’ll have spent maybe a million dollars by the time you get to actually performing the experiment. Then if it doesn’t work it’s all over and all that money is lost.²²

Perkins argued for subcontracting the experimental work to institutions that already had some of the necessary capabilities instead of creating an entirely new experimental facility. As he said, “I’ll want to own most of the company if I’m going to take all of that conventional risk.”

Perkins’s proposal prevailed, and Genentech contracted with several research institutions. One contract allowed the institution to own any patents produced; Genentech would be an exclusive licensee and pay royalties on sales. Another allowed Genentech to own any patents and pay a 2% royalty on sales.

The experiment was a success, and Perkins told investors he was pleased that the first commercial demonstration of the new technology had cost only \$515,000. He commented that the experiment was able to “remove much of the risk from the entire venture. . . . For next to nothing we had removed a world class question about risk.”²³

The takeaway here is that it is critical to identify the technology risks and to devise inexpensive ways to reduce them, such as developing prototypes and conducting small-scale experiments. Such approaches may lead to higher valuations from investors, but they may also require sharing some of the value created with partners, as Genentech did.

Identifying the Customer

While established industries already have customers, entirely new offerings may not. Innovators may need to define, target, and develop—in other words, *produce*—a customer.

Which customer should you target? As Carl Shapiro and Hal Varian explain in their book *Information Rules*, “A new technology had better offer significant value added.”²⁴ Target the prospective customers for whom the customer proposition is strongest and the competitive forces are weakest. Sometimes that means creating a new market. Targeting the right customers requires an analysis of the value the technology creates for them and of potential industry participants’ likely response to your market entry.

In choosing which customers to target, Amazon founder Jeff Bezos considered the capabilities of the then-new Web technology, the potential value propositions for customers, and—where customer needs were already being met by another technology—the nature of the industry environment. He believed that online retailing represented a significant opportunity, but it was important to target the market where this new technology provided the greatest competitive advantage. Because online retailing necessitated shipping products to customers, items needed to be physically small and have a high ratio of value to weight to make shipping

economical. And because customers could not inspect the goods, there had to be no doubt about their quality. The goods had to be something that the relatively affluent and well-educated early users of the Web would want. Bezos developed a list of over 20 categories of products that he thought could be sold successfully online, including software, music (sold at the time in compact disc form), and books.²⁵ As he explained, books were a particularly good match for online retailing:

At the time, I made the observation that books was one of the few—maybe the only—category where computers have already been very helpful in selling the product. For a long time, bookstores have had information desks, where you walk up and somebody uses a computer to help you find what you’re looking for. . . . You could see how with a large number of products, the sorting and searching could help. But that wasn’t the main thing. The main thing was that you could build a bookstore on the Web that simply couldn’t exist any other way. The Web is an infant technology. If you want to be successful in the short-to-medium term, you can only do things that offer incredibly strong value propositions to customers relative to the value of doing things in more traditional ways. This basically means that, right now, you should do online only what you cannot do any other way. The largest physical bookstores only carry 170,000 titles. There are only three that big. We have 1.1 million titles in our catalogue. And if we printed our catalogue, it would be the size of seven New York City phone books.²⁶

In choosing which industry to enter, Bezos considered the size of the market and the power of suppliers. In the music industry, six major companies owned most of the big labels, which Bezos saw as a concentration of power that could easily freeze out an upstart. This was much less of a risk in the book industry, given that there were over 20,000 publishers in the United States alone. The competition was fragmented, too: Barnes and Noble and Borders, the two largest players in the United States, accounted for less than 25% of sales, which meant that a new entrant would be unlikely to encounter a coordinated response from competitors. As Bezos said, “There aren’t any 800-pound gorillas in bookselling.” Traditional book retailers also faced a cost disadvantage because of the need for large investments in inventory, real estate, and staff members at each retail location. Bezos’s analysis led him to enter the book-retailing industry, and the rest is history.

Some successful innovators use a stealth approach, entering underserved or nontraditional markets rather than challenging powerful incumbents directly. Clayton Christensen cites the example of 3.5-inch disk drive manufacturers, which targeted the new portable computer market rather than the large and well-established desktop computer market.²⁷ Netscape, the producer of the first widely used Web browser, chose instead to challenge Microsoft openly with a potential replacement for applications software (Web apps), eliciting a powerful competitive response. Michael Cusumano and David Yoffie, arguing that this may not have been the wisest strategy, offer this memorable advice: “Don’t moon the giant.”²⁸

For innovators that are existing firms, markets where the firm can use its complementary assets represent attractive opportunities for the new technology. Apple, for example, leveraged its brand, software and hardware design capabilities, and product ecosystem to target the market for portable music players with the iPod.

Commercialization

A new technology is essentially an idea. All innovators face a fundamental strategic issue: How do I make money from this idea? The answer to that question is a *commercialization strategy*.

Joshua Gans and Scott Stern characterize the commercialization issue as a choice between cooperation and competition. Innovators can choose to cooperate with another firm—usually an industry incumbent, a firm currently serving the market targeted by the innovator—to commercialize the idea, or they can choose to compete with incumbents by entering the product market. The choice depends on two factors: the robustness of the “market for ideas” and the ownership of valuable or specialized complementary assets.²⁹

When the market for ideas works well—that is, when there are opportunities for licensing, a joint venture, a strategic alliance, or even an acquisition that allows the innovator to realize a fair price—an innovator can commercialize a new technology through cooperative efforts without having to enter a product market. For example, the inventor of a new drug can sell the idea to a large pharmaceutical company with the resources to gain clinical approval for it, manufacture it, and distribute it worldwide.

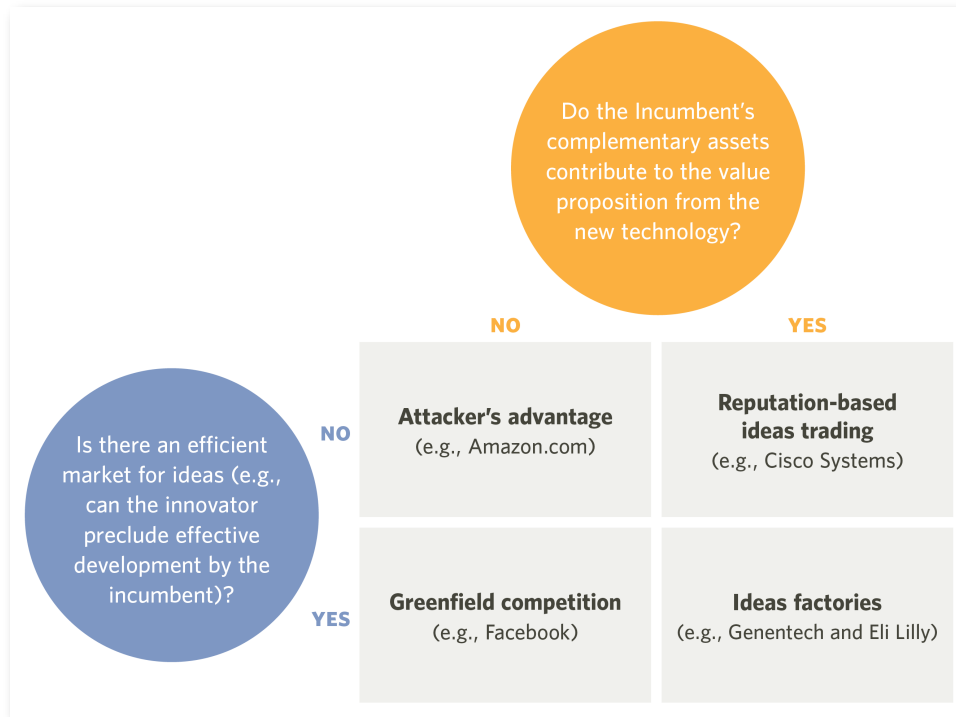
Several issues can interfere with the market for ideas, however. If a new technology is easy to copy, an innovator may be unwilling to approach potential buyers for fear of imitation.³⁰ Patents, copyrights, trademarks, and trade secrets offer some protection, but many can be invented around, and intellectual property protection is sometimes weak. To cooperate with a firm, the innovator must disclose information about the idea, but doing so reduces the incentive for the potential partner to pay for it. This is known as the paradox of disclosure.

The innovator’s choice between cooperation and competition is also informed by the ownership of valuable complementary assets. An innovator that does not own those assets—and wants to avoid costly and risky investments in them—has an incentive to cooperate with an incumbent that does. For the incumbent, cooperation preserves market power and avoids potential competition in the product market.

A subtle interaction exists between the effectiveness of the market for ideas and the ownership of complementary assets. Owners of valuable complementary assets are likely to have the market knowledge to appreciate the value of the idea and the technical expertise to imitate it. When intellectual property rights are not strong—that is, when the market for ideas is weak—the owners of complementary assets (incumbents) are the most able to imitate the idea and the most likely to do so. Gans and Stern cite the case of the inventor of the intermittent windshield wiper, who fought for decades to get compensation from automakers who copied his idea.

