Chapter **Five**

Timing of Entry

UberAIR

In April 2017, Jeff Holden, the chief product officer at Uber Technologies Inc. announced a radically new product called UberAir, an on-demand air transportation service:

> On-demand aviation, has the potential to radically improve urban mobility, giving people back time lost in their daily commutes. . . . Just as skyscrapers allowed cities to use limited land more efficiently, urban air transportation will use three-dimensional airspace to alleviate transportation congestion on the ground. A network of small, electric aircraft that take off and land vertically (called Vertical Take-off and Landing, or VTOL, and pronounced vee-tol), will enable rapid, reliable transportation between suburbs and cities and, ultimately, within cities.[a]

Uber's on-demand ride-sharing service had seriously disrupted traditional taxi and livery, and induced many people to eschew car ownership altogether. However, that service was based on an innovative business model and a software application—it did not require technological advances in either automobiles or driving infrastructure. UberAIR was almost the opposite: it would leverage Uber's existing business model and software programs, but would require major technological development in air transportation technology, infrastructure for air traffic control, and a network of landing pads. It was an ambitious project, to put it mildly.

Uber's Rise

Uber was founded in 2009 as a taxi-like ride-sharing service. Customers could request a ride using a smartphone application, and the software would notify Uber drivers in the area of the request. When one accepted, it would show the customer the car's approach on a map in real-time. The driver would take the user to their destination, and payment would occur automatically using the customer's credit card information that was stored online.

Perhaps the most unique part of the business model was that Uber drivers did not technically work for Uber. Drivers were independent contractors; they

needed only a smartphone, a driver's license, a car, insurance, and a clean driving record to qualify to become an Uber driver.[b] A dynamic pricing model raised prices when demand was high and drivers were few, and the higher prices, in turn, lured more Uber drivers to start accepting ride requests.

Over time the company added different classes of services (such as UberPool, Uber X, Uber XL, Uber Select), and different services such as food delivery (Uber Eats), freight service (Uber Freight), and pet transport (Uber Pets). By 2016, Uber was also testing autonomous vehicles in San Francisco.

Though the firm had endured numerous early conflicts with taxi unions and some highly public scandals involving one of the company's founders, Travis Kalanick, the service was a huge success. By 2015, it had completed its one billionth ride, making it the second largest ride-sharing service worldwide, after Didi Chuxing in China. By 2018, it was operating in more than 674 cities in 82 countries worldwide. Its net revenue (after paying drivers) in 2017 was $7.4 billion, and though the company was not publicly held, its market valuation was estimated to be $72 billion.

Opportunities and Challenges for UberAIR

In 2018, there were more than seventy companies developing electric VTOLs (eVTOLS), including Karem Aircraft, Embraer, Aurora Flight Sciences, and Bell Helicopter. However, there were a number of obstacles that had to be overcome to make UberAIR a reality. First, an eVTOL used an enormous amount of energy and would be heavily reliant on advances on battery development and charging infrastructure. Second, there would be numerous legal and safety issues to be worked out pertaining to air traffic control, pilot training and licensing, compatibility with city infrastructures, noise, dealing with adverse weather, and more.

Last, but not least, was cost. The technology to vertically take off and land already existed in the form of helicopters, but most people have never ridden in one because it is an extremely expensive mode of transportation, estimated to be at least $8.93 per passenger per mile. How would UberAIR be different? First, electric propulsion was expected to be much more fuel efficient and require less maintenance. Second, the much smaller eVTOLs could land at flexible "skyports" rather than the large helipads or airports that helicopters used. Uber estimated that its initial operating costs would be $5.73 per passenger per mile, and with efficient pooling it believed it could get the operating costs down to $1.84 per passenger per mile. As people began to use eVTOLs in large numbers, scale economies would also drive down the cost of producing the eVTOLs themselves. The final major cost-cutting measure would be to eliminate pilots with fully autonomous eVTOLs, saving training costs, salaries, and making room for an additional passenger. Uber estimated that with fully autonomous operation at scale, the long-run operating costs of UberAIR could be as low as 44 cents per passenger mile—less than the operating cost of many cars.[c]

Elon Musk, who is known for larger-than-life ambitions such as moving the world's auto fleet to renewable energies and colonizing Mars, was skeptical, noting "it's difficult to imagine the flying car becoming a scalable solution."[d] Musk also thought that aerial transportation would be too disruptive to people on the

ground, tweeting sarcastically, "If you love drones above your house, you'll really love vast numbers of 'cars' flying over your head that are 1000 times bigger and noisier and blow away anything that isn't nailed down when they land."[e] Musk was betting that a better solution could be achieved underground, with electric pods that zipped through tunnels. Even Uber's CEO, Dara Khosrowshahi was initially doubtful about the project. However, after several rounds of discussion on the economics of it, he began to be persuaded. "For me the 'aha' moment came when I started understanding that Uber isn't just about cars," Khosrowshahi said. "Ultimately where we want to go is about urban mobility and urban transport, and being a solution for the cities in which we operate."[f]

As of June, 2018, the company had plans for testing the service in Dallas and Los Angeles by 2020, and was seeking an international launch city.[g] It planned to have commercial deployment of the service by 2023.

