

Chapter Five

Dynamics of Internet Business Models

In Chapter 4, we explored the components of a business model and the linkages between them. This exploration was largely static because we described a business model at a point in time and said nothing about the impact of change on the model. We said very little about the changes in the components and linkages of dot.coms as the Internet evolves. Nor did we say much about the impact of the Internet on bricks-and-mortar business models that existed prior to the emergence of the Internet. But as Figure 5.1 reminds us, change has a direct impact on business models and for these models to continue to give a firm a competitive advantage, they too must change—they must be dynamic. In this chapter, we examine the dynamics of business models. We explore several models of technological change that are helpful in formulating and executing business models as firms create or respond to technological change. We begin by exploring a simple but important question: Who profits from technological change? We then examine several technological change models—incremental/radical, architectural innovation, disruptive change, innovation value-added chain, and technology life cycle models—that explore how best to develop a new technology. Finally, we discuss the implications of these technological change models for Internet business models.

WHO PROFITS FROM TECHNOLOGICAL CHANGE?

By definition, business models are about making money. Therefore, to formulate and execute the right business models in the face of a technological change, it is important to first understand what it takes to make money from technological change. One of the first models to explore the question of who profits from a technological change is the complementary assets model.

Complementary Assets Model

What does it take to make money from a technology or invention? David Teece argued that two things determine the extent to which a firm can profit from its

FIGURE 5.1
Change and
Business Models

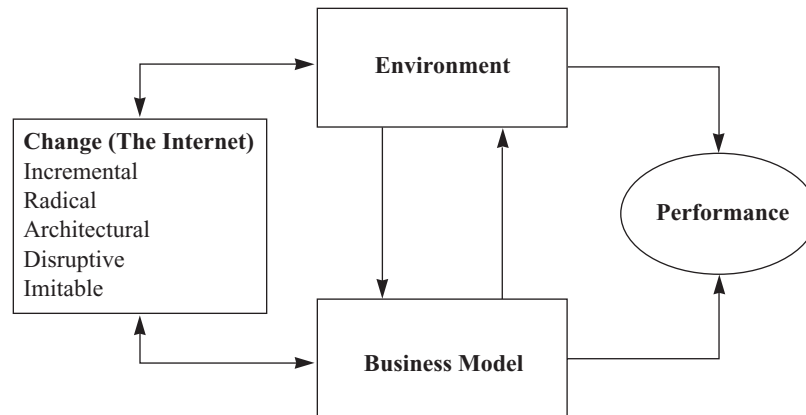


FIGURE 5.2
Who Profits from
Innovation

		I		II	
		Difficult to make money		Holder of complementary assets makes money	
Imitability	High				
	Low	IV		III	
		Inventor makes money		Party with both technology and assets or with bargaining power makes money	
		Freely Available or Unimportant		Tightly Held and Important	
		Complementary Assets			

invention or technology: imitability and complementary assets (see Figure 5.2).¹ **Imitability** is the extent to which the technology can be copied, substituted, or leapfrogged by competitors. Low imitability may derive from the intellectual property protection of the technology, from the failure of potential imitators to have what it takes, or from the inventor's strategies to sustain its lead. **Complementary assets** are all other capabilities—apart from those that underpin the technology or invention—that the firm needs to exploit the technology. These include brand name, manufacturing, marketing, distribution channels, service, reputation, installed base of products, relationships with clients or suppliers, and complementary technologies.

Figure 5.2 suggests when a firm is likely to profit from an innovation in this model. When imitability is high, it is difficult for an innovator to make money if complementary assets are easily available or unimportant (cell I in Figure 5.2).

If, however, complementary assets are tightly held and important, the owner of such assets makes money (cell II). For example, CAT scanners were easy to imitate and EMI, the inventor, did not have complementary assets such as distribution channels and the relations with U.S. hospitals that are critical to selling such expensive medical equipment. General Electric had these assets and quickly captured the leadership position by imitating the innovation. Coca-Cola and Pepsi were able to profit from RC Cola's diet and caffeine-free cola inventions because they had the brand-name reputation and distribution channels that RC did not, and the innovations were easy to imitate.