Gans and Stern use these two dimensions—the existence of an efficient market for ideas and ownership of valuable complementary assets—to create a useful framework for choosing a commercialization strategy. Their framework is shown in **Figure 3**. We will discuss the commercialization strategy for each environment in turn.³¹

FIGURE 3 Commercialization Strategies



Source: Adapted from "The Product Market and the Market for 'Ideas': Commercialization Strategies for Technology Entrepreneurs," Joshua S. Gans and Scott Stern, *Research Policy* 32, no. 2 (February 2003). *Research Policy* by North-Holland. Reproduced with permission of North-Holland via Copyright Clearance Center.

Attacker's Advantage

Where the incumbent does not control valuable complementary assets, there is no incentive for the innovator to cooperate. If the incumbent can exploit the idea, the innovator has an incentive to enter the market and attack the incumbent before the incumbent can copy the idea. This situation is called the *attacker's advantage*. In entering the product market, the innovator is likely to have several advantages. It will have skills in the new technology that are not well developed in the incumbent. The incumbent may be so focused on protecting its own profitability that it overlooks the innovator. The innovator can follow a stealth strategy—by targeting unserved markets—to avoid provoking a competitive response.

For example, in the US retail book market, incumbents Barnes and Noble and Borders had no assets that Jeff Bezos considered valuable for Amazon. In fact, he perceived their retail stores and retail staff members as liabilities. He had little incentive to try to sell the idea of online book retailing to them because there was no way to stop them from adopting the idea themselves. Amazon's best commercialization strategy was to enter the product market and attack the incumbents.

In doing so, Amazon had some advantages. It had developed skills in online retailing that the incumbents did not have. Barnes and Noble struggled between protecting the returns from its brick-and-mortar stores and responding to the attacker.

When innovators' ideas have little intellectual property protection, their technology advantages may be fleeting. Amazon's idea, for example, was easy for other startups to imitate. Like any other innovator that enters a product market with an idea that is easy to imitate, Amazon had to develop a strategy to deal with emerging competitors. We discuss its strategy in the section on Growth.

Ideas Factories

At the other extreme is the commercialization environment where an innovator has a technology that the incumbent cannot exploit on its own, and the incumbent has complementary assets that enhance the value of the technology. The two parties have every incentive to cooperate. Gans and Stern characterize this environment as suitable for what they call *ideas factories*: innovators that produce ideas for incumbents to buy.

Genentech was essentially an ideas factory. According to Tom Perkins,

. . . after two or three years of work at Genentech we had some strategic questions to ask ourselves. Should we attempt to use our patents as a barrier to other companies? Or should we license our patents broadly?³²

For Genentech, the relatively strong intellectual property rights of the pharmaceutical industry made licensing feasible. The company decided to license its technology to pharmaceutical firms, which had the resources to fund both clinical trials and production. A natural target as a licensee was Eli Lilly, holder of 80% of the US market for insulin, which it produced by deriving human insulin from the pancreases of animals. Both companies benefited from cooperation.

In this environment, the question is: When and how to cooperate? As Gans and Stern explain, “The key to an effective cooperation strategy is to initiate cooperation at a point where technological uncertainty is sufficiently low but sunk investment costs have not yet become substantial.” Genentech could have attempted to license the technology after it produced the simple human protein somatostatin. By waiting until it had successfully produced insulin, the company increased the perceived value of the technology and the importance to Lilly of acquiring it. Lilly was the major supplier of insulin, and this alternative source was a strategic threat.

In the case of Genentech, the market for ideas worked well. Four years after Tom Perkins agreed to buy 25% of the equity for \$100,000, an initial public offering (IPO) valued Genentech at \$300 million. In 2009, it was fully acquired by the Swiss health-care company Roche for \$47 billion. Reflecting on their choices years later, Perkins said, “. . . I still think the strategy of the way we did it—subcontracting the experiments, then licensing to Lilly . . . I don’t think we could have done it better.”

Reputation-Based Ideas Trading

Why would Google, Apple, or IBM ever buy a software company? An idea for a new software product is relatively easy to imitate. All these firms have deep software expertise and valuable complementary assets. Once they hear of a new idea, any of them could apply considerable resources to develop their own version of it.

The problem with developing a reputation for imitating ideas is that doing so eliminates the incentive for ideas factories to develop new technologies that might benefit the imitating firm. In fact, it gives them an incentive to hide their ideas from such a firm and instead approach competitors that have a better reputation.

Incumbents who develop a reputation for being willing to participate in the market for ideas—for example, by paying licensing fees or acquiring companies at a fair price—provide an incentive for innovators to develop new technologies that enhance the value of the incumbent’s assets. In this situation, the incumbent’s good reputation allows for reputation-based ideas trading, which benefits both the innovator and the incumbent.

Intel, for example, rewards managers responsible for relationships with outside innovators on the basis of the growth of worldwide semiconductor sales. By targeting industry growth

rather than Intel's bottom line, this policy signals a focus on creating a bigger pie rather than trying to grab the largest piece.³³ Intel specifically commits to protect the value capture of partners in its ecosystem in order to encourage their contribution to value creation.³⁴

Trading in ideas requires innovators to get the attention of potential acquirers. This may not be a problem for in-house research and development staff developing a new technology for the company's use, but innovators in technology startups may have difficulty getting access to decision makers. Venture capital firms can be useful intermediaries in those situations, adding credibility to the innovator's idea.

Greenfield Competition

The last type of commercialization environment is one where the innovator has a technology idea that is difficult for an incumbent to develop, and the incumbent has no valuable complementary assets. In this case, there is no incentive for the innovator and the incumbent to cooperate. In such so-called greenfield opportunities, the competition is among the innovators, who may end up in a race for first-mover position. For example, when Mark Zuckerberg developed Facebook's technology, the main incumbent (Myspace) had no valuable complementary assets. Zuckerberg's best option was to be a fast follower in the greenfield online social networking market.

Google's developers, Larry Page and Sergey Brin, initially tried to sell their search technology to a leading Web portal for \$1 million, reportedly because they felt it was taking too much time away from their PhD studies at Stanford University.³⁵ After that attempt failed, the two got some venture capital backing and chose to enter the market for online search services. Although there were other search engines and Web portals, Google was the first *fast* search engine. The technology worked already, so the risk was low, and the rapid growth in the number of users was a clear demonstration of market need. The number of potential users was vast. With limited time before an imitator appeared, entering the online search market made sense. The next question for Page and Brin was how to get people to pay for the service.

Choosing an Offering and Selecting a Revenue Model

In new markets, the way firms get paid—the *revenue model*—may not be established. Innovators often experiment with revenue models, which may entail experimenting with offerings. In some cases, the customers of the revenue-producing commercial offering may be quite different from those of the initial offering.

Consider Facebook and Google, providers of *information goods*, which have a distinctive characteristic: near zero marginal cost. While either firm could have attempted to charge users a proportion of the value they received, the two companies would have faced competition from firms offering similar services for free. Both firms chose instead to develop an offering for advertisers, for whom users' attention was a valuable complementary asset. Facebook and Google had an incentive to work with advertisers, and advertisers had an incentive to work with them.

Advertising is not the only revenue model for information goods and services. Other options include subscriptions, freemium pricing models (in which a basic version is free but a version with extra features is not), and complement pricing (in which a basic service is free but the firm charges for complementary goods or services). All those models have been employed in the new mobile apps industry, and complement pricing through in-app purchases was discovered to be profitable only as the industry evolved.^{36,37}

Growth

Once an innovator has chosen how to commercialize a new technology, the competition shifts from the market for ideas to the market for products or services. The strategic challenge is to grow the market while capturing the maximum possible share of the value created.

An offering based on a new technology may be a familiar offering—produced in a new way—for an existing market or an entirely new offering for which no market currently exists. Amazon’s initial offering, for example, was entirely familiar—a book—and the retail market for books was well established. Only the technology of producing retail book sales was different. The first personal computer, on the other hand, was an entirely new offering for a market that at the time did not exist.

Despite these very different situations, the strategic questions remain the same:

- How do we get mainstream customers to adopt the offering?
- How can we maintain competitive advantage and bargaining power to capture a share of the value as the market develops?
- How can we shape the competitive environment to sustain bargaining power in the long run?

The challenge of technology strategy is to address these three questions *concurrently* in an environment that is changing and evolving. The technology strategy needs to specify a series of choices over time that create value by getting mainstream customers to adopt the offering and that capture value by preserving and enhancing the innovator’s competitive advantage and bargaining power, both in the short and long term.