Battle for the Skies

Uber was not the only company with dreams of revolutionizing personal air travel. Makers of eVTOLs such as eVolo (based in Germany) and EHang (based in China) were also in the process of launching air taxi services, and Terrafugia (based in the United States) was building a vehicle that it believed would be a mass market flying car for personal use. If eVTOLs became widely available and economical, other ride-sharing companies such as Lyft might also be well positioned to target the market. Would Uber's scale in ride sharing enable it to achieve dominance in air ride sharing, and would such a position be sustainable?

Discussion Questions

1. Will there be increasing returns to adoption for an early mover in air taxi service? If so, what will they be?
2. What are the disadvantages of entering the air taxi market early?
3. What are the important complementary goods and enabling technologies for the air taxi market? Are they available in sufficient quality and economy?
4. Is Uber well positioned to be a dominant player in this market? What resources will it need to be successful?
5. Overall, would you say Uber's entry into the air taxi market is too early, too late, or about right?

[a] Holden, J., and N. Goel, "Fast-Forwarding to a Future of On-Demand Urban Air Transportation" (*San Francisco: Uber Elevate,* October 27, 2016).

[b] Pancer, E., K. Gulliver, and M. MacLeod, "Uber Elevate: The Case for Flying Cars," *Ivey Publishing* (2018), case W18135.

[c] Goodwin, A., "Will You Be Able to Afford UberAir's Flying Car Service?" *CNET* (May 8, 2018).

[d] Muoio, D., "Elon Musk Says Flying Cars Aren't a Good Fix for Traffic—Here's Why," *Business Insider* (February 16, 2017).

[e] Source: Elon Musk, February 22, 2018. https://twitter.com/elonmusk/status/966627437458026497?lang=en

[f] Dickey, M. R., "Uber's Aerial Taxi Play," *TechCrunch*, (May 9, 2018).

[g] www.uber.com/info/elevate.

OVERVIEW

The previous chapter pointed out that some industries are characterized by increasing returns to adoption, meaning that the more a technology is adopted, the more valuable it becomes. In such industries, timing can be crucial—a technology that is adopted earlier than others may reap self-reinforcing advantages such as greater funds to invest in improving the technology, greater availability of complementary goods, and less customer uncertainty. On the other hand, the same factors that cause increasing returns to adoption may make very early technologies unattractive: If there are few users of the technology or availability of complementary goods is poor, the technology may fail to attract customers. A number of other first-mover advantages, and disadvantages, can shape how timing of entry is related to likelihood of success.

first movers
The first entrants to sell in a new product or service category.

early followers
Entrants that are early to market, but not first.

late entrants
Entrants that do not enter the market until the time the product begins to penetrate the mass market or later.

Entrants are often divided into three categories: **first movers** (or pioneers), which are the first to sell in a new product or service category; **early followers** (also called early leaders), which are early to the market *but not first*; and **late entrants**, which enter the market when or after the product begins to penetrate the mass market. The research on whether it is better to be a first mover, early follower, or late entrant yields conflicting conclusions. Some studies that contrast early entrants (lumping first movers and early followers together) with late entrants find that early entrants have higher returns and survival rates, consistent with the notion of first-mover (or at least early-mover) advantage.[1] However, other research has suggested the first firm to market is often the first to fail, causing early followers to outperform first movers.[2] Still other research contends the higher returns of being a first mover typically offset the survival risk.[3] A number of factors influence how timing of entry affects firm survival and profits. In this chapter, we will first examine first-mover advantages and disadvantages. We will then look more closely at what factors determine the optimal timing of entry, and its implications for a firm's entry strategy.

FIRST-MOVER ADVANTAGES

Being a first mover may confer the advantages of brand loyalty and technological leadership, preemption of scarce assets, and exploitation of buyer switching costs.[4] Furthermore, in industries characterized by increasing returns, early entrants may accrue learning and network externality advantages that are self-reinforcing over time.[5]

Brand Loyalty and Technological Leadership

The company that introduces a new technology may earn a long-lasting reputation as a leader in that technology domain. Such a reputation can help sustain the company's image, brand loyalty, and market share even after competitors have introduced comparable products. The organization's position as technology leader also enables it to shape customer expectations about the technology's form, features, pricing, and other characteristics. By the time later entrants come to market, customer requirements may be well established. If aspects that customers have come to expect in a technology are difficult for competitors to imitate (e.g., if they are protected by patent or copyright, or arise from the first mover's unique capabilities), being the technology leader can yield sustained

monopoly rents
The additional returns (either higher revenues or lower costs) a firm can make from being a monopolist, such as the ability to set high prices, or the ability to lower costs through greater bargaining power over suppliers.

monopoly rents. Even if the technology characteristics are imitable, the first mover has an opportunity to build brand loyalty before the entry of other competitors.

