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.[45]

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.

Growth Strategy: 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. With a new technology, the difference is that all of these conditions 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 offering based on newer technology. As we will see later, such ***technological leapfrogging*** is an important tactic in technology strategy.

Similarly, Uber ceded much of its market share in Southeast Asia to rival ride-sharing app Grab. Although Uber made few changes to its app when it entered this market, it initially dominated the region. When Grab moved into the market, however, it supplanted Uber by focusing on localized features that supported a wide range of regional languages, location data, and payment options (including, crucially, cash). Grab also offered variations on its service, such as motorcycle rides, as an alternative in more congested areas. Finally, Grab differentiated itself by adapting its app to appeal to riders' safety concerns and to drivers' desire to view the destination before they accepted a ride—Uber penalized drivers who turned down customers. In this case, "[t]he initial innovations that made Uber dominant also left it vulnerable."[46]

To ensure a superior product, a firm may find it beneficial—or necessary—to fill in the gaps in components and assets when they are unavailable from complementors.[47] While this strategy may drive value and user adoption, it comes with risks. Assets that are susceptible to imitation or face weak intellectual property (IP) protections may benefit the market rather than capture value for the firm. Most successful firms, however, find an optimal balance for their technology to achieve *both* value capture and value creation. In

this "open but not open" approach, a firm opens some assets to attract users and complements but guards others closely to protect and capture the technology's value, and in doing so may be able to shape the market around its standard.[48]

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 called "discovery-driven expeditions into the marketplace."[49] Venture capitalist Ben Horowitz says, "That is what product strategy is all about—figuring out the right product is the innovator's job, not the customer's job."[50] 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. 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. 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.[51] 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.[52]

Establish and Defend Intellectual Property

Maintaining bargaining power though ownership of intellectual property is an important part of a technology strategy. Mobile phone chip maker Qualcomm, for example, remained highly profitable through its control of a suite of patents related to code-division multiple access (CDMA) technology.[53] Qualcomm's bargaining power came from its patents (over 200,000 as of 2016) and R&D,

along with licensing fees and royalties to use its technology. This business model also led to challenges related to licensing agreements and IP, including litigation and regulatory issues, and the company faced changing requirements from regulatory bodies and service providers with each move to a new mobile standard. Nonetheless, in the transition to 4G, which relied on its underlying technologies, Qualcomm continued to hold a dominant share of the market. [54]

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 cooperation and competition, Adam Brandenburger and Barry Nalebuff used the term *co-opetition*.[55]

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 cited 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. Thus, 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.[56]

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."[57]

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].) 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. The aggressive growth strategy favors value creation for the firm and its ecosystem, but at the cost of value capture (profit). In entering a winner-take-all (or winner-take-most) market, a firm will first need to overcome the chicken-or-egg problem and grow aggressively with little expectation of short-term returns and plans to monetize later, especially when network effects exist.

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.[58] 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.[59] 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 by, 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 must react to any choices that change the competitive environment. If a supplier decides to integrate forward and enter the market, for example, the innovator must respond.

An alternative approach is to try to *shape* the competitive environment. By changing the basis of competition by influencing the strategic decisions of competitors, suppliers, customers, and others in the ecosystem, innovators can set 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 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."[60]

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).[61] 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 was able to 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 during its initial public offering in 1997:

> 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.[62]

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 Surface tablets and PCs. Amazon offers its Kindle readers and Echo devices, along with its web services offerings. 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. Transforming a product into a platform is also a new opportunity to change the competitive landscape. (More on the risks and rewards of creating a platform is discussed in the Supplemental Reading in section 3.1.)

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

2.2.5 Maturity

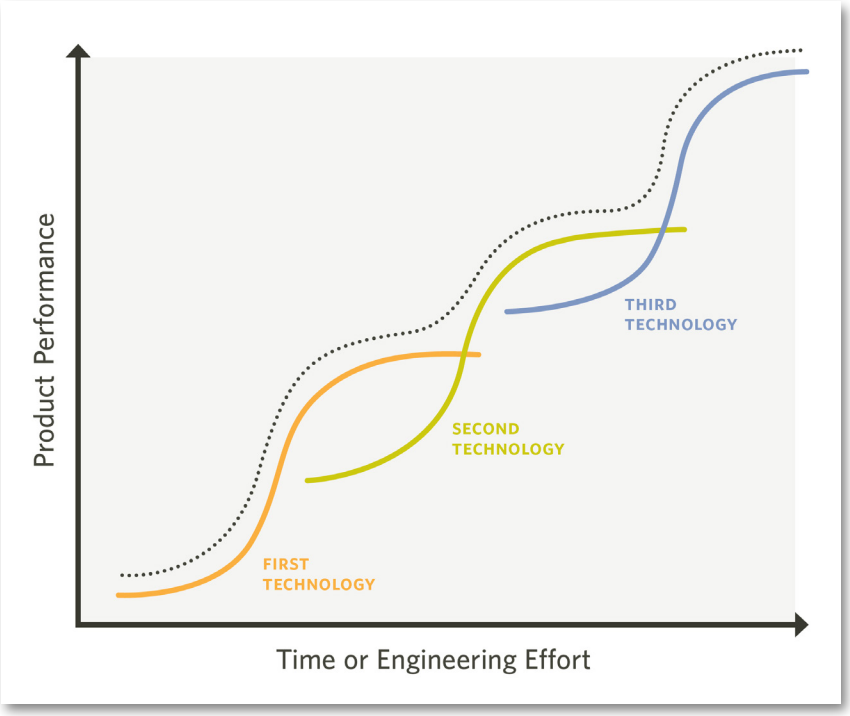
At some point in the development of a market, growth starts to level off. Everyone who wants the offering based on the new technology has it. For example, the US market for thin-screen LCD computer displays grew rapidly as