Achieve Adoption by Mainstream Customers

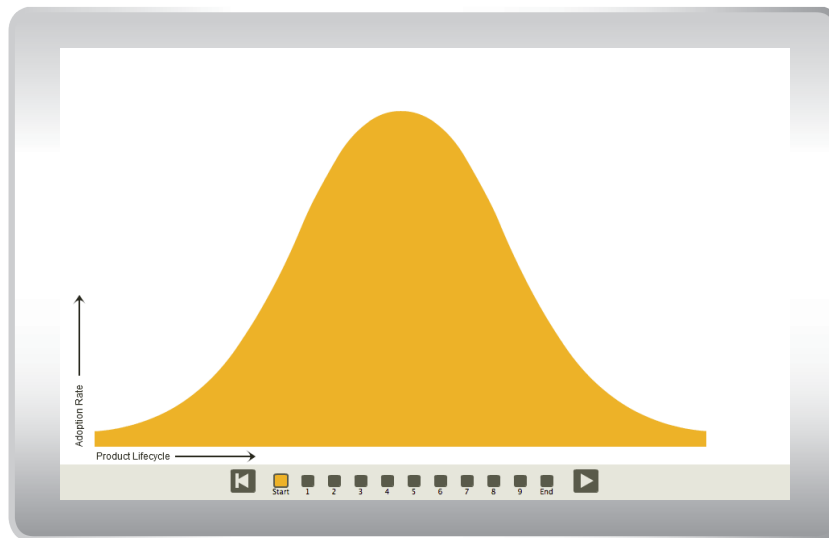
In *Crossing the Chasm*, Geoffrey Moore explains that different parts of the market adopt new technology at different rates. *Early adopters* are quick to see the potential benefits of a new technology. The *early majority*, by contrast, “are content to see how other people are making out before they buy in themselves.”³⁸ The key, Moore says, is in “making the transition from an *early market* dominated by a few *visionary* customers to a *mainstream market* dominated by a large block of customers who are predominantly *pragmatists* in orientation”³⁹ (italics in original). The product offering must evolve to meet the differing needs of those market segments. Moore refers to the gap between the needs of the early adopters and the needs of the majority as a chasm. “Crossing this chasm,” he writes, “must be the primary focus of any long-term high-tech marketing plan.”⁴⁰



INTERACTIVE ILLUSTRATION 1 The Chasm in the Technology Adoption Life Cycle



Scan this QR code, click the image, or use this link to access the interactive illustration: bit.ly/hbsp2FPqmyv



Source: Figure: "Technology Adoption Life Cycle," from *Crossing the Chasm* by Geoffrey A. Moore. Copyright © 1991 by Geoffrey A. Moore. Reprinted by permission of HarperCollins Publishers.

The chasm is wider for some technologies than it is for others. Its width depends on switching costs—the cost to the customer of switching to a new product or service. Where switching costs are low, a small improvement in performance may be enough to get the early majority of the market to switch. Where switching costs are high, collaboration with complementors may be necessary to develop a value proposition that meets the early majority’s needs. For example, the manufacturer of a new video game console will collaborate with developers to make popular games available on the new console.

Click on **Interactive Illustration 1** and then click the play button to see the characteristics of each market segment, the reasons why a gap (or, in one case, a chasm) exists between the needs of one segment and the needs of the next, and how to negotiate the gaps and cross the chasm.

The best way to cross the chasm is to seek to dominate a market niche. A tight focus allows the innovator to provide excellent support, develop targeted marketing messages, and promote word-of-mouth marketing. Moore likens that strategy to the D-Day invasion of Normandy during World War II:

Cross the chasm by targeting a very specific niche market where you can dominate from the outset, drive your competitors out of that market niche, and then use it as a base for broader operations. Concentrate an overwhelmingly superior force on a highly focused target. It worked in 1944 for the Allies, and it has worked since for any number of high-tech companies.⁴¹

Amazon’s initial focus on the US retail book market is an example of targeting a niche to cross the chasm. It was always plausible that tech-savvy early adopters would buy products online. The question was, Would mainstream (early majority) customers be willing to change the way they purchased books? By focusing tightly on delivering a powerful value proposition

to book buyers, Amazon was able to attract millions of customers who had never before made an online purchase.

Retain Competitive Advantage and Bargaining Power

Whether a company is competing using a new technology or an existing one, the fundamental principles of competitive strategy are the same: The value captured depends on the value you create, your competitive advantage, and your bargaining power. The difference with a new technology is that all of these are continually changing as the market grows and the technology develops. If the new technology produces a competitive advantage, competitors will rush to exploit it. A large market will open up. Having created value, the challenge for the technology innovator is to capture a share of that value in the face of the many other market participants—suppliers, powerful customers, competitors, potential entrants, suppliers of substitute products, and complementors—who would like to secure that value for themselves. A successful strategy for a technology innovator will include many of the following elements:

- Seek to dominate a market segment.
- Sustain competitive advantage by improving the value proposition.
- Be prepared to adjust your offering and cannibalize your business.
- Preempt competitors.
- Establish and defend intellectual property.
- Establish a position of power in an ecosystem.
- Exploit switching costs and increasing returns to scale.

Seek to Dominate a Market Segment

Dominating a niche market is not just a sound strategy for crossing the chasm. It also strengthens bargaining power by reducing rivalry, making price-based competition less likely. LinkedIn, for example, has avoided head-to-head competition with other social networks by focusing tightly on professional relationships and employment advertising.

Sustain Competitive Advantage by Improving the Value Proposition

Customers don't want to buy the second-best product. You need to choose a segment, however narrowly defined, where your product is the best. But with a new technology, the "best" product is likely to improve rapidly, along with the performance of the technology. You need to invest to keep your product's performance ahead of, or at least equal to, the competition. Myspace, an early and initially successful social networking site, failed to improve its technology and was overtaken by Facebook's superior offering based on newer technology. As we will see later, such technological leapfrogging is an important tactic in technology strategy.

Be Prepared to Adjust Your Offering and Cannibalize Your Business

Your offering's value proposition will evolve as you learn about your customers through what Clayton Christensen calls "discovery-driven expeditions into the marketplace."⁴² Ben Horowitz, a venture capitalist and blogger, says, "That is what product strategy is all about—figuring out the right product is the innovator's job, not the customer's job."⁴³ For many offerings based on new technology, the critical role of a product manager is to interpret customer needs and translate them into product specifications.

Sometimes the offering will need to change dramatically. Ben Horowitz's company, LoudCloud, was formed as a computer infrastructure services provider. In his book *The Hard*

Thing About Hard Things, Horowitz describes how, facing a funding crisis created by the 2000 dot-com crash, he made a “bet the company” decision and sold the LoudCloud business—which represented 100% of the company’s revenue and employed 440 out of its 450 employees—to EDS. He then went into business marketing the Opsware software that had powered LoudCloud, a decision that he later described as “the best decision I made in my career.” Opsware was later sold to Hewlett-Packard for \$1.65 billion.⁴⁴ LoudCloud completely changed its offering, its staffing, and its revenue model as it adapted to the changing market.

Preempt Competitors

Any successful new technology attracts imitators, who will try to develop an improved version of the technology to overtake the innovator. Innovators can preempt competitors by early investment. Google, for example, bought YouTube when the advertising potential of streaming video was highly uncertain in order to preempt competitors from controlling that potentially valuable opportunity. Cisco Systems, a maker of networking equipment, maintained its technology lead by acquiring and integrating over 150 technology firms.⁴⁵

Establish and Defend Intellectual Property

Maintaining bargaining power through ownership of intellectual property is an important part of a technology strategy. Mobile phone chip maker Qualcomm, for example, has remained highly profitable through its control of a suite of patents related to code-division multiple access (CDMA) technology.⁴⁶

Establish a Position of Power in an Ecosystem

A technology generally needs complementary assets in order to deliver value to end users. Mobile telecommunication, for example, requires mobile phones, cell towers, base stations, and billing and call routing software. Where an ecosystem does not exist, an innovator may need to develop one.

The innovator, suppliers, customers, and complementors in an ecosystem share an interest in growing the market (and hence the total value created), but they compete over how the value is distributed. To describe this mixture of cooperating and competition, Adam Brandenburger and Barry Nalebuff used the term “co-opetition.”⁴⁷

Innovators need a strategy to ensure that other members of the ecosystem do not appropriate all the value. In a *Harvard Business Review* article entitled “Skate to Where the Money Will Be,” Clayton M. Christensen, Michael E. Raynor, and Matthew C. Verlinden cite the cautionary tale of the IBM PC: Despite the fact that the PC was IBM’s innovation, the microprocessor maker Intel and the operating system supplier Microsoft captured the majority of the value. The IBM PC was introduced when the personal computer market was in its early stages. The IBM brand gave “early majority” corporate buyers the confidence to adopt this new product offering, alleviating their fears that smaller companies would not survive to provide technical support and that hardware and software would not be compatible. Consequently, IBM was initially in a powerful position and could capture a reasonable share of the profits. Later, as performance of PC clones started to meet and exceed customers’ needs, the IBM brand became less valuable, and IBM’s power in the ecosystem declined. Pricing power and profits migrated to the scarce resources: the suppliers of critical and proprietary modular components.⁴⁸

The challenge, then, is to participate in an ecosystem while maintaining control of a scarce resource—such as a brand, a proprietary technology, or a specific and valuable asset (such as established customer relationships)—in order to capture a share of the value. If there are many partners whose roles and capabilities are evolving, as is often the case with new technologies, it

can be complicated to figure out who has the bargaining power and how that will change. Horowitz refers to this kind of problem as “eight-dimensional chess.”⁴⁹

Apple’s strategy, for example, is to control the ecosystem by owning multiple components of it—including hardware, the operating system, key application software, and services such as iTunes and streaming music—and by retaining the right to decide which firms may participate. Google’s strategy is to share ownership more broadly, inducing more innovation by complementors while retaining control of the operating system. As we will see later, control of an ecosystem is an important way to shape the competitive environment.