Preemption of Scarce Assets

Firms that enter the market early can preemptively capture scarce resources such as key locations, government permits, patents, access to distribution channels, and relationships with suppliers.

For example, companies that wish to provide any wireless communication service must license the rights to broadcast over particular radio frequencies from the government. In the United States, the Federal Communications Commission (FCC) is primarily responsible for allotting rights to use bands of radio frequencies (known as the spectrum) for any wireless broadcasting. The FCC first allocates different portions of the spectrum for different purposes (digital television broadcasting, third-generation wireless telecommunication, etc.) and different geographic areas. It then auctions off rights to use these segments to the highest bidders. This means that early movers in wireless services can preemptively capture the rights to use portions of the wireless spectrum for their own purposes, while effectively blocking other providers. By 2003, the proliferation of wireless services had caused the spectrum to become a scarce commodity, and the FCC was under pressure to allow the holders of wireless spectrum rights to sublet unused portions of their spectrum to other organizations.

Exploiting Buyer Switching Costs

Once buyers have adopted a good, they often face costs to switch to another good. For example, the initial cost of the good is itself a switching cost, as is the cost of complements purchased for the good. Additionally, if a product is complex, buyers must spend time becoming familiar with its operation; this time investment becomes a switching cost that deters the buyer from switching to a different product. If buyers face switching costs, the firm that captures customers early may be able to keep those customers even if technologies with a superior value proposition are introduced later. This is often the reason given for the dominance of the QWERTY typewriter keyboard. In 1867, Christopher Sholes began experimenting with building a typewriter. At that time, letters were struck on paper by mechanical keys. If two keys were struck in rapid succession, they often would jam. Key jamming was a particularly significant problem in the 1800s because typewriters then were designed so that keys struck the back side of the paper, making it impossible for users to see what they were typing. The typist thus might not realize he or she had been typing with jammed keys until after removing the page. Scholes designed his keyboard so that commonly used letter combinations were scattered as widely as possible over the keyboard. The QWERTY keyboard also puts a disproportionate burden on the left hand (3000 English words can be typed with the left hand alone, while only 300 can be typed with the right hand alone). This positioning of keys would slow the typing of letter combinations, and thus reduce the likelihood of jamming the keys.[6]

Over time, many competing typewriter keyboards were introduced that boasted faster typing speeds or less-tiring typing. For example, the Hammand and Blickensderfer "Ideal" keyboard put the most commonly used letters in the bottom row for easy access, and used only three rows total. Another example, the Dvorak keyboard, placed

all five vowels and the three most commonly used consonants in the home row, and common letter combinations required alternating hands frequently, reducing fatigue. However, QWERTY's early dominance meant typists were trained only on QWERTY keyboards. By the time Dvorak keyboards were introduced in 1932, tens of millions of typists were committed to QWERTY keyboards—the switching costs of learning how to type all over again were more than people were willing to bear.[7] Even after daisy-wheel keys (and later, electronic typewriters) removed all possibility of jamming keys, the QWERTY keyboard remained firmly entrenched. August Dvorak is said to have died a bitter man, claiming, "I'm tired of trying to do something worthwhile for the human race. They simply don't want to change!"[8]

Reaping Increasing Returns Advantages

In an industry with pressures encouraging adoption of a dominant design, the timing of a firm's investment in new technology development may be particularly critical to its likelihood of success. For example, in an industry characterized by increasing returns to adoption, there can be powerful advantages to being an early provider; a technology that is adopted early may rise in market power through self-reinforcing positive feedback mechanisms, culminating in its entrenchment as a dominant design. Intel is an apt example of this.

Intel's Ted Hoff invented the first microprocessor in 1971, and in 1975, Bill Gates and Paul Allen showed that it could run a version of BASIC that Gates had written. Gates's BASIC became widely circulated among computer enthusiasts, and as BASIC was adopted and applications developed for it, the applications were simultaneously optimized for Intel's architecture. IBM's adoption of Intel's 8088 microprocessor in its PC introduction secured Intel's dominant position, and each of Intel's subsequent generations of products has set the market standard.[9]

FIRST-MOVER DISADVANTAGES

Despite the great attention that first-mover advantages receive, there are also arguments for not entering a market too early. In a historical study of 50 product categories, Gerard Tellis and Peter Golder found that market pioneers have a high failure rate—roughly 47 percent—and that the mean market share of market pioneers is 10 percent.[10] By contrast, early leaders (firms that enter after market pioneers but assume market leadership during the early growth phase of the product life cycle) averaged almost three times the market share of market pioneers.[11] Tellis and Golder point out that the market may often perceive first movers to have advantages because it has misperceived who the first mover really was. For example, while today few people would dispute Procter & Gamble's claim that it "created the disposable diaper market,"[12] in actuality, Procter & Gamble entered the disposable market almost 30 years after Chux, a brand owned by a subsidiary of Johnson & Johnson. In the mid-1960s, *Consumer Reports* ranked both products as best buys. However, over time Pampers became very successful and Chux disappeared, and eventually people began to reinterpret history.