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, as well as food retail with its acquisition of Whole Foods, and services such as furniture assembly and home theater setup.[63] The company also transitioned successfully to a new technology by developing an e-book offering.

Most markets experience technology transitions, as shown in **Exhibit 5**. 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.

EXHIBIT 5 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. In *The Hard Thing About Hard Things*, 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."[64]

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. Horowitz goes on to explain that 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. Then, in the sections that follow, 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. By 2019, the Apple iPhone had captured the majority of the handset industry's profit, but it was not the first smartphone—it was preceded by the BlackBerry, which was preceded in Japan by smartphones from NTT DoCoMo.[65,66] 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.[67] 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*.[68]

Rather than focusing on being first to market, *leading* or *following* refers to achieving the optimal timing along the adoption curve: Do you want to *follow the market* and enter based on "expected impending adoption of the new technology by the broader market"? Or do you want to "*lead the market* by driving that technology adoption with your strategy"?[69] Followers tend to strategize for a "fragmented market structure where multiple firms can coexist" and capture value. Leaders anticipate a winner-take-all scenario where a firm "must grow at all costs today or risk being locked out forever," which requires investing aggressively at the outset—even at a loss—to push the market forward as quickly as possible, which often requires enormous resources to build an ecosystem and outlast the competition.[70]

While the firm that first enters a market with an offering based on a new technology is often said to have a *first-mover advantage*, 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. For markets that appeal to early entrants—which also tend to be winner-take-all scenarios[71]—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*.[72] 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.[73] 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.[74]

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.[75] We will discuss disruptive technologies in more detail in section 2.5, Strategies for Existing Markets.

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."[76]

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 PC 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 discussed in section 2.2.3, Commercialization, 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."[77]

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 an initial strategy to take market share from major booksellers at the time, including Barnes & 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.

2.5.1 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."[78]

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

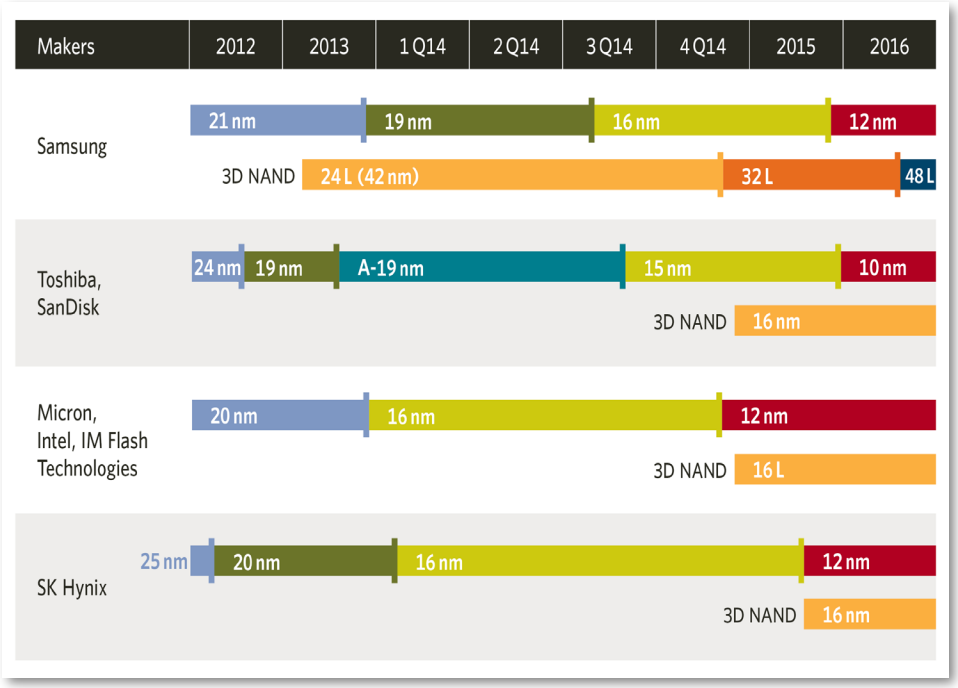
Develop a Technology Road Map

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 **Exhibit 6**, a market research firm has forecast the evolution of the technologies used by flash semiconductor memory manufacturers. The term *3D NAND* indicates a transition to a technology that stacks transistors in three dimensions instead of the two dimensions previously used. Such a transition substantially increased the capacity of flash memory chips, giving the first company to make that transition a competitive advantage. In Exhibit 6, *32L* indicates the number of layers of stacked NAND flash chips, and the roadmap anticipates a 48L 3D NAND chip. By 2019, a 1024GB chip combined eight-stacked 96L V-NAND chips had been announced, and the roadmap was shifting once again to consider future capacity as well as further advances in chip design. Competitors in the flash memory manufacturing industry can use such a

roadmap to plan for future investments to ensure that their product remains competitive.