Exploit Switching Costs and Increasing Returns to Scale

Exploiting switching costs and increasing returns to scale are standard tactics in competitive strategy. (For more on the forces that affect profitability and strategies to exploit them, see *Core Reading: Industry Analysis* [HBP No. 8101], especially Table 7.) Increasing switching costs makes it more difficult for customers to defect, thus reducing the threat of new entrants and the bargaining power of buyers. A firm that has increasing returns to scale enjoys a larger advantage over its competitors. For instance, where economies of scale exist, firms that achieve large scale develop a cost advantage over potential entrants. Where demand-side network effects exist, the value of an offering to a customer depends on how many other customers have chosen the same offering. The firm with the most customers is most attractive for future customers, creating a snowball effect—the bigger the firm becomes, the faster it grows. Such firms can grow to dominate a market, putting them in a winner-takes-most position.

Switching costs and increasing returns to scale are particularly important for technology strategy. They allow firms like eBay and Facebook to dominate their industries. As we will see later, switching costs are also an important factor when managing technology transitions.

When the winner takes most, competition in markets featuring increasing returns to scale can be fierce. W. Brian Arthur argues that just being first or having the best product may not be enough in increasing returns markets. He advocates “active management” of increasing returns by strategies such as heavy initial discounting to build an installed base.⁵⁰ Tactics include penetration pricing (pricing below cost); moving down the learning curve rapidly; sharing value with customers, suppliers, and complementors; and promoting an open standard.⁵¹ Zero pricing for market penetration is a common tactic for increasing returns to scale in markets for products with very low marginal costs. Both Facebook and Skype, for example, provide services at zero price.

Shape the Competitive Environment

As the market grows and evolves, your competitive position evolves with it. Innovation diffuses not only on the demand side, as more and more customers accept the new offering, but also on the supply side, as competitors adopt the new technology. The strategic challenge is to ensure that your competitive position does not erode but instead becomes stronger over time.

One approach to technology strategy is to take the competitive environment as a given and focus on competing successfully within it through, for example, investing heavily to maintain superior product performance. This is a *reactive approach*, based on the premise that a firm has little influence over the choices made by others and has to react to any choices that change the competitive environment. If a supplier decides to integrate forward and enter the market, for example, the innovator has to respond.

An alternative approach is to try to *shape* the competitive environment, thus changing the basis of competition by influencing the strategic decisions of competitors, suppliers, customers, and others in the ecosystem, and setting the stage for superior financial performance.

Firms competing using existing technologies can shape their competitive environments, but new technology provides new opportunities to do so. Innovators can:

- Establish the dominant design.
- Commoditize the other elements of the ecosystem.
- Use the new technology to create barriers to entry.
- Use the ecosystem to compete.
- Create a technology platform.

Establish the Dominant Design

When a new technology emerges, firms may use it to develop product offerings with different designs. To understand the difference between a design and a technology, consider housing construction. The building technology is the way the builders produce outputs (houses) from inputs (building materials, labor). If two houses are constructed of bricks and mortar using similar construction techniques, the builders are using the same technology. But the resulting house designs may be very different.

Differing designs don't matter so much in the housing market; there's no problem with a diversity of architectural styles as long as housing buyers have varying tastes. But where network effects exist, the design a customer chooses depends on the choices other customers make. Where designs are incompatible (that is, switching costs are high), customers may wait for one design to become the de facto standard before adopting the new offering. James Utterback calls such a standard a **dominant design**: "A dominant design in a product class is, by definition, the one that wins the allegiance of the marketplace, the one that competitors and innovators must adhere to if they hope to command significant market following."⁵²

The importance of a dominant design to market growth depends on network effects, economies of scale, switching costs, and interoperability. Strong network effects mean that customers are heavily influenced by others' choices, increasing the importance of a dominant design. Economies of scale can also increase the likelihood of a dominant design because the largest producer will have a competitive cost advantage. If supporting multiple designs is costly, suppliers also have an incentive to back a winning design. If competing designs are compatible (interoperable), a dominant design is less important.

If market success requires a dominant design, your task as an innovator is to get your design adopted as the standard. Tactics in the competition to own the dominant design, known as a *standards war*, include preemption (building an early lead) and expectations management (creating an expectation in customers' minds that your product will become the dominant one).⁵³ In the competition between high-density optical disk formats for high-definition TV, Sony's Blu-ray Disk and Toshiba's HD-DVD fought a standards war that Blu-ray eventually won.

Establishing the dominant design shapes the competitive environment by compelling participants in the ecosystem to ensure compatibility with the standard. If you own a technology vital to the dominant design, you can profit. In the personal computer industry, the IBM PC became the dominant design because of IBM's marketing muscle and its powerful brand, and because its open architecture provided an incentive for peripheral equipment manufacturers to design compatible products, further enhancing the value of the IBM design. The establishment of a dominant design encouraged software developers to produce software that ran on the IBM PC's operating system. It also shaped the competitive environment of the personal computer industry by establishing Microsoft's disk operating system (DOS) as the standard operating system and an Intel design as the standard microprocessor. Although IBM

established the standard, it failed to acquire ownership of its key components, yielding most of the value created to Microsoft and Intel.

Commoditize the Other Elements of the Ecosystem

As we explained earlier, most technologies require an ecosystem of suppliers, customers, and complementors to create value. When other participants in the ecosystem have no direct competitors, their bargaining power grows, enabling them to capture a significant share of the value created. An innovator can reduce the bargaining power of other participants by commoditizing them in three ways: encouraging competitors by sharing information, creating standard interfaces with the innovator's own technology, and subsidizing entrants. Microsoft has been able to diminish the power of Intel by supporting its competitor, AMD. Encouraging competition in the other parts of the ecosystem increases an innovator's ability to capture value from the entire industry.

Use the New Technology to Create Barriers to Entry

Yet another way to shape the competitive environment is to use the technology to create barriers to entry. Amazon, for example, has shaped the competitive environment of online retailing by entering an astonishing range of product categories and exploiting economies of scope. The company articulated a strategy for shaping its competitive environment as far back as its initial public offering:

The Company believes that its success will depend in large part on its ability to (i) extend its brand position, (ii) provide its customers with outstanding value and a superior shopping experience, and (iii) achieve sufficient sales volume to realize economies of scale. Accordingly, the Company intends to invest heavily in marketing and promotion, site development and technology and operating infrastructure development. The Company also intends to offer attractive pricing programs, which will reduce its gross margins. Because the Company has relatively low product gross margins, achieving profitability given planned investment levels depends upon the Company's ability to generate and sustain substantially increased revenue levels. As a result, the Company believes that it will incur substantial operating losses for the foreseeable future, and that the rate at which such losses will be incurred will increase significantly from current levels.⁵⁴

Here Amazon announced its intention to build barriers to entry by developing economies of scale. The large capital requirement due to "substantial operating losses for the foreseeable future" formed a second barrier to entry. The commitment to "outstanding value" was a signal that Amazon would not be beaten on price. These barriers to entry were not fixed; they grew *stronger* over time. Branding and economies of scale have cumulative value. Taken together, these actions explain why Amazon is the dominant online retailer.

Use the Ecosystem to Compete

The importance of complementary goods has led to competition not just between products but also between ecosystems. An example is the competition between the Apple iOS and Google Android ecosystems. Apple controls an ecosystem of application developers, hardware (iPad, iPhone, etc.), and the iOS operating system. Google offers a competing ecosystem and licenses the Android operating system to multiple hardware vendors. Microsoft's ecosystem, based on the Windows operating system and a vast array of application software, now also

includes hardware such as the Surface tablet and Nokia smartphones. Even Amazon has entered the battle of ecosystems by offering the Kindle Fire phone to go with its tablet and Web services offerings.⁵⁵ A firm with the power to control an ecosystem can shape the competitive environment by requiring firms to cooperate or risk exclusion from the ecosystem.

Create a Technology Platform

Creating a technology platform is a powerful way to shape industry competition. Google developed an advertising platform that created value for a vast ecosystem of advertisers and buyers. Apple developed an integrated ecosystem of products and software services that reshaped competition in the recording music industry. See the Supplemental Reading section for a discussion of platform technologies.