Other studies have found that first movers earn greater revenues than other entrants, but that they also face higher costs, causing them to earn significantly lower profits in the long run.[13] First movers typically bear the bulk of the research and development

expenses for their product or service technologies, and they must also often pay to develop suppliers and distribution channels, plus consumer awareness. A later entrant often can capitalize on the research and development investment of the first mover, fine-tune the product to customer needs as the market becomes more certain, avoid any mistakes made by the earlier entrant, and exploit **incumbent inertia**.[14] Later entrants can also adopt newer and more efficient production processes while early movers are either stuck with earlier technologies or must pay to rebuild their production systems.[15]

incumbent inertia
The tendency for incumbents to be slow to respond to changes in the industry environment due to their large size, established routines, or prior strategic commitments to existing suppliers and customers.

Research and Development Expenses

Developing a new technology often entails significant research and development expenses, and the first to develop and introduce a technology typically bears the brunt of this expense. By the time a firm has successfully developed a new technology, it may have borne not only the expense of that technology but also the expense of exploring technological paths that did not yield a commercially viable product. This firm also typically bears the cost of developing necessary production processes and complementary goods that are not available on the market. Since the new product development failure rate can be as high as 95 percent, being the first to develop and introduce an unproven new technology is expensive and risky.

By contrast, later entrants often do not have to invest in exploratory research. Once a product has been introduced to the market, competitors can often ascertain how the product was created. The later entrant can also observe the market's response to particular features of the technology and decide how to focus its development efforts. Thus, the later entrant can both save development expense and produce a product that achieves a closer fit with market preferences.

Undeveloped Supply and Distribution Channels

When a firm introduces a new-to-the-world technology, often no appropriate suppliers or distributors exist. The firm may face the daunting task of developing and producing its own supplies and distribution service, or assisting in the development of supplier and developer markets. For example, when DEKA Research began developing its self-balancing IBOT wheelchair, it needed a type of ball bearing for which there were no suppliers. DEKA was forced to develop a machine to mold the bearings. According to Dean Kamen, the company's founder, "Nobody here planned to invent new ball bearings, but in order to make this engine practical we have to develop a bearing technology that doesn't exist."[16]

Immature Enabling Technologies and Complements

enabling technologies
Component technologies that are necessary for the performance or desirability of a given innovation.

When firms develop technologies, they often rely on other producers of **enabling technologies**. For instance, for Uber to launch its UberAIR transportation service required the development of economical aircraft capable of taking off and landing vertically, advances in battery technology that would increase the range of the aircraft while keeping costs low, a charging infrastructure to charge the aircraft, a network of "skyports" for landing and takeoff, and pilots for the aircraft (until they could be made fully autonomous). Uber was thus heavily reliant on numerous third parties to make its project feasible.

Theory in Action Obstacles to the Hydrogen Economy

Fuel cells create electricity from a reaction between hydrogen and oxygen, and are much more efficient than internal combustion gasoline engines. Whereas a typical internal combustion engine converts less than 20 percent of the energy potential of gasoline into power for the automobile, fuel cells capture 40 percent to 60 percent of the energy potential of their fuel source, which can be any hydrogen-rich liquid or gas.[a] Hydrogen is one of the most abundant elements on the Earth and can be obtained in a number of ways, including electrolysis of water or steam conversion of methanol. Furthermore, the only waste products of hydrogen fuel cells are water vapor and carbon dioxide. Hydrogen thus offers an inexhaustible and environmentally friendly fuel source.[b] Utilizing hydrogen to power vehicles (among other things) offers the promise of reducing reliance on dwindling fossil fuel reserves while dramatically decreasing the environmental impact of automobiles. Many of the key players in fuel cell development envision a "hydrogen economy" whereby automobiles with hydrogen fuel cells are used to supply power to homes and offices, eventually replacing the existing electrical power grids.