When imitability is low, the innovator stands to profit from it if complementary assets are freely available or unimportant (cell IV). For example, the inventor of the Stradivarius violin profited enormously because no one could imitate it, and complementary assets for it were neither difficult to acquire nor important. When imitability is low and complementary assets are important and difficult to acquire as in cell III, whoever has both or the more important of the two wins. The better negotiator can also make money. Pixar's interaction with Disney is a good example. Imitability of some of its digital studio technology is somewhat low given the software copyrights it holds and the combination of technology and creativity it takes to deliver a compelling animation movie. But offering customers movies made with that technology requires distribution channels, brand-name recognition, and financing which are tightly held by the likes of Disney and Sony Pictures. Before *Toy Story*, Disney had the bargaining power because it had all the complementary assets and the technology had not been proven. After the success of *Toy Story*, when Pixar proved that it could combine technology and creativity—something that is more difficult to imitate than plain computer animation—there was a shift in bargaining power to Pixar, which was then able to renegotiate a better deal.²

Implications for the Internet

This model has some important implications for the Internet, which we will see throughout this chapter and the other chapters that follow. Since the use of the Internet is relatively easy to imitate, we can say that imitability of the technology is high. This leaves us in cell I or II of Figure 5.2. Firms that are in industries where complementary assets are easy to get or unimportant (cell I) have a difficult time making money from the Internet. If firms are in industries where complementary assets are important and difficult to get (cell II), those firms that own complementary assets are more likely to make money.

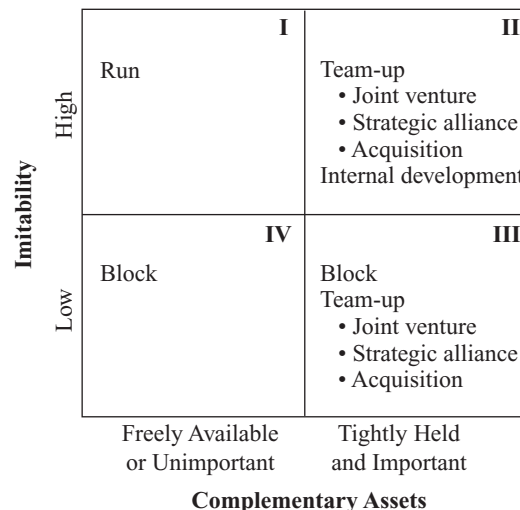
Strategic Implications of Complementary Assets Model

Does this mean that a firm that finds itself in cell I should give up on making money? Of course not! It means that such a firm should take this important piece of information—that it is easy to imitate its technology and that complementary assets are either unimportant or easy to come by—into consideration as it develops and executes its business model. A firm in cell I can pursue a run strategy (see Figure 5.3); that is, since its technology can be easily imitated,

the firm keeps innovating. By the time competitors catch up with yesterday's technology, the firm has moved on to tomorrow's technology. The more frequently encountered case is that of cell II: although complementary assets are tightly held and important, the technology is easy to imitate. The firm must develop the complementary assets internally or get them by teaming up with someone else. Either way, the key thing is timing. If the firm decides to build internally, it must do so before competitors with complementary assets have had a chance to copy the technology. If the firm is going to team up, it must do so while it still has something to bring to the table—while potential partners have not yet imitated the technology. As defined earlier, teaming up means forming some kind of partnership (e.g., joint venture, strategic alliance, or an acquisition) with a firm that has the important complementary assets (Figure 5.3). It can also mean offering the firm for acquisition by another firm that has the complementary assets.