EXHIBIT 6 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 the industry. Yet the company that became an industry leader in ATMs was NCR, a company that was founded in 1884 as National Cash Register Company.[79]

Retail banks, cash-handling companies, financial transaction equipment manufacturers, and financial services information technology suppliers comprise a ***value network***: a network of organizations that provide 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 referred to these as ***sustaining technologies***.[80] 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.[81]

But incumbents often failed to adopt new technologies that initially underperformed compared to 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 called these ***disruptive technologies***.

Beware of Disruptive Technologies

Because disruptive technologies offer inferior performance, at least initially, incumbents typically dismiss or ignore them. These technologies, according to Christensen, 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."[82]

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.[83] 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."[84] 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 argued 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. Harvard Business School itself faced a disruptive technology in the form of online management education courses.[85] Part of the challenge is in identifying the threat. "Defining the market is hard in changing times," Foster noted, and requires vigilance.[86] Henry Ford said that successful defense comes not in "slavish following of its yesterdays" but in "alertness to its day."[87]

VIDEO 1 Disruptive Innovation
To view the video, select the icon or use this link.

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.
4. Developing new markets that value the attributes of the disruptive technology.[88]

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).[89]

Christensen's proposal may not be radical enough, however, for wrenching technological change. Foster cites classic examples, such as 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."[90] Incumbent booksellers such as Barnes & 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.[91]

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.[92] 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 be an opportunity for value creation—as Apple saw with its deliberate approach to adding iPod features to the iPhone[93]—but it can also threaten incumbents. Manufacturers of MP3 players 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.

2.5.2 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."[94]

2.6 Riding the Wave

Technology change is difficult to forecast. There is some empirical evidence suggesting, however, that it comes in waves.[95] 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."[96]

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

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

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.[97]

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."[98]

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.[99]

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 Twitter, LinkedIn, TikTok, and Snapchat. In the video game industry, Sony's PlayStation competes with Microsoft's Xbox and Nintendo. 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***. Microsoft's operating system for the PC has dominated and shaped the evolution of the PC 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.[100] Payment platforms such as PayPal or Square, 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.[101] 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?

As appealing as the platform model is to both companies and investors, not every product is destined to become a platform. Harvard Business School professors Feng Zhu and Marco Iansiti caution, "Too many companies believe that moving to a platform will somehow revive a struggling product. That's a mistake."[102] 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."[103] 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. Tactics for coring include maintaining high switching costs along with high ***multihoming costs*** so that users commit to only one platform rather than using multiple platforms simultaneously.[104]

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 **Exhibit 7**.

EXHIBIT 7 Strategies to Become a Platform Leader: Coring and Tipping

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

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.[105] 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. Amazon Marketplace provides a platform over which suppliers interact directly with customers, and Amazon collects a commission.[106] The company has reportedly found that the margins from providing a platform are greater than those from operating as a retailer.[107]

The hybrid approach that Amazon takes, providing both a retail business and a platform, has been a successful business model for other firms as well.[108] For music and movies sold over the iTunes Store, 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.[109]

Not every new technology has potential as a successful platform, 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.

Consider, for instance, the challenges EbonyLife Media, the production company behind many of Nigeria's biggest films and TV shows, faced as it decided whether to build and maintain an on-demand streaming platform.[110] Initially, the company's goal was to exert greater control over its own product creation and distribution—a significant value driver for many established firms. EbonyLife had already encountered risks when working with an outside platform, [111] including the bargaining power of the platform owner, which had the ability to cancel distribution contracts, as well as reduced visibility into market data, such as viewership. At the same time, the firm had to weigh the network effects already in place; the benefits of working with a streaming platform included a ready-made installed base of users and proven market share for building a critical mass of content to attract users.

Further, any firm that produces products that are part of an ecosystem dominated by an industry platform needs 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). Perhaps "everyone wants to be a platform,"[112] but the role of the strategist is essential in identifying which technologies have platform potential.

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.

chicken-or-egg problem This occurs when a new product relies on network effects for success but does not yet have the critical mass of users needed to acquire and retain new customers.

commercialize To bring 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 the product or service 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.

multihoming cost The cost and effort required for a single customer or partner to use multiple competing products or platforms.

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.

winner-take-all market A scenario in which a product or service is favored over others for a disproportionately large share of profits in the market, and this product or service ultimately dominates the market.

5 FOR FURTHER READING

Adner, Ron. *The Wide Lens: What Successful Innovators See That Others Miss*. New York: Portfolio, 2012.

Ahuja, Gautam, Curba Morris Lampert, and Elena Novelli. "The Second Face of Appropriability: Generative Appropriability and Its Determinants." *Academy of Management Review* 38 (April 2013): 248–269.