Fuel cells were developed more than 150 years ago, but were initially too bulky and expensive to be used in automobiles. In the 1970s, however, the energy crisis sparked a resurgence in fuel cell development, and a number of prototypes emerged through the late 1970s and 1980s. By the 1990s, several auto manufacturers, including Toyota and Daimler had developed automobiles powered by fuel cells and were planning commercial production. A number of serious obstacles, however, stood in the way of fuel cell adoption by the mass market. The most serious of these was the lack of a complementary refueling infrastructure. Before fuel cell vehicles could be promoted to the mass market, refueling options had to be developed that would be convenient and easy for consumers to use. This was no small feat—the existing fuel stations that were ubiquitous in almost every corner of the globe could not handle a gaseous fuel such as hydrogen. While liquid gasoline can be stored in almost any type of container, hydrogen gas is liquid only under very high pressure and has very small molecules. It would rapidly leak out of existing gasoline storage containers. Both fueling stations and automobiles would need to be able to keep compressed hydrogen in a pressurized tank. Furthermore, many of the existing gasoline stations were owned or otherwise connected to oil companies. Since it was not yet clear what role oil companies would play in the hydrogen economy, many suspected that oil companies would use their resources and lobbying power to resist the adoption of hydrogen fuel cells. To unleash the power of the "hydrogen economy" vision would not only require heavy investment in new infrastructure, but also require resolving or overcoming the conflicting interests of numerous stakeholders, including government, utilities, auto manufacturers, oil producers, and consumers.

[a] www.doe.gov.
[b] J. Rifkin, "The Hydrogen Economy," *E Magazine*, January–February 2003, pp. 26–37.

As discussed in Chapter Four, many products also require complementary goods to be useful or valuable. Computers need software, cameras need film, automobiles need service, gasoline, and roads. When new technologies are introduced to a market, important complements may not yet be fully developed, thus hindering adoption of the innovation. The development of vehicles powered by hydrogen fuel cells (see the above Theory in Action) provides an excellent example of how a lack of complementary technologies and infrastructure can pose serious obstacles for early movers.

Uncertainty of Customer Requirements

A first mover to the market may face considerable uncertainty about what product features customers will ultimately desire and how much they will be willing to pay for them. For a very new product technology, market research may be of little help.

Customers may have little idea of the value of the technology or the role it would play in their lives. As a consequence, first movers may find that their early product offerings must be revised as the market begins to reveal customer preferences.

For instance, when Kodak introduced the 8-mm video camera in the late 1980s, it expected that customers would flock to the design's smaller size and superior recording ability. Instead, consumers rejected the product. The 8-mm video cameras were more expensive, and consumers had not yet recognized a need for this product and were unsure of what value it could provide. Kodak decided to withdraw from the market. However, by the early 1990s, consumers had become more comfortable with the concept of 8-mm video camera technology, and several competitors (most notably Sony) successfully entered this market.

First movers have an opportunity to shape customer preferences by establishing the precedent for product design in the newly emerging market and by investing in customer education. Customer education efforts are expensive, however. If the product is slow to begin to reap revenues for the sponsoring firm, it may collapse under the weight of its R&D and marketing expenses. Figure 5.1 provides a number of product categories with their first movers, prominent followers, and which of these were ultimately more successful.

FIGURE 5.1
First Movers and Followers—Who Wins?

Source: R. M. Grant, *Contemporary Strategy Analysis* (Malden, MA: Blackwell Publishers, 1998); D. Teece, *The Competitive Challenge: Strategies for Industrial Innovation and Renewal* (Cambridge, MA: Ballinger, 1987); and M. A. Schilling, "Technology Success and Failure in Winner-Take-All Markets: Testing a Model of Technological Lock Out," *Academy of Management Journal* 45 (2002), pp. 387–98.

Product	First Mover	Notable Follower(s)	The Winner
8-mm video camera	Kodak	Sony	Follower
Disposable diaper	Chux	Pampers Kimberly Clark	Followers
Float glass	Pilkington	Corning	First mover
Groupware	Lotus	AT&T	First mover
Instant camera	Polaroid	Kodak	First mover
Microprocessors	Intel	AMD Cyrix	First mover
Microwave	Raytheon	Samsung	Follower
Personal computer	MITS (Altair)	Apple IBM	Followers
Personal computer operating system	Digital Research	Microsoft (MS-DOS)	Follower
Smartphones	IBM (Simon)	Apple Nokia	Followers
Social networking sites	SixDegrees.com	MySpace Facebook	Followers
Spreadsheet software	VisiCalc	Microsoft (Excel) Lotus	Followers
Video game console	Magnavox	Atari Nintendo	Followers
Web browser	NCSA Mosaic	Netscape Microsoft (Internet Explorer)	Followers
Word processing software	MicroPro (WordStar)	Microsoft (MS Word) WordPerfect	Followers
Workstation	Xerox Alto	Sun Microsystems Hewlett-Packard	Followers

FACTORS INFLUENCING OPTIMAL TIMING OF ENTRY

In very early market stages, a technology may be underdeveloped and its fit with customer needs unknown. In late market stages, a technology may be well understood, but competitors may have already captured controlling shares of the market. How does a firm decide whether to attempt to pioneer a technology category or to wait while others do so? The answer will depend on several factors, including customer certainty, the margin of improvement offered by the new technology, the state of enabling technologies and complementary goods, the threat of competitive entry, the degree to which the industry exhibits increasing returns, and the firm's resources.