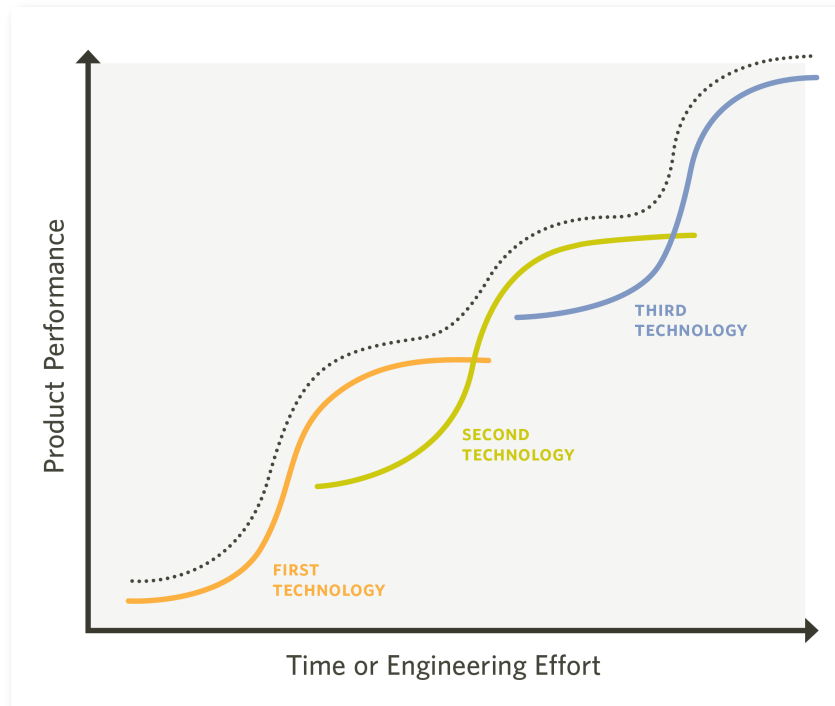
It is difficult to provide a recipe for shaping a competitive environment, but we can point to questions that the technology strategy should address: Is there an opportunity to establish the dominant design (create a standard)? Can we commoditize the other elements of the ecosystem? Can we use network effects or economies of scale to create barriers to entry? Can we create a platform that encourages other firms to cooperate with us in creating value? Answering yes to any of these questions points to an opportunity to create and capture significant value.

Maturity

At some point in the development of a market, growth starts to level off. Everyone who wants the offering based on the new technology has it. For example, the US market for thin-screen LCD computer displays grew rapidly as people replaced their bulky CRT displays. Eventually, however, the market became saturated and growth slowed.

When a market matures, further growth for the technology innovator depends on applying the new technology in new markets or transitioning to the next new technology. Amazon, for example, applied its online retailing technology to many other product categories, including electronics and computers, home and garden products, beauty products, toys, and clothing. The company also transitioned successfully to a new technology by developing a compelling e-book offering.

Most markets experience technology transitions, as shown in **Figure 4**. While one technology is in wide use, the next new technology is in development. A technology transition occurs when the performance of the new technology surpasses the old one. In the lighting industry, for example, the energy efficiency of incandescent bulbs was surpassed by compact fluorescent tubes, which were in turn overtaken by LED bulbs.

FIGURE 4 The Technology S-Curve and Technology Transitions

Source: Clayton M. Christensen, "Exploring the Limits of the Technology S-Curve. Part 1: Component Technologies," *Production and Operations Management* 1, no. 4 (Fall 1992): 340. © 1992 Production and Operations Management Society. Reprinted by permission of Wiley.

Many innovators are established firms that plan to stay in an industry through multiple generations of technology change. Technology innovators that are startup firms, however, face a fundamental question: Should we attempt to transition to the next new technology, or should we sell the business?

A startup may not be able to capture the value of its new technology early in its development. As the technology is proven and the number of potential customers increases, further growth may require a global sales force—a complementary asset that a young firm may not be able to acquire on its own. In such cases, it may be more attractive to sell the business to the right firm at the right time. Because such a decision involves capturing value, whether or when to sell a technology startup is part of technology strategy.

If a technology startup can grow to dominate a market, it has an incentive to remain independent. Amazon, Google, and Microsoft have not been acquired because there is no company that could realize more value from them than they could themselves. In *The Hard Thing About Hard Things*, Ben Horowitz proposes a rule of thumb: "(a) if you are very early on in a very large market and (b) you have a good chance of being number one in that market, then you should remain stand-alone."⁵⁶

Such firms are the exception, however, rather than the rule. Frequently, a startup reaches a point where a customer, competitor, supplier, or complementor can realize more value from the firm than the firm could by remaining independent.

The decision to sell depends on many factors, including market and technology changes. Ben Horowitz continues, explaining how his company, Opsware, had achieved a leading position but was seeing changes in the market due to the new technology of virtualization. Faced with a significant investment to reengineer the product, and with interest from large vendors of complementary products such as Hewlett-Packard, Horowitz decided to sell.

2.3 To Lead or to Follow?

In the previous section, we described the strategic challenges an innovator faces as its new technology and the market for the offering enabled by the new technology develop. We now want to address the question of timing: Should a firm seek to be the first to introduce a new technology to a market, or is it wiser to wait? That is, should the firm be a leader or a follower? In this section, we discuss the factors that influence the success of leading or following. In the following two sections, we apply these concepts to discuss strategies for new and existing markets.

The words *leader* and *follower* may sound like *winner* and *loser*, respectively, but the firm that captures most of the value from a new technology is often not the firm that introduces it to the market. Although the Apple iPhone currently captures the majority of the handset industry's profit, for example, it was not the first smartphone—it was preceded by the BlackBerry, which was preceded in Japan by smartphones from NTT DoCoMo.^{57,58} The early leaders in the US personal computer market included the Altair 8800, followed closely by the Commodore PET, the Apple II, and the Tandy TRS-80 from Radio Shack, yet all of these were superseded by the IBM PC design, which came to dominate the market.⁵⁹ As Constantinos Markides and Paul Geroski explain in their book *Fast Second*, there is a big difference between being first to market and first to the *mass market*.⁶⁰

The firm that first enters a market with an offering based on a new technology is often said to have a first-mover advantage. But a real advantage does not come merely from being first; it comes only when the first mover can use its lead to create a *competitive* advantage. Such competitive advantages may come from:

- Customer lock-in: acquiring customers who would then face switching costs if they defected to a follower's offering.
- Preempting scarce assets: securing exclusive access to scarce assets such as intellectual property or specialized complementary assets.
- Sustaining a technology advantage: using accumulated learning to maintain a technology lead over followers.
- Achieving scale advantages: achieving a cost advantage through economies of scale or a demand-side advantage by exploiting network effects.

In their *Harvard Business Review* article, “The Half Truth of First-Mover Advantage,” Fernando F. Suarez and Gianvito Lanzolla argue that the likelihood of first-mover advantage depends on the pace at which the technology is evolving and the rate at which the market is expanding. If technology is changing rapidly, a first-mover advantage is unlikely to last long because a fast follower can enter the market with a superior technology—a strategy sometimes called *technological leapfrogging*.⁶¹ The iPhone, for example, was not just a variant on the BlackBerry; with its large touch screen, intuitive user interface, and ability to integrate music and video playing seamlessly, the iPhone provided a jump in performance over the earlier market leaders.

If the market is growing very rapidly, sustaining a first-mover advantage will likely require substantial resources, potentially opening the door for fast followers to target new customer segments.⁶² Amazon is an example of a successful follower. The first online bookstore was established by Charles Stack in 1991, several years before Amazon entered the market. Amazon was able to dominate the market, however, by establishing the standard for an online shopping experience and by making enormous investments to achieve economies of scale and build its brand.⁶³

Complementary assets and switching costs also influence the choice of whether to lead or follow. Technology startup firms with no complementary assets have little choice but to enter a market early and race to establish first-mover advantage. Firms with significant resources and complementary assets can afford to wait and enter when the technology is more established, however, as GE did with the CT scanner and IBM did with the PC.

When a new technology enables a firm to target multiple markets, the choice of whether to lead or follow is related to the choice of market. If one firm introduces the new technology to a market, a second firm can choose to follow in the same market or lead in some other market. In *Zero to One*, Peter Thiel argues that, where possible, firms should seek to create a monopoly in a new market rather than targeting existing markets and attempting to disrupt others.⁶⁴ We will discuss disruptive technologies in more detail in section 2.5.

2.4 Strategies for New Markets

At the formation of a new market, there are no incumbent firms. The first personal computer, for example, created a new market, and new entrants targeted customers who had never purchased a computer. Consequently, the strategic issues in new markets are not concerned primarily with displacing incumbent firms but with growing the market and developing a competitive advantage.

First movers in new markets may not be able to achieve a substantial competitive advantage for several reasons. One is that a new market for a radically new offering tends to attract many entrants, all offering different designs. In the market's early stages, product features come from supply push—that is, from technologists' exploring the possibilities of the new technology. The resulting proliferation of features and incompatible designs makes it difficult for any early mover to achieve significant scale; the early majority of the market, along with industry suppliers and suppliers of complementary goods and services, waits for a dominant design to emerge. Markides and Geroski cite the example of the early years of the automobile industry, when over 1,000 automobile firms produced an enormous variety of cars “powered by gasoline, electricity, and steam: cars with three and four wheels, and cars with open or closed bodies that came in a bewildering variety of different designs.”⁶⁵

This initial proliferation of offerings presents an opportunity for a fast second mover to establish a dominant design, consolidate the market, achieve economies of scale, drive down costs, and capture the bulk of the available profits. Ford's Model T established a dominant design, drove down costs, and facilitated the rapid growth of the automobile market. Similarly, the IBM PC established a standard that led to the rapid growth of the personal computer market. The smartphone market did not take off until Apple and Google established standard operating system designs. These firms were not the first to enter their respective markets with an offering based on a new technology, but by being a fast second mover, each was able to dominate a large segment of the new market.