Arora, Ashish, Andrea Fosfuri, and Alfonso Gambardella. *Markets for Technology: The Economics of Innovation and Corporate Strategy*. Cambridge, MA: MIT Press, 2001.

Arthur, W. Brian. *Increasing Returns and Path Dependence in the Economy*. Ann Arbor: University of Michigan Press, 1994.

Boudreau, Kevin J., and Karim R. Lakhani. "Using the Crowd as an Innovation Partner." *Harvard Business Review* 91 (April 2013): 60–69.

Bresnahan, Timothy F., and Manuel Trajtenberg. "General Purpose Technologies: Engines of Growth?" *Journal of Econometrics* 65 (January 1995): 83–108.

Brynjolfsson, Erik, and Adam Saunders. *Wired for Innovation: How Information Technology Is Reshaping the Economy*. Cambridge, MA: MIT Press, 2009.

Buge, Max, and Pinar Ozcan. "Platform Scaling, Fast and Slow." *MIT Sloan Management Review* 62, no. 3 (Spring 2021): 40–46.

Cusumano, Michael A. *Staying Power: Six Enduring Principles for Managing Strategy and Innovation in an Uncertain World*. New York: Oxford University Press, 2010.

Dosi, Giovanni. "Technological Paradigms and Technological Trajectories: A Suggested Interpretation of the Determinants and Directions of Technical Change." *Research Policy* 11 (June 1982): 147–162.

Duncan, Robert B. "The Ambidextrous Organization: Designing Dual Structures for Innovation." In *The Management of Organization Design: Strategies and Implementation*, edited by Ralph H. Kilmann, Louis R. Pondy, and Denis P. Slevin. New York: North Holland, 1976, pp. 167–188.

Fagerberg, Jan, David C. Mowery, and Richard R. Nelson, eds. *The Oxford Handbook of Innovation*. New York: Oxford University Press, 2004.

Gawer, Annabelle, and Rebecca M. Henderson. "Platform Owner Entry and Innovation in Complementary Markets: Evidence from Intel." *Journal of Economics and Management Strategy* 16 (Spring 2007): 1–34.

Greenstein, Shane M. *Diamonds Are Forever, Computers Are Not: Economic and Strategic Management in Computing Markets*. London: Imperial College Press, 2004.

Jaffe, Adam B., and Benjamin F. Jones, eds. *The Changing Frontier: Rethinking Science and Innovation Policy*. Chicago: University of Chicago Press, 2015.

King, Andrew, and Karim R. Lakhani. "Using Open Innovation to Identify the Best Ideas." *MIT Sloan Management Review* 55 (Fall 2013): 41–48.

Klepper, Steven. "Entry, Exit, Growth, and Innovation over the Product Life Cycle." *The American Economic Review* 86 (June 1996): 562–583.

Knee, Jonathan. "Why Some Platforms Are Better Than Others." *MIT Sloan Management Review* 59, no. 2 (Winter 2018): 18–20.

Kuhn, Thomas S. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, 1962.

March, James G. "Exploration and Exploitation in Organizational Learning." *Organization Science* 2 (February 1991): 71–87.

Simon, Herbert A. "Forecasting the Future or Shaping It?" *Industrial and Corporate Change* 11 (June 2002): 601–605.

Teece, David J. "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy." *Research Policy* 15 (December 1986): 285–305.

Tushman, Michael L., and Philip Anderson. "Technological Discontinuities and Organizational Environments." *Administrative Science Quarterly* 31 (September 1986): 439–465.

Tushman, Michael L., and Charles A. O'Reilly III. "Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change." *California Management Review* 38 (Summer 1996): 8–30.

Utterback, James M. *Mastering the Dynamics of Innovation*. Boston: Harvard Business School Press, 1994.

Van Alstyne, Marshall W., and Geoffrey G. Parker. "Digital Transformation Changes How Companies Create Value." *Harvard Business Review* web, December 17, 2021. https://hbr.org/2021/12/digital-transformation-changes-how-companies-create-value.

von Hippel, Eric. *The Sources of Innovation*. Oxford: Oxford University Press, 1988.

6 ENDNOTES

[1] Peter A. Thiel and Blake Masters, *Zero to One: Notes on Startups, Or How to Build the Future* (New York: Crown Business, 2014), p. 2.

[2] "Saudi America," *The Economist*, February 15, 2014, https://www.economist.com/united-states/2014/02/14/saudi-america, accessed June 2022.

[3] James Barron, "Before Anyone Complained About the Air-Conditioning, an Idea," *The New York Times*, July 16, 2012, http://cityroom.blogs.nytimes.com/2012/07/16/before-anyone-complained-about-the-air-conditioning-an-idea/, accessed June 2022.

[4] See, for example, Hal R. Varian, "Technology," in *Intermediate Microeconomics: A Modern Approach,* 6th ed. (New York: W.W. Norton, 2002).

[5] William R. Trumble, "Technology," in *Shorter Oxford English Dictionary*, 6th ed. (New York: Oxford University Press, 2007).

[6] Flowers Foods Inc., https://www.wonderbread.com/about-us, accessed June 2022.