1. How certain are customer preferences?

When new-to-the-world technologies are first developed, customers may have difficulty understanding the technology and its role in their life. Both producers and customers may face considerable ambiguity about the importance of various features of the technology. As producers and customers gain experience with the technology, features that initially seemed compelling may turn out to be unnecessary, and features that had seemed unimportant may turn out to be crucial. For example, many of the companies that raced to establish an online presence in the e-commerce frenzy of the late 1990s believed that their Web sites needed exciting graphics and sounds to be competitive. Graphics and sound, however, turned out to be the downfall of many early Web sites. Many customers did not have high-speed Internet access or computers with enough processing power to quickly download the Web sites, making multimedia Web sites an annoyance rather than an attraction.

The reverse scenario is demonstrated in Sony's introduction of the PlayStation 2. When Sony introduced its multifeatured PlayStation 2, many industry analysts believed that Sony had overestimated consumer interest in having a game console that would play music CDs or DVD movies. It turned out, however, that Sony may have *underestimated* the desirability of these features. Video game consoles are typically sold at cost (or at a loss) in order to rapidly build an installed base. Profits are then made on game royalties. However, when consumers realized that the PlayStation 2 was a very affordable combination of game console and high-quality DVD player, many consumers bought the system for its DVD capabilities first and game capabilities second. Many of these consumers bought very few games, causing Sony's strategy of subsidizing the console with the intention of making money on the games to backfire. Observing this, Microsoft disabled DVD playback on its Xbox unless consumers purchased an add-on DVD playback kit.

Not all pioneers face customer uncertainty—some innovations are developed in response to well-understood customer needs. Customer requirements may have been long known even if the method of meeting them was not. For example, the developers of Tagamet (a medication for patients with chronic heartburn or ulcers) faced very little customer uncertainty. Customers wanted an affordable, easy-to-use solution to their stomach discomfort. Once a method of achieving this objective had been developed, tested, and approved, its developers raced the product to market in hopes of patenting it and securing market share ahead of competing products. Other things being equal, less customer uncertainty favors earlier timing of entry.[17]

2. How much improvement does the innovation provide over previous solutions?

The degree to which the technology represents an improvement over previous technologies increases a firm's likelihood of successful early entry. That is, when a technology makes a dramatic improvement over previous generations or different technologies that serve similar functions, it will more rapidly gain customer acceptance. There will be less ambiguity about the value of the technology and more early adoptions (as well as more support by complementary goods providers); as a consequence, customer expectations should become known sooner, and adoptions should be more rapid.[18]

3. Does the innovation require enabling technologies, and are these technologies sufficiently mature?

As mentioned earlier, many innovations rely on crucial enabling technologies to ensure their performance. A high-definition television set is of little value if networks are incapable of broadcasting in high definition; cellular phones or portable stereos would have little value if small and long-lasting batteries were unavailable. A developer must identify which enabling technologies will affect the performance of the new innovation and assess the degree to which those technologies are mature enough (or *will be* mature enough) to deliver the desired performance. More mature enabling technologies allow earlier entry; less mature enabling technologies may favor waiting for enabling technologies to be further developed.

4. Do complementary goods influence the value of the innovation, and are they sufficiently available?

If the value of an innovation hinges critically on the availability and quality of complementary goods, then the state of complementary goods determines the likelihood of successful entry. Not all innovations require complementary goods, and many more innovations can utilize existing complementary goods. For example, though numerous innovations in 35-mm cameras have been introduced in the last few decades, almost all have remained compatible with standard rolls of 35-mm film; thus availability of that complementary good was ensured. If, on the other hand, the innovation requires the development of new complementary goods, then a pioneer must find a way to ensure their availability. Some firms have the resources and capabilities to develop both a good and its complements, while others do not. If the firm's innovation requires complementary goods that are not available on the market, and the firm is unable to develop those complements, successful early entry is unlikely.

5. How high is the threat of competitive entry?

If there are significant entry barriers or few potential competitors with the resources and capabilities to enter the market, the firm may be able to wait while customer requirements and the technology evolve. Over time, one would expect customer expectations to become more certain, enabling technologies to improve, and support goods and services to be developed, thus increasing the likelihood that sponsored technologies will possess a set of attributes that meet consumer demands. However, if the technology proves to be valuable, other firms are also likely to be attracted to the market. Thus, if entry barriers are low, the market could quickly become quite competitive, and entering a market that has already become highly competitive can be much more challenging than entering an emerging market.[19] Margins may already have been

Research Brief Whether and When to Enter?