In the early part of their life cycles, many Internet start-ups are positioned in either cell I or cell II, but they are chiefly in cell II since their exploitation of the technology is easy to imitate or substitute and complementary assets are important. By carefully determining what complementary assets are critical to them, these start-ups can build them before incumbent competitors have had time to imitate their technologies or build similar complementary assets. For this strategy of developing complementary assets to be successful, it is important that the firm builds in switching costs for its clients and customers. Given the network externalities feature of the Internet, switching costs can be network size where network externalities are important. For example, the larger a community or number of clients, the more valuable it is to members and the more difficult it is for a member to switch to a lesser community. eBay pursued these strategies early in its life cycles.

FIGURE 5.3
Strategies for
Building Business
Models



In cell III, a firm can pursue one of two strategies: block or team-up. If it has both the technology and complementary assets, it can protect both. The danger is that sooner or later most technologies are imitated or become obsolete. Imitation or obsolescence moves the firm from cell III to cell II (in Figure 5.3) where it can use its complementary assets to team up with someone who has the new technology. In a world where technology is difficult to imitate but complementary assets are easy to come by (cell IV), a firm depends on protecting that technology if it is going to make money. Very few firms, especially those exploiting the Internet, can be found in cell IV.

Determining One's Complementary Assets

We defined a firm's complementary assets above as all other capabilities—apart from those that underpin the technology or invention—that the firm needs to exploit a technology. This definition suggests that a good way for a profit-seeking firm to determine its complementary assets involves the following two steps: First, the firm should understand what **product-market position** it occupies or wants to occupy. By product-market position here, we mean the customer value, scope, and positioning (relative bargaining position vis-a-vis co-opetitors) that a firm attains or wants to attain. For most start-ups, this is not an easy task since such a position is not always clear early in the life of a technology. Second, the firm should understand its value configuration (value chain, value network, or value shop) and determine what capabilities, other than the technology, are critical not only to offering the right customer value to the right market segments but also to increasing the firm's relative positioning vis-a-vis suppliers, customers, and complementors. To avoid ending up with a laundry list, it is important to understand what drives value in the industry and limit the list to those capabilities that are critical to these value drivers.

One way to determine which capabilities are critical is to ask two simple questions for each stage of the value chain of activities that need to be performed for the firm to offer value to its customers: (1) Do the complementary assets make an unusually high contribution to the value that customers perceive? and (2) How quickly and to what extent can other firms duplicate or substitute the complementary assets? The first question is about customer value. In the end, customers must find some value in a technological innovation if it is going to be successful. This customer value is in the form of low cost or differentiated attributes as perceived by customers. Complementary assets that make an unusually high contribution to the value that customers perceive are more likely to help a firm profit from a technological change. An example of complementary assets that made an unusually high contribution to customer value was Caterpillar's worldwide service and supplier networks which, in the early 1980s, enabled the firm to deliver any part, for any of its equipment, to any part of the world, in two days or less. For many customers in remote construction sites who must meet tight completion schedules, this was a very valuable complementary asset.³ If complementary assets make an unusually high contribution to customer value, the next question is, How long

can such complementary assets last before they can be duplicated or substituted? For example, Komatsu substituted the service network by designing and building machines that were so reliable that the company did not need as efficient a service and supplier network as Caterpillar did.

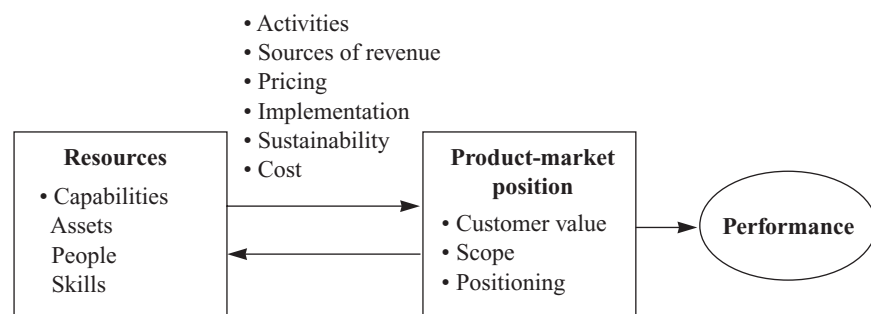
Thus, in determining one's complementary assets, it is important to sort out those that make a relatively high contribution to customer value and also to understand the extent to which they can be imitated or substituted. This avoids generating a laundry list of assets that can be more confusing than helpful.