Establishing a dominant design and consolidating a new market typically require substantial resources and significant complementary assets. Apple, for example, had a powerful brand, a strong manufacturing capability, control of a comprehensive ecosystem of complementary products and services, and the financial resources to invest heavily in advertising. In *Fast Second*, Markides and Geroski argue that established firms with significant complementary assets are in a powerful position to act as fast followers and capture the majority of the value from new markets. As we discussed in the Commercialization section of this reading, fast followers with valuable complementary assets don't necessarily have to develop their own product; they can purchase technology from an ideas factory (as Eli Lilly

did with Genentech) or engage in reputation-based ideas trading and cooperate with a network of technology developers, as Cisco Systems has done by acquiring more than 150 technology firms.

When a new technology creates an entirely new offering for a new market, Markides and Geroski come down firmly on the side of a fast-second strategy for large firms with complementary assets:

First, note that very few of the original entrants (that is, the pioneers) survive the consolidation of the market—most disappear, never to be heard of again; second, the consolidators who win in the end are almost never the first into the new market. Their success is based not on moving fast but on choosing the right time to move—and that is rarely first; and third, the things that consolidators do—such as entering at the right time, standardizing the product, cutting prices, scaling up production, creating distribution networks, segmenting the market, spending huge amounts of money on advertising and marketing—are exactly the kinds of things that create what we (somewhat inaccurately) call “first-mover advantages.”⁶⁶

For firms following a fast-second strategy, choosing when to enter the market is important. If such a firm enters too early, the technology could be quickly superseded; too late, and another firm could establish the dominant design. Markides and Geroski suggest looking for a slowing in the rate of innovation, a growing sense of legitimacy, and the appearance of complementary goods producers.

A startup with a technology capability but few resources and no valuable complementary assets is very unlikely to be able to enter a market late and consolidate it. Such a firm has little choice but to enter the market early and race to achieve first-mover advantages. Many such firms seek to be acquired by followers with substantial resources or to attract the resources needed to grow rapidly through an initial public offering.

2.5 Strategies for Existing Markets

In an existing market, a new entrant exploiting a new technology must take market share from incumbent firms. In the book-retailing industry, for example, Amazon had to develop a strategy to take market share from major booksellers such as Barnes and Noble and Borders. Those incumbents had to develop strategies to respond to the attack from this new competitor.

For incumbents, the strategic questions are: When should we transition to the new technology (if ever)? Should we lead or follow? How can we defend ourselves against a new entrant using the new technology to attempt to take market share? For potential entrants, a new technology represents an opportunity to displace an incumbent. The strategic questions are: Should we enter this market? If so, when? How will we compete successfully with the incumbent? We will first discuss strategies for incumbents, and then proceed to strategies for potential entrants.

Strategies for Incumbents

For industry incumbents, transitioning to a new technology can be expensive and time-consuming. The firm may have to acquire new competencies and assets and discard old ones, causing a wrenching change. A whole network of suppliers, distributors, and producers of complementary goods may have to make substantial investments to adopt the new technology. Incumbents that delay making the transition, however, may face competition from new entrants using the superior technology to gain market share. Richard Foster characterizes this as a battle between attackers and defenders: “Innovation . . . is a battle in the marketplace between innovators or attackers trying to make money by changing the order of things, and defenders protecting their existing cash flows.”⁶⁷

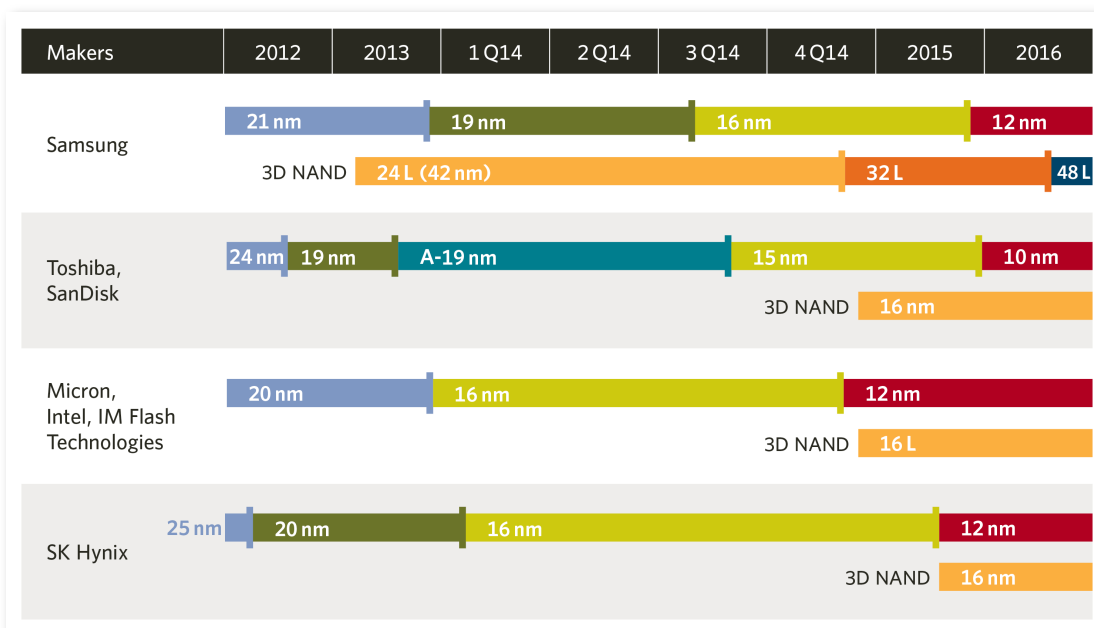
Incumbents should plan for new technologies by developing a technology road map, assessing the strategic implications of the new technology, being alert to disruptive technologies, and building barriers to entry by managing switching costs and developing complementary assets.

Develop a Technology Road Map

Because of the strategic importance of technology transitions and the time, effort, and expense required to make them, businesses need to try to forecast such transitions and plan accordingly. In technology industries, firms often represent their forecast of technology transitions using a technology road map.

In **Figure 5**, a market research firm has forecast the evolution of the technologies used by flash semiconductor memory manufacturers. The technologies are described by their line width. For example, 12 nm indicates that many features on the semiconductor chip will have dimensions as small as 12 nanometers. The term 3D NAND indicates a transition to a technology that will stack transistors in three dimensions instead of the two dimensions currently used. Such a transition substantially increased the capacity of flash memory chips, providing the first company to make that transition with a competitive advantage. Competitors in the flash memory manufacturing industry can use such a road map to plan for future investments to ensure that their product remains competitive.

FIGURE 5 A Technology Road Map for NAND Flash Memory



Source: TechInsights, "Technology Roadmap for NAND Flash," <http://www.techinsights.com/NAND-flash-roadmap/>, accessed June 24, 2014.

Evaluate the Strategic Implications of New Technologies

New technologies that reinforce and enhance the value of an organization's current skills and assets present less of a threat than those that do not. Even a radical technology change can be successfully adopted by incumbent firms when their customers demand it.

Consider the market for automated teller machines (ATMs). ATMs, which allow retail banks to offer 24-hour service to their customers, appeared to be the kind of new technology that could transform an industry. Yet the current industry leader in ATMs is NCR, a company that was founded in 1884 as National Cash Register Company.^{68,69}

Retail banks, cash-handling companies, financial transaction equipment manufacturers, and financial services information technology suppliers comprise a **value network**: a network of organizations that provides a specific measure of customer value. In this case, the measure of value is convenience and security of cash handling. Because ATMs offer improved performance on this measure of value, they sustain or reinforce the value network, and so all members have an incentive to support the new technology. Such new competence-enhancing technologies tend to favor incumbents, which can use their existing skills and assets to exploit the new technology. It would have been difficult for a startup to plug into this value network.

Such new technologies do not represent a strategic threat as long as they result in improved performance that customers are willing to pay for. Clayton Christensen refers to these as **sustaining technologies**.⁷⁰ In a study of disk drive manufacturers, Christensen found that incumbent firms *always* adopted new technologies that were sustaining—that is, technologies that offered improved performance on a dimension that current customers valued, like storage capacity.⁷¹

But incumbents often failed to adopt new technologies that initially underperformed current technologies on the current measure of value, even though they performed better on some other measure, like the physical size of the disk drive. Christensen calls these **disruptive technologies**.