In a study of 30 years of data on entry into the medical diagnostic imaging industry, Will Mitchell examined the factors that drive whether and when a firm that is an incumbent in one subfield of an industry chooses to enter a newly emerging subfield of the industry.[a] For instance, what determines whether and when a manufacturer of conventional X-ray machines decides to go into magnetic resonance imaging (MRI) equipment? While new goods offer opportunities for growth, they can cannibalize existing products, and they also require an investment in new skills. Incumbents often are slow to enter new technical subfields.[b] They may be intentionally waiting for industry turbulence to subside, or they may be unintentionally slowed by factors that create inertia, such as the difficulty in altering well-established routines and strategic commitments to the firm's existing supplier and customer base.

Mitchell pointed out that entry barriers and imitability of a new product (e.g., whether it can be effectively protected by patents) interact to create different incentives for timing. First, if only one firm can produce an inimitable good, it can enter if and when it wants. However, if several firms could produce a good that will subsequently be inimitable, they may race to do so to capture the market. In such a circumstance, being early confers a significant advantage. Finally, if the good is expected to be highly imitable (e.g., if it would be difficult to effectively protect with patents because competitors could easily invent around the patent), then firms will prefer to wait while others bear the expense of developing and introducing the good. There are disincentives to being early to market.[c]

Mitchell found that firms that had more specialized assets that would be useful in the new subfield (e.g., a well-established distribution system that could be used for the new imaging equipment) were more likely to enter the new subfield. A firm was also more likely to enter if the products it currently produced were threatened by the new products (i.e., if the new technology was likely to displace the firm's current technology as the dominant choice in the market). Furthermore, the incumbent was likely to enter *earlier* if its core products were threatened and there were several potential rivals.

[a] W. Mitchell, "Whether and When? Probability of Incumbent's Entry into Emerging Technical Subfields," *Administrative Science Quarterly* 38 (1989), pp. 208–30.

[b] F. M. Scherer, *Industrial Market Structure and Economic Performance*, 2nd ed. (Chicago: Rand McNally, 1980).

[c] M. Katz and C. Shapiro, "Technology Adoption in the Presence of Network Externalities," *Journal of Political Economy* 94 (1986), pp. 822–41.

driven down to levels that require competitors to be highly efficient, and access to distribution channels may be limited. If the threat of competitive entry is high, the firm may need to enter earlier to establish brand image, capture market share, and secure relationships with suppliers and distributors. This is discussed further in the Research Brief "Whether and When to Enter?"

6. Is the industry likely to experience increasing returns to adoption?

In industries that have increasing returns to adoption due to strong learning curve effects or network externalities, allowing competitors to get a head start in building an installed base can be very risky. If a competitor's offering builds a significant installed base, the cycle of self-reinforcing advantages could make it difficult for the firm to ever catch up. Furthermore, if there are forces encouraging adoption of a single dominant design, a competitor's technology may be selected. If protection mechanisms such as patents prevent the firm from offering a compatible technology, the firm may be locked out.[20]

7. Can the firm withstand early losses?

As was discussed earlier, a first mover often bears the bulk of the expense and risk of developing and introducing a new innovation. First movers thus often need significant amounts of capital that either is available internally (in the case of large firms) or can be accessed externally (e.g., through the debt or equity markets). Furthermore, the first mover must be able to withstand a significant period with little sales revenue from the product. Even in the case of successful new technologies, often a considerable period elapses between the point at which a first mover introduces a new innovation and the point at which the innovation begins to be adopted by the mass market. The s-curve shape of technology diffusion (discussed in Chapters Three and Thirteen) illustrates this aptly. New innovations tend to be adopted very slowly at first, while innovators and early adopters try the technology and communicate their experience to others. This slow initial takeoff of new innovations has caused the demise of many start-up firms. For example, in the personal digital assistant (PDA) industry—the precursor to smartphones—start-ups such as GO Corporation and Momenta had received accolades for their technology designs, but were unable to withstand the long period of market confusion about PDAs and ultimately ran out of capital. Companies such as IBM and Compaq survived because they were large and diversified, and thus not reliant on PDA revenues. Palm was a relatively late mover in the PDA industry so it did not have to withstand as long of a takeoff period, but even Palm was forced to seek external capital and was acquired by U.S. Robotics, which was later bought by 3COM.

On the other hand, firms with significant resources also may be able to more easily catch up to earlier entrants.[21] By spending aggressively on development and advertising, and leveraging relationships with distributors, a late entrant may be able to rapidly build brand image and take market share away from earlier movers. For example, though Nestlé was very late to enter the freeze-dried coffee market with Taster's Choice, the company was able to use its substantial resources to both develop a superior product and rapidly build market awareness. It was thus able to quickly overtake the lead from General Foods' Maxim.[22]

8. Does the firm have resources to accelerate market acceptance?

A firm with significant capital resources not only has the capability to withstand a slow market takeoff, but also can invest such resources in accelerating market takeoff. The firm can invest aggressively in market education, supplier and distributor development, and development of complementary goods and services. Each of these strategies can accelerate the early adoption of the innovation, giving the firm much greater discretion over entering early.[23] These strategies are discussed in more detail in Chapter Thirteen. Thus, a firm's capital resources can give it some influence on the shape of the adoption curve.