DEVELOPING THE TECHNOLOGY

Whether a technology is imitable or not, developing it is often not easy. In fact, the inability of firms to develop products or services using a new technology is often the reason why such firms fail to exploit the new technology despite having the right complementary assets. Five models of technological change provide some guidance for successfully developing a new technology: (1) Radical versus incremental change, (2) architectural innovation, (3) disruptive change, (4) innovation value-added chain, and (5) technology life cycle. Before we explore these models, it is important to recall that a business model can be conceptualized as a mapping of capabilities into the three business model components of customer value, scope, and positioning, which make up the firm's product-market position (Figure 5.4). Low cost capabilities, for example, allow a firm to offer its customers lower-cost products/services than its competitors, support customer segments that are cost conscious, and help the firm's position vis-a-vis rivals and potential new entrants. Thus the changes that must take place in a firm's business model for the firm to stay profitable in the face of a technological change depend on the type of capabilities that are needed to support the potential new product-market positions.

Since the Internet is an information technology and information needs vary from industry to industry, we can expect the impact of each of the properties of the Internet that we saw in Chapter 3—mediating technology, universality, network externalities, distribution channels, time moderator, information asymmetry shrinker, infinite virtual capacity, low cost standard, creative destroyer,

FIGURE 5.4
Mapping of
Capabilities into
Product-Market
Positions



and transaction-cost reducer—on capabilities and product-market positions to vary from industry to industry. The models of technological change that we explore provide frameworks for understanding the impact of change on capabilities and product-market positions, and by doing so, we understand the impact on Internet business models since capabilities and product-market positions are the core components of business models.

Models of Technological Change

Existing models of technological change focus on the impact that technological change has on the existing or new product-market positions and the capabilities on which such positions rest.

Radical/Incremental Change Model

The radical/incremental innovation framework argues that the type of firm that is likely to exploit a technological change is a function of the type of change. It is a function of the extent to which the change impacts the firm's product-market position and capabilities.

Product-Market Position View

A technological change usually results in products or services that render existing products and services noncompetitive, enhances them, or allows the old and new to coexist. If the change results in products that render existing products noncompetitive, it is said to be **radical in the economic sense**. In that case, incumbents with dominant market positions in the industry may be reluctant to invest in the new technology for fear of cannibalizing their existing products or services.⁴ Thus, one can expect new entrants to be more likely than incumbents to invest in radical technological change and therefore improve their chances of being successful in developing the new technology. The electronic point-of-sale (EPOS) cash register is an example of a radical technological change in the economic sense because it rendered existing mechanical cash registers noncompetitive. Often, however, the realization that if they do not cannibalize their own products, someone else will, gives incumbents the incentive to invest in the new technology.

If a technological change results in enhancing existing products or allows them to remain competitive, it is said to be an **incremental innovation in the economic sense**. Since such an innovation does not threaten incumbents' existing product-market positions, but rather stands to reinforce such positions, incumbents have an incentive to invest in the new technology. As a result, incumbents are more likely to develop incremental technological changes than new entrants. Both diet and caffeine-free cola were incremental innovations in the economic sense because they allowed classic cola drinks to stay competitive in the market. Electric razors are also an incremental innovation over traditional mechanical razors since they allow the former to remain competitive.