[7] Joseph A. Schumpeter, *Capitalism, Socialism, and Democracy*, 3rd ed. (New York: HarperCollins Publishers, 2003), p. 84.

[8] Joseph A. Schumpeter, *Capitalism, Socialism, and Democracy*, 3rd ed. (New York: HarperCollins Publishers, 2003), p. 81.

[9] William J. Baumol, *The Free Market Innovation Machine: Analyzing the Growth Miracle of Capitalism* (Princeton, NJ: Princeton University Press, 2002).

[10] Michael L. Tushman and Philip Anderson, "Technological Discontinuities and Organizational Environments," *Administrative Science Quarterly* 31 (September 1986): 439–465.

[11] Michael J. De La Merced, "Eastman Kodak Files for Bankruptcy," *The New York Times*, January 19, 2012, http://dealbook.nytimes.com/2012/01/19/eastman-kodak-files-for-bankruptcy/, accessed June 2022. For more on Kodak post-bankruptcy, see "Kodak: The Rebirth of an Iconic Brand" (HBS No. 519-051) by Anat Keinan, Michael Beverland, and Giana M. Eckhardt, and "Kodak's Downfall Wasn't About Technology" by Scott D. Anthony, *Harvard Business Review,* July 15, 2016.

[12] There is a large amount of literature on innovation processes and startups. See, for example, Eric Ries, *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses* (New York: Crown Business, 2011). See also the literature on open innovation: Eric von Hippel, *The Sources of Innovation* (Oxford: Oxford University Press, 1988); Kevin J. Boudreau and Karim R. Lakhani, "Using the Crowd as an Innovation Partner," *Harvard Business Review* 91 (April 2013): 60–69; Andrew King and Karim R. Lakhani, "Using Open Innovation to Identify the Best Ideas," *MIT Sloan Management Review* 55 (Fall 2013): 41–48.

[13] Dickson L. Louie and Jeffrey F. Rayport, "Amazon.com (A)," HBS No. 897-128 (Boston: Harvard Business School, 1998).

[14] Nathan Rosenberg, "Innovation's Uncertain Terrain," *McKinsey Quarterly* 3 (1995): 170.

[15] Andy Wu, "Strategy for Technology on the Cutting Edge," HBS No. 721-444 (Boston: Harvard Business School Publishing, 2021), p. 1.

[16] Andy Wu, "Strategy for Technology on the Cutting Edge," HBS No. 721-444 (Boston: Harvard Business School Publishing, 2021).

[17] David J. Teece, "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy," *Research Policy* 15 (December 1986): 285–305.

[18] For a discussion of sources of growth for online platforms , see "Digital Platforms: An Introduction" HBS No. 621-016.

[19] Andy Wu, "Competitive Growth Strategy in Technology," HBS No. 721-442 (Boston: Harvard Business School Publishing, 2021).

[20] Chiara Farronato, Michael W. Toffel, Feng Zhu "Digital Platforms: An Introduction," HBS No. 621-016. (Boston: Harvard Business School Publishing, 2020).

[21] Richard N. Foster, *Innovation: The Attacker's Advantage* (New York: Summit Books, 1986), p. 31.

[22] Zvi Griliches, "Hybrid Corn: An Exploration in the Economics of Technological Change," *Econometrica* 25 (October 1957): 501–522.

[23] Tania Bucic and Gaganpreet Singh, "Apple Watch: Managing Innovation Resistance," HBS No. W18034 (Ivey Business School Foundation, 2018). Katie Canales, "The Apple Watch Wasn't Always the King of Smartwatches" Insider.com, June 13, 2021 https://www.businessinsider.com/history-of-apple-watch-smartwatch-fitbit-wearable-fitness-facebook-2021-6, accessed June 2022.

[24] Geoffrey A. Moore, *Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers,* 3rd ed. (New York: HarperCollins, 2014), p. 23.

[25] This discussion of Kleiner-Perkins and Genentech is reprinted from Harvard Business School, "Kleiner-Perkins and Genentech: When Venture Capital Met Science," HBS No. 813-102, by G. Felda Hardymon and Tom Nicholas. Copyright © 2019 by the President and Fellows of Harvard College; all rights reserved.

[26] G. Felda Hardymon and Tom Nicholas, "Kleiner-Perkins and Genentech: When Venture Capital Met Science," HBS No. 813-102 (Boston: Harvard Business School Publishing, 2019).

[27] G. Felda Hardymon and Tom Nicholas, "Kleiner-Perkins and Genentech: When Venture Capital Met Science," HBS No. 813-102 (Boston: Harvard Business School Publishing, 2019).

[28] Carl Shapiro and Hal R. Varian, *Information Rules: A Strategic Guide to the Network Economy* (Boston: Harvard Business School Press, 1998).

[29] "Jeff Bezos: The King of E-Commerce," *Entrepreneur*, May 16, 2022, http://www.entrepreneur.com/article/197608, accessed June 2022.

[30] Reprinted from Harvard Business School, "Amazon.com (A)," HBS No. 897-128, by Jeffrey F. Rayport and Dickson L. Louie. Copyright © 1997 by the President and Fellows of Harvard College; all rights reserved.