9. Is the firm's reputation likely to reduce the uncertainty of customers, suppliers, and distributors?

In addition to capital resources, a firm's reputation and credibility can also influence its optimal timing of entry.[24] A firm's reputation can send a strong signal about its likelihood of success with a new technology. Customers, suppliers, and distributors will use the firm's track record to assess its technological expertise and market prowess. Customers may use the firm's reputation as a signal of the innovation's quality, and

thus face less ambiguity about adopting the innovation. A firm with a well-respected reputation for successful technological leadership is also more likely to attract suppliers and distributors.[25] This was aptly demonstrated in Microsoft's entry into the video game console industry: Despite having little experience in producing hardware, suppliers and distributors eagerly agreed to work with Microsoft because of its track record in personal computing. Other things being equal, an entrant with a strong reputation can attract adoptions earlier than entrants without strong reputations.

STRATEGIES TO IMPROVE TIMING OPTIONS

As should now be clear, managing the timing of entry into the market is a complex matter. If the technology has a clear advantage to consumers, entering the market early may give the entrant a path-dependent advantage that is nearly impossible for competitors to overcome. If, on the other hand, a firm enters a market very early and the advantages of the technology are not very clear to consumers, there is a strong possibility that the technology will receive a tepid welcome. Confounding this risk is the fact that watchful competitors may be able to use the firm's failure to their advantage, refining the technology the firm has introduced to the market and making any corrections necessary to improve the technology's market acceptance. The later entrant may be able to enter at a lower cost because it can capitalize on the research and development of the early firm, and use knowledge of the market gained from observing the early entrant's experience.

In the above, it is assumed that timing of entry is a matter of *choice* for the firm. However, implicit in this assumption is a corollary assumption that the firm is capable of producing the technology at any point in the time horizon under consideration. For this to be true, the firm must possess the core capabilities required to produce the technology to consumer expectations, or be able to develop them quickly. Furthermore, if the firm intends to refine an earlier entrant's technology and beat the earlier entrant to market with a new version of this technology, it must have *fast-cycle development processes.* If a firm has very fast development processes, the firm not only has a better chance at being an early entrant, but it can also use experience gained through customers' reactions to its technology to quickly introduce a refined version of its technology that achieves a closer fit with customer requirements. In essence, a firm with very fast development deployment processes should be able to take advantage of both first- and second-mover advantages. The research on new product development cycle time indicates that development time can be greatly shortened by using strategic alliances, cross-functional new product development teams, and **parallel development processes**. Chapter Eleven will deal specifically with how firms can ensure that their innovations are deployed rapidly to the market.

parallel development process When multiple stages of the new product development process occur simultaneously.

Summary of Chapter

1. A first mover may be able to build brand loyalty and a reputation for technological leadership, preemptively capture scarce resources, and exploit buyer switching costs.
2. First movers may also benefit from increasing returns to adoption due to learning curve effects and network externalities.

3. Some studies, however, argue that first movers may have higher failure rates. First movers have to bear the brunt of R&D expenses and may face considerable consumer ambiguity. Second movers can capitalize on the R&D and marketing efforts of the first mover, producing a technology that costs less to develop and that corrects for any of the first mover's mistakes.
4. First movers may also face poorly developed supplier markets, distribution channels, and availability of complementary goods, all of which can increase the challenge of successfully launching their new product or service. Enabling technologies may also be immature, hindering the new technology's performance.
5. The biggest disadvantage many first movers face is uncertainty over customer requirements. Customers themselves may be uncertain about what features or form they desire in a new innovation. A firm may have to withstand significant losses before customer preferences become more certain.
6. The optimal timing of entry is thus a function of several factors, including the margin of advantage offered by the new innovation, the state of enabling technologies and complements, the state of customer expectations, the threat of competitive entry, whether the industry faces increasing returns, and a firm's resources.
7. Firms that have fast-cycle development processes have more options when it comes to timing. Not only does a fast-cycle developer have an advantage in introducing innovations earlier, but it also can be its own fast follower by quickly introducing refined versions of its own technology.

Discussion Questions

1. What are some advantages of entering a market early? Are there any advantages to entering a market late?
2. Name a successful (*a*) first mover, (*b*) early follower, and (*c*) late entrant. Identify unsuccessful examples of each.
3. What factors might make some industries harder to pioneer than others? Are there industries in which there is no penalty for late entry?

Suggested Further Reading

Classics

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