Beware of Disruptive Technologies

Because disruptive technologies offer inferior performance, at least initially, incumbents typically dismiss or ignore them. These technologies, Christensen writes, present “the innovator's dilemma”: By focusing on innovating with a technology that its customers want, the firm may fail to invest in a disruptive technology that may eventually dominate its market. “Blindly following the maxim that good managers should keep close to their customers can sometimes be a fatal mistake.”⁷²

Richard Foster argued that innovators using these new technologies have an attacker's advantage because of the incumbents' difficulty in diverting resources away from profitable and high-margin current technologies to lower-margin and lower-performance new technologies.⁷³ The problem is compounded by the fact that the threat may be difficult to detect—innovators using disruptive technologies often target a niche market and so do not substantially affect the financial performance of the incumbent.

As Geoffrey Moore says, “A key characteristic of a disruptive technology is that it changes the basis of competition.”⁷⁴ Consider Voice over Internet Protocol (VoIP) calls. Subscriber phone calling is profitable, but what happens if everyone makes calls over the Internet using services like Skype? Should phone companies cannibalize their currently profitable business by offering VoIP? Or should they ignore it and risk seeing their profits disappear?

Such new technologies are disruptive because innovators can use them to enter underserved markets, gain experience, and move up the technology performance curve. Christensen argues that by the time the disruptive technology meets the needs of the majority

of customers, the innovator has an unassailable technical lead and can displace the incumbent. Click on **Video 1** to see how innovators can use disruptive technologies to challenge incumbent firms.



VIDEO 1 Disruptive Innovation



Scan this QR code, click the icon, or use this link to access the video: bit.ly/hbsp2utt3og

Ironically, Harvard Business School may face a disruptive technology in the form of online management education courses.⁷⁵ Part of the challenge is in identifying the threat. “Defining the market is hard in changing times,” Foster noted, and requires vigilance.⁷⁶ Henry Ford said that successful defense comes not in “slavish following of its yesterdays” but in “alertness to its day.”⁷⁷

Christensen’s proposed solution is for firms to create separate organizational units with incentives aligned for success with the disruptive technology. In practice, that means (1) placing responsibility for a potentially disruptive technology in an organization whose customers need it (rather than attempting to push it into the firm’s existing markets), (2) giving responsibility to an organization small enough to get excited about small victories, (3) supporting a process of trial and error in the market, and (4) developing new markets that value the attributes of the disruptive technology.⁷⁸ The literature on ambidextrous organizations suggests developing capabilities in the firm to execute a more balanced approach between exploitation (serving current customers) and exploration (investing in innovations).⁷⁹

Christensen’s proposal may not be radical enough, however, for wrenching technological change. Foster cites RCA’s failure to transition from vacuum tubes to transistors, and the bias-ply tire manufacturers’ loss of 50% of their market share to radial-ply tires in just 18 months. “It is relatively easy to spot new technologies on the horizon and to decide to monitor them or perhaps invest in them. What is much harder, indeed agonizing at times, is to stunt the growth of the older technology by withholding development funds from it even though progress can be made. People lose their jobs, friendships are destroyed, often the entire business must change.”⁸⁰ Incumbent booksellers such as Barnes and Noble and Borders, for example, would have had to dismantle their brick-and-mortar businesses rapidly to respond effectively to Amazon’s new technology.

Build Barriers to Entry

Incumbent firms can defend against attack at technology transitions by developing complementary assets and managing switching costs. Consider the impact of new technologies over a 100-year period in the typesetter industry. Typesetting is the process of arranging type prior to printing on paper. Over that period, typesetting saw three radical shifts in technology, as Mary Tripsas describes in a study: from hot metal, to analog phototypesetting, to digital phototypesetting, and finally to laser image setting. In every case, incumbents invested significant resources in the new technology. Because each new technology required new skills, however, the incumbents’ products were substantially inferior initially to those of new entrants. Despite that, in only one of these technology shifts did new entrants displace incumbent firms. In the other cases, incumbents were able to survive because of their ownership of specialized complementary assets: font libraries. The incumbents’ ownership of proprietary fonts made it very difficult for new entrants to offer customers the fonts they were used to. Ownership of specialized complementary assets protected incumbents despite their inferior technology.⁸¹

According to Melissa Schilling, incumbents should work to prevent the emergence of a technological gap by continuous innovation, protecting the installed base (by maintaining

backward compatibility, providing attractive licensing to producers of complementary goods, and increasing customer switching costs), and shaping customers' perceptions that the platform will continue to dominate.⁸² Microsoft's technology strategy for its operating system software is a notable example. By making its products backward-compatible—that is, able to operate with previous versions—Microsoft has worked to reduce switching costs for existing customers who purchase upgrades while preserving switching costs for those thinking of moving to competing software. By ensuring backward compatibility, Microsoft has been able to dominate the PC software industry over generations of software evolution.

Watch for Convergence

The technology-driven convergence of two previously separate industries is another force that can threaten incumbents. Manufacturers of MP3 players, for example, have seen their business disappear as smartphones have incorporated music players. Convergence is yet another reason that technology firms must remain vigilant. If they can spot emerging convergence early, incumbents may be able to position themselves by selling their businesses or evolving into other markets.

Strategies for New Entrants

We addressed technology strategy for innovators at length earlier in this reading. Here, we emphasize the aspect of using a new technology to enter a market with well-established incumbents.

To succeed in attacking incumbents with a new technology, a new entrant needs to offer a significant improvement in performance. If the market features network effects and incumbents have a large base of users, the entrant must also invest heavily in building a customer base and providing complementary assets.

For example, in a study of the US video game console industry, Melissa Schilling found that technological functionality, the size of the installed base, and the availability of complementary goods were critical for success. Late market entrants such as Sony (PlayStation) and Microsoft (Xbox) were able to leapfrog incumbents Atari and Nintendo but only by offering significant improvements in performance, forming alliances with game developers, and marketing aggressively to build installed bases for their consoles. Sony used its powerful relationships with retailers to gain distribution for the PlayStation, and Microsoft spent \$500 million on marketing the Xbox.

Schilling concludes that, when attacking an industry with network effects, a new entrant's strategy should be to create a technological gap, build an installed base, make complementary goods available, and shape customer perceptions about the future size of the installed base and the new technology's likely success.^a She points out that "[t]echnological leapfrogging requires . . . managing a whole system of value components. . . ."⁸³

^a One tactic is to produce so-called vaporware: advance product announcements that influence customers' expectations.

2.6 Riding the Wave

Technology change is difficult to forecast. There is some empirical evidence suggesting, however, that it comes in waves.⁸⁴ For example, new computer and communications technologies combined with the invention of the Internet to create a wave of innovation. According to W. Brian Arthur, “Adaptation means watching for the next wave and positioning the company to take advantage of it. Adaptation is what drives increasing-returns businesses, not optimization.”⁸⁵

Technology strategists describe this adaptation as riding the wave (a reference to surfing). The inter-networking equipment manufacturer Cisco Systems, for example, rode multiple waves of change. The first was a change from manufacturing hardware to outsourcing the manufacturing and focusing on software. The second wave was the surge in demand for corporate networking when companies found a need to connect computer and peripheral equipment from manufacturers that used different communication protocols. The third wave was the rise in Internet Protocol (IP) networking use by corporations. The fourth was the explosion in Internet use by the general public. Cisco did not create any of these waves, but the firm was able to see them building and position itself to ride them all the way to a \$100 billion market capitalization.⁸⁶

Innovators cannot predict a wave of technological change, but savvy innovators can see one coming and position themselves to catch it. When asked how Apple could challenge Microsoft’s dominance, Apple’s former CEO Steve Jobs said, “I’m going to wait for the next big thing.”⁸⁷

2.7 Conclusion

Technology strategy is formed in an environment of uncertainty and risk. Markets that do not exist cannot be analyzed, and new technologies can combine in unexpected ways and with unforeseen consequences. Consequently, no technology strategy is a guarantee against failure.

Yet innovators have a better alternative than to “launch and hope.” The founders of Genentech, Amazon, Microsoft, Google, and Facebook were not just lucky. They understood how to seize an opportunity, remove technical risk cheaply, and identify a compelling application for their technology. They selected commercialization strategies (after some trial and error) based on the power of complementors and the strength of intellectual property rights. They chose to enter markets where their value proposition was strong and the competitive forces were weak. They understood the imperative to improve their value propositions constantly by moving up the technology performance curve. They figured out how to create and control ecosystems, how to shape their competitive environments, and how to negotiate technology transitions successfully.

The tools of strategy analysis apply to technology-based competition. Innovators’ technology strategies still need to answer the fundamental questions: Why would anyone buy from us? Why will we be profitable? To answer those questions, an innovator needs to develop a powerful value proposition; retain ownership of a scarce resource; and manage the evolution of bargaining power and competitive advantage in an environment where suppliers, customers, competitors, and complementors are rapidly changing and adapting. Innovators need to understand the strength of network effects in their markets, measure switching costs and economies of scale, and know how to exploit first-mover advantages and win a standards war. Once they achieve success in their industry, they need to be able to analyze the threats of

disruptive technologies and industry convergence and position themselves to ride the next wave of change.