[31] Jeffrey F. Rayport and Dickson L. Louie. "Amazon.com (A)," HBS No. 897-128 (Boston: Harvard Business School, 1997).

[32] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Boston: Harvard Business School Press, 1997), p. 20.

[33] Michael A. Cusumano and David B. Yoffie, *Competing on Internet Time: Lessons from Netscape and Its Battle with Microsoft* (New York: Free Press, 1998).

[34] Joshua S. Gans and Scott Stern, "The Product Market and the Market for 'Ideas': Commercialization Strategies for Technology Entrepreneurs," *Research Policy* 32 (February 2003): 333–350.

[35] David J. Teece, "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy," *Research Policy* 15 (December 1986): 285–305.

[36] Extensions to this commercialization strategy choice framework can be found in Gautam Ahuja, Curba Morris Lampert, and Elena Novelli, "The Second Face of Appropriability: Generative Appropriability and Its Determinants," *Academy of Management Review* 38 (April 2013): 248–269.

[37] Jeffrey F. Rayport and Dickson L. Louie. "Amazon.com (A)," HBS No. 897-128 (Boston: Harvard Business School) 1997, John R. Wells, Benjamin Weinstock, Galen Danskin and Gabriel Ellsworth "Amazon.com, 2021" HBS No. 716-402 (Boston: Harvard Business School Publishing, 2021).

[38] This discussion of Kleiner-Perkins and Genentech is reprinted from Harvard Business School, "Kleiner-Perkins and Genentech: When Venture Capital Met Science," HBS No. 813-102, by G. Felda Hardymon and Tom Nicholas. Copyright © 2012 by the President and Fellows of Harvard College; all rights reserved.

[39] M. G. Siegler, "When Google Wanted to Sell to Excite for Under $1 Million—And They Passed," *TechCrunch*, September 29, 2010, http://techcrunch.com/2010/09/29/google-excite/, accessed June 2022.

[40] Timothy F. Bresnahan and J. P. Davis, "Economic Value Creation in Mobile Applications," in *The Changing Frontier: Rethinking Science and Innovation Policy,* Adam B. Jaffe and Benjamin F. Jones, eds. (University of Chicago Press, Chicago, 2015).

[41] Timothy Bresnahan et al., "Mobile Applications, The Economics of," in *The New Palgrave Dictionary of Economics,* Online Edition, Steven N. Durlauf and Lawrence E. Blume, eds. (London: Palgrave Macmillan, 2015), available at https://doi.org/10.1057/978-1-349-95121-5_3019-1, accessed June 2022.

[42] Geoffrey A. Moore, *Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers,* 3rd ed. (New York: HarperCollins, 2014), p. 16.

[43] Geoffrey A. Moore, *Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers,* 3rd ed. (New York: HarperCollins, 2014), p. 6.

[44] Geoffrey A. Moore, *Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers,* 3rd ed. (New York: HarperCollins, 2014), p. 6.

[45] Geoffrey A. Moore, *Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers,* 3rd ed. (New York: HarperCollins, 2014), p. 79.

[46] Howard Yu, "For Some Platforms, Network Effects Are No Match for Local Know-How" HBR.org (HBS No. H04GIH), July 26, 2018, p. 4.

[47] Andy Wu, "Strategy for Technology on the Cutting Edge," HBS No. 721-444 (Boston: Harvard Business School Publishing, 2021).

[48] Andy Wu and Aticus Peterson, "Intellectual Property Strategy," HBS No. 721436 (Boston: Harvard Business School Publishing, 2021).

[49] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Boston: Harvard Business School Press, 1997), p. 162.

[50] Ben Horowitz, *The Hard Thing About Hard Things: Building a Business When There Are No Easy Answers* (New York: HarperCollins, 2014), p. 49.

[51] Ben Horowitz, *The Hard Thing About Hard Things: Building a Business When There Are No Easy Answers* (New York: HarperCollins, 2014), pp. 31, 48.

[52] Through July 2021, there were at least 218 acquisitions, based on data at "List of Acquisitions by Cisco," Wikipedia.com, https://en.wikipedia.org/wiki/List_of_acquisitions_by_Cisco, and Cisco.com "Acquisitions by Year," https://www.cisco.com/c/en/us/about/corporate-strategy-office/acquisitions/acquisitions-list-years.html, accessed June 2022.

[53] David Yoffie, Andrei Hagiu, and Liz Kind, "Qualcomm Incorporated 2009," HBS No. 710-433 (Boston: Harvard Business School, 2009).[54] David B. Yoffie and Andrew S. Choi, "Qualcomm Inc., 2019," HBS No. 718-514 (Boston: Harvard Business School Publishing, 2019).

[55] Adam M. Brandenburger and Barry J. Nalebuff, *Co-opetition* (New York: Currency Doubleday, 1996), and the 2021 *Harvard Business Review* article "The Rules of Co-opetition" (HBS No. R2101C).

[56] Clayton Christensen, Michael Raynor, and Matt Verlinden, "Skate to Where the Money Will Be," *Harvard Business Review* 79 (November 2001): 72–81.

[57] Ben Horowitz, *The Hard Thing About Hard Things: Building a Business When There Are No Easy Answers* (New York: HarperCollins, 2014).

[58] W. Brian Arthur, "Increasing Returns and the New World of Business," *Harvard Business Review* 74 (July–August 1996): 100–109.

[59] Carl Shapiro and Hal R. Varian, *Information Rules: A Strategic Guide to the Network Economy* (Boston: Harvard Business School Press, 1998), pp. 227–260.

[60] James M. Utterback, *Mastering the Dynamics of Innovation* (Boston: Harvard Business School Press, 1994), p. 24.

[61] Carl Shapiro and Hal R. Varian, *Information Rules: A Strategic Guide to the Network Economy* (Boston: Harvard Business School Press, 1998), pp. 261–296.

[62] Amazon.com Inc., "Form S-1 Registration Statement," March 24, 1997, p. 5, http://www.sec.gov/Archives/edgar/data/1018724/0000891618-97-001309-index.html, accessed June 2022.

[63] John R. Wells, Benjamin Weinstock, Galen Danskin and Gabriel Ellsworth, "Amazon.com 2021" HBS No. 716-402 (Boston: Harvard Business School Publishing, 2021).

[64] Ben Horowitz, *The Hard Thing About Hard Things: Building a Business When There Are No Easy Answers* (New York: HarperCollins, 2014), p. 49.

[65] Harmeet Singh Walia, Counterpoint Research, "Apple Captures 75% of Global Handset Market Operating Profit in Q2 2021," https://www.counterpointresearch.com/global-handset-market-operating-profit-q2-2021/, accessed June 2022.

[66] "Smartphone," Wikipedia.com, http://en.wikipedia.org/wiki/Smartphone#Early_years, accessed June 2022.

[67] "History of Personal Computers," Wikipedia.com, http://en.wikipedia.org/wiki/History_of_personal_computers, accessed June 2022.

[68] Constantinos C. Markides and Paul A. Geroski. *Fast Second: How Smart Companies Bypass Radical Innovation to Enter and Dominate New Markets* (San Francisco: Jossey-Bass, 2005).

[69] Andy Wu, "Strategy for Technology on the Cutting Edge," HBS No. 721-444 (Boston: Harvard Business School Publishing, 2021), p. 6.

[70] Andy Wu, "Strategy for Technology on the Cutting Edge," HBS No. 721-444 (Boston: Harvard Business School Publishing, 2021), pp. 5-7.

[71] Andy Wu, "Strategy for Technology on the Cutting Edge," HBS No. 721-444 (Boston: Harvard Business School Publishing, 2021),

[72] Melissa A. Schilling, "Technological Leapfrogging: Lessons from the U.S. Video Game Console Industry," *California Management Review* 45 (Spring 2003): 6–32.

[73] Fernando Suarez and Gianvito Lanzolla, "The Half-Truth of First-Mover Advantage," *Harvard Business Review* 83 (April 2005): 121–127.

[74] Amazon.com booked losses of more than $2 billion before turning an accounting profit. Calculation by the writer, based on Amazon's Annual Reports 1995–2002.

[75] Peter A. Thiel and Blake Masters, *Zero to One: Notes on Startups, Or How to Build the Future* (New York: Crown Business 2014), p. 56.

[76] Constantinos C. Markides and Paul A. Geroski. *Fast Second: How Smart Companies Bypass Radical Innovation to Enter and Dominate New Markets* (San Francisco: Jossey-Bass, 2005).

[77] Constantinos C. Markides and Paul A. Geroski. *Fast Second: How Smart Companies Bypass Radical Innovation to Enter and Dominate New Markets* (San Francisco: Jossey-Bass, 2005).

[78] Richard N. Foster, *Innovation: The Attacker's Advantage* (New York: Summit Books, 1986), p. 20.

[79] NCR, "Company Overview," https://www.ncr.com/about/history. NCR led ATM manufacturing, and, in a later shift, became a leader as an ATM software provider (see https://investor.ncr.com/news-releases/news-release-details/ncr-remains-1-provider-multivendor-atm-software-2018-rbr).

[80] Rebecca M. Henderson and Kim B. Clark, "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms," *Administrative Science Quarterly* 35 (March 1990): 9–30.

[81] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Boston: Harvard Business School Press, 1997).

[82] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Boston: Harvard Business School Press, 1997).

[83] Richard N. Foster, *Innovation: The Attacker's Advantage* (New York: Summit Books, 1986).

[84] Geoffrey A. Moore, *Crossing the Chasm: Marketing and Selling Disruptive Products to Mainstream Customers,* 3rd ed. (New York: HarperCollins, 2014), p. 172.

[85] Kara Driscoll, "Why Don't Wharton and Harvard Have Online MBA Programs?," Fortune.com, April 11, 2022, https://fortune.com/education/business/articles/2022/04/11/why-dont-wharton-and-harvard-have-online-mba-programs/, accessed June 2022. For a view of Harvard Business School's response to early trends in online courses, see Jerry Useem, "Business School, Disrupted," *The New York Times*, May 31, 2014, http://www.nytimes.com/2014/06/01/business/business-school-disrupted.html, accessed June 2022.