None of this is easy. Success requires clear-sighted analysis, creativity, and the courage to adapt. To paraphrase Andy Grove, it also helps to be a little paranoid.⁸⁸

3 SUPPLEMENTAL READING

3.1 Platform Technologies

Some technologies are more important than others. Suppose you owned a technology that was *essential* for coordinating suppliers and buyers to deliver consumer value. That would put you in a powerful position to profit. Such essential technologies are often referred to as **platform technologies**.

The Boeing 787 airframe, for example, is a platform technology. Without such a platform, the manufacturers of airplane seats, engines, overhead lockers, and avionics cannot create value for the end customer. Facebook is also a type of platform. It coordinates suppliers and consumers of social information. Without a social media platform such as Facebook, it would be much more difficult and costly for people to exchange social information.

Industries can contain competing platforms. The various Boeing airframe platforms compete with Airbus platforms. Facebook competes with Google Plus and Twitter. In the video gaming industry, Sony's PlayStation competes with Microsoft's Xbox and Nintendo's Wii.

However, some industries have seen the emergence of **industry platforms**, which shape the technological evolution of an industry. The firms that own such platforms are **platform leaders**. In the personal computer industry, Microsoft's operating system for the personal computer has dominated and shaped the evolution of the industry and generated enormous value for its shareholders.

Microsoft's operating system became an industry platform in part because of its leverage of indirect network effects in which demand on one side of the platform (the users) affects supply on the other side (the application developers). Microsoft allowed third-party software developers to produce software that ran on its operating system, so the more users who chose computers running Microsoft's operating system, the more incentive there was for application developers to write software for the platform, which further increased its value to users.

Indirect network effects are such an important factor in determining which platforms come to dominate an industry that some people *define* a platform as something that exhibits those effects.⁸⁹ Payment platforms such as Visa and PayPal, online dating platforms such as Match.com, social media platforms such as Facebook, trading platforms such as eBay, and gaming platforms such as the Sony PlayStation have all become powerful in their industries because of indirect network effects. Although not all technology platforms exhibit powerful network effects (the Boeing airframe, for one), those that do have a better chance of growing to a position of dominance in their industries.

In his research on platform management, Kevin Boudreau has noted that technology platforms can allow an innovator to create the ecosystem around a new technology without giving up the ability to capture value.⁹⁰ Complementors can harness the power of the

technology through the platform, but the innovator can manage it to capture the value generated from complementors' innovations.

The high valuations of some platform technology owners have made platforms a focus of interest in technology strategy. Owners of products or services with platform potential face several strategic questions: How can I transform my product into a platform? What kind of platform should I create? How can I make my platform into a leader in the industry?

According to Annabelle Gawer and Michael Cusumano, to have platform potential, a product (or technology or service) "should perform at least one essential function . . . or solve an essential technological problem within an industry."⁹¹ A computer game, for example, does not have platform potential because no one game is essential. The game console, on the other hand, has platform potential because it performs an essential function: It provides the processing power to render the graphics necessary to engage gamers.

Gawer and Cusumano propose that firms that want to be platform leaders follow two principal strategies. The first is coring: transforming a product into a platform. Qualcomm, for example, developed a communications technology for mobile phones called CDMA, protected the technology with patents, then licensed it widely and created a chip set that made it easy for cell phone manufacturers to incorporate the technology into their products.

The second strategy is tipping: the process of building market momentum so that the industry tips toward wide adoption of the platform technology. Tactics can include penetration pricing and subsidies, building coalitions of customers, and providing powerful incentives for complementors. Linux became one of the dominant platforms for Web servers because of its high quality; low price; tight integration with the free, open-source Apache Web server; and powerful coalition of supporters, including IBM and Hewlett-Packard. Gawer and Cusumano's strategic options are summarized in **Table 2**.

TABLE 2 Strategies to Become a Platform Leader: Coring and Tipping

Strategic Option	Technology Actions to Consider	Business Actions to Consider
<p>Coring: How to create a new platform where none existed before</p>	<p>Solve an essential "system" problem.</p> <p>Facilitate external companies' provision of add-ons.</p> <p>Keep intellectual property closed on the innards of your technology.</p> <p>Maintain strong interdependencies between platform and complements.</p>	<p>Solve an essential business problem for many industry players.</p> <p>Create and preserve complementors' incentives to contribute and innovate.</p> <p>Protect your main source of revenue and profit.</p> <p>Maintain high switching costs to competing platforms.</p>
<p>Tipping: How to win platform wars by building market momentum</p>	<p>Try to develop unique, compelling features that are hard to imitate and that attract users.</p> <p>Tip across markets: absorb and bundle technical features from an adjacent market.</p>	<p>Provide more incentives for complementors than your competitors do.</p> <p>Rally competitors to form a coalition.</p> <p>Consider pricing or subsidy mechanisms that attract users to the platform.</p>

Source: Annabelle Gawer and Michael A. Cusumano, "How Companies Become Platform Leaders," *MIT Sloan Management Review* 49 (Winter 2008): 28-35. © 2008 from MIT Sloan Management Review/Massachusetts Institute of Technology. All rights reserved. Distributed by Tribune Content Agency, LLC.

One key choice in platform development is the degree of openness—that is, the extent to which other firms can use the platform to create customer value. More access to the platform can substantially accelerate the development of complementary products. Too much access may allow others to capture all the value. Apple lost the war for dominance in desktop computing to Microsoft because it did not allow third-party developers to access the platform and contribute to compatible software applications. IBM won the standards war in desktop computing by allowing third-party entry into hardware manufacturing but lost the ability to capture substantial value from the PC because it also allowed Microsoft to retain ownership of the operating system.

Another key choice for platform technology owners is the business model—more precisely, what kind of intermediary the owner of the platform technology wants to be.⁹² Amazon, for example, acts as an online retailer for most products, choosing which products to sell and what prices to ask. Suppliers and customers do not interact directly. But Amazon also provides a platform over which people can interact directly to buy and sell used books, and Amazon collects a commission. The company has reportedly found that the margins from providing a platform are greater than those from operating as a reseller.⁹³ Apple also uses both models. For music and movies sold over iTunes, Apple acts as a reseller. But Apple's App Store provides a platform for direct interaction between buyers and sellers of application software. Andrei Hagiu and Julian Wright's "Do You Really Want to Be an eBay?" discusses the factors firms should consider in selecting a particular platform model.⁹⁴

Not every new technology has platform potential, but every firm must understand the importance of platforms. Firms with a product that has platform potential need a strategy to win a platform war (which is analogous to a standards war) without giving up too much value. Firms producing products that are part of an ecosystem dominated by an industry platform need a strategy to remain compatible with that platform while avoiding commoditization or competition from the platform owner. Coexisting with a powerful platform can be difficult, as the developers of application software such as WordPerfect and Lotus 1-2-3, both designed to run on Microsoft's operating system, can attest; both were superseded by Microsoft's own products (Word and Excel, respectively). Maybe that's why these days "everyone wants to be a platform."⁹⁵

4 KEY TERMS

attacker's advantage The advantage an entrant with a new technology may have when it is difficult for incumbents to divert resources away from profitable and high-margin current technologies.

commercialize The process by which a firm brings a product or service to market and makes money from it.

complementary assets The assets associated with a product or service that are necessary to commercialize it successfully.

complementor A firm in one industry whose products or services increase the value of the products or services of a firm in another industry.

creative destruction The creation and destruction of businesses through revolutions in technology.

disruptive technologies Technologies that offer inferior performance, at least initially, along dimensions that current customers value and are therefore dismissed or ignored by incumbents.

dominant design The design that becomes the standard in the market.

early adopters The first users to see the benefits of a new technology and who adopt it.

economies of scale A situation in which a firm's average production costs decrease for each additional unit of output at a high level of production.

ecosystem The set of mutually dependent suppliers, customers, and complementors that work together to create value.

first-mover advantage A competitive advantage that a firm can derive by being first to market.

increasing returns to scale Relationship between two elements where one increases disproportionately to increases in the other. In this reading, the elements are profits and customers.

industry platform A platform technology that shapes the evolution of an industry.

information goods Technological products and services for which the marginal cost is almost zero.

innovation A new technology that significantly improves a product or service on a dimension of performance that current or new customers value.

network effects A situation in which the value of an offering to a customer depends on how many other customers have chosen the same offering.

platform leader A firm that owns an industry platform.

platform technology A technology that is essential for coordinating suppliers and buyers in order to deliver value to consumers.

revenue model How firms make money for the product or service they provide.

S-curve Pattern of increases relative to effort and time in which the increases are slow, then rapid, then slow. In this reading, the patterns identify how performance and market diffusion increase relative to effort and time.

standards war A winner-take-all situation in which firms with different product designs compete to make their design the industry standard.

sustaining technology A technology that offers improved performance along a dimension that current customers value.

switching costs The costs associated with switching from one product to another.

technological leapfrogging A situation in which a new firm's technological offering is superior to those of incumbents.

technology The way an organization creates outputs from inputs.

technology strategy An integrated set of choices about how to use new technology to produce superior financial returns in the long run.

value network A network of organizations that provides some type of value to customers.

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