[86] Richard N. Foster, *Innovation: The Attacker's Advantage* (New York: Summit Books, 1986), p. 157.

[87] Henry Ford, quoted in Richard N. Foster, *Innovation: The Attacker's Advantage* (New York: Summit Books, 1986), p. 22.

[88] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Boston: Harvard Business School Press, 1997), p. 99.

[89] See Robert Duncan, "The Ambidextrous Organization: Designing Dual Structures for Innovation," *The Management of Organization Design* 1 (1976): 167–188; Michael Tushman and Charles A. O'Reilly III, "Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change," *California Management Review* 28 (Summer 1996): 8–30; James March, "Exploration and Exploitation in Organizational Learning," *Organization Science* 2 (May 1991): 71–87.

[90] Richard N. Foster, *Innovation: The Attacker's Advantage* (New York: Summit Books, 1986), p. 139.

[91] Mary Tripsas, "Unraveling the Process of Creative Destruction: Complementary Assets and Incumbent Survival in the Typesetter Industry," *Strategic Management Journal* 18 (Summer 1997): 119–142.

[92] Melissa A. Schilling, "Technological Leapfrogging: Lessons from the U.S. Video Game Console Industry," *California Management Review* 45 (Spring 2003): 6–32.

[93] Alex Heath, Tech Insider, "Apple Explains Its Brutal Survival-of-the-Fittest Approach to Selling Computers," December 22, 2015, https://www.businessinsider.com/apple-on-cannibalization-2015-12, accessed June 2022.

[94] Melissa A. Schilling, "Technological Leapfrogging: Lessons from the U.S. Video Game Console Industry," *California Management Review* 45 (Spring 2003): 6–32.

[95] "Kondratiev Wave," Wikipedia.com, https://en.wikipedia.org/wiki/Kondratiev_wave, accessed June 2022.

[96] W. Brian Arthur, "Increasing Returns and the New World of Business," *Harvard Business Review* 74 (July–August 1996): 100–109.

[97] Richard P. Rumelt, *Good Strategy, Bad Strategy: The Difference and Why It Matters* (New York: Crown Business, 2011), pp. 190–192.

[98] Richard P. Rumelt, *Good Strategy, Bad Strategy: The Difference and Why It Matters* (New York: Crown Business, 2011).

[99] Andrew S. Grove, *Only the Paranoid Survive: How to Exploit the Crisis Points That Challenge Every Company* (New York: Crown Business, 1999).

[100] See, for example, Marc Rysman, "The Economics of Two-Sided Markets," *Journal of Economic Perspectives* 23 (Summer 2009): 125–143.

[101] Kevin Boudreau, "Open Platform Strategies and Innovation: Granting Access vs. Devolving Control," *Management Science* 56 (October 2010): 1849–1872.

[102] Feng Zhu and Marco Iansiti, "Why Some Platforms Thrive . . . and Others Don't," *Harvard Business Review*, January–February 2019, HBS No. R1901J.

[103] Annabelle Gawer and Michael A. Cusumano, "How Companies Become Platform Leaders," *MIT Sloan Management Review* 49 (Winter 2008): 28–35.

[104] Andy Wu, "Strategy for Technology on the Cutting Edge," HBS No. 721-444 (Boston: Harvard Business School Publishing, 2021).

[105] This discussion of platforms as intermediaries is based on Andrei Hagiu, "Multi-Sided Platforms: Foundation and Strategy," HBS No. 714-436 (Boston: Harvard Business School Publishing, 2013).

[106] Chiara Farronato, Michael W. Toffel, Feng Zhu, "Digital Platforms: An Introduction," HBS No. 621-016 (Boston: Harvard Business School Publishing, 2020).

[107] Andrei Hagiu, "Multi-Sided Platforms: Foundation and Strategy," HBS No. 714-436 (Boston: Harvard Business School Publishing, 2013).

[108] Feng Zhu and Nathan R. Furr go into more detail in their article, "Products to Platforms: Making the Leap," in *Harvard Business Review* (April–May 2016); they observe, "It has long been assumed that leaders must commit to either a product-based or platform-based business model, because each demands a particular approach to resource allocations and operations. But firms often employ a hybrid model."

[109] Andrei Hagiu and Julian Wright, "Do You Really Want to Be an eBay?," *Harvard Business Review* 91 (March 2013): 102–108.

[110] Andy Wu, Feng Zhu, Wale Lawal, and Pippa Tubman Armerding, "EbonyLife Media (A)," HBS No. 722–373 (Boston: Harvard Business School Publishing, 2022).

[111] Feng Zhu, "Business Model Transformation in the Platform Age," HBS No. 620-109 (Boston: Harvard Business School Publishing, 2020).

[112] Derek Pilling, "So, You Want to Be a Platform?," CloudAve blog post, November 25, 2009, http://www.cloudave.com/1149/so-you-want-to-be-a-platform/, accessed June 2022.

7 INDEX