Technological Capabilities View

It is not unusual that some firms that invest in a technological change still fail to successfully develop products or services using the new technology.⁵ This suggests that it takes more than incentive to invest in a new technology to profit from it. Success is also a function of the extent to which the capabilities (knowledge, skills, assets, resources) that underpin the new technology build on existing ones or are radically different from them. If the capabilities to develop the new technology are very different from existing ones, the change is said to be radical in the organizational sense, or competence destroying.⁶ For example, the capabilities that were required to develop electronic calculators were very different from those required to develop mechanical calculators. Making mechanical calculators required knowledge of gears, ratchets, belts, levers, and methods to combine them to generate calculations whereas electronic calculators required knowledge of microchips with very different core concepts. Thus, electronic calculators were a radical (competence destroying) technological change to makers of mechanical calculators.

For several reasons, incumbents that face radical or **competence-destroying** technological changes are likely to have difficulties hanging onto any competitive advantage that they held prior to the change. First, in attaining the competitive advantage using an old technology, incumbents would have developed technological assets, resources, and capabilities that helped give the firm the advantage. It would also have developed a **culture**—a system of shared values (what is important) and beliefs (how things work) that interact with the organization's people, organizational structures, and systems to produce behavioral norms (the way we do things around here)⁷—that is embedded in the technology. Each incumbent is also likely to have had a business model: delivered some value to its customers, targeted particular segments of customers, focused on certain revenue sources, had pricing strategies, developed well-connected sets of activities, implemented the bricks-and-mortar strategy well, and may have sustained an advantage over some period. In the face of a radical technological change, these capabilities and cultures that were an advantage with the old technology may not only be useless, but they may also actually constitute a handicap. Learning new ways of doing things that are radically different from old ways usually means discarding the old ways first.⁸ But cultures are difficult to change, especially in radical ways. Moreover, processes established to support an old technology that become embedded in organizational values and culture are difficult to uproot fast enough to catch up with new entrants who do not have such processes in place. Second, if those in power at the incumbent derive their power from the old technology, they will not let the old technology die since their power will die with it. One reason why IBM had problems with the PC was because most of its executives derived their power from the mainframe computers threatened by the PC.

New entrants do not have old capabilities and culture to handicap them in their efforts to exploit a new technology. They do not have old knowledge to

unlearn either and are therefore less likely to have as much difficulty in developing products/services using a new technology as do incumbents.

In general, most radical technological changes are likely to be radical to one or a few of the stages of a firm's value chain but may leave other stages intact. Thus, in the face of many competence-destroying technological changes, many of a firm's complementary assets such as distribution channels, relations with customers, and brand-name reputations are likely to be useful assets for the incumbent.⁹ New entrants usually do not have these complementary assets.

On the other hand, a technological change is said to be **incremental** (in the organizational sense) or **competence-enhancing** if the capabilities required to exploit the new technology build on existing firm capabilities. In that case, the capabilities and culture that incumbents have developed give them an advantage over new entrants. Most technological changes are incremental and incumbents usually use such changes to reinforce their competitive advantages.

Implications for the Internet The Internet is likely to be radical—both in the economic and organizational sense—to firms in industries whose competitive advantage rested largely on information asymmetries. Firm capabilities and product-market positions (customer value, scope, and positioning) are likely to be impacted. Recall from Chapter 3 that one of the properties of the Internet is its ability to reduce information asymmetries. The industries that are likely to experience this reduction in information asymmetry include real estate, tour ticketing, airline and concert ticketing, car dealerships, investment banking, commercial banking, and stock brokerages. Prior to the Internet, real estate agents had easy access to multiple housing listings, local chamber of commerce information, and knowledge of neighborhoods. Travel agents had access to airline schedules and pricing that travelers did not have. Car dealers had information on car features and prices that customers lacked. Stockbrokers had access to investment research and to timely stock quotes that most investors did not have. The Internet makes most of that information available directly to customers without intermediaries. Firm positioning vis-a-vis competitors is also likely to change where the basis of bargaining power was information asymmetries. For example, car dealers do not have the type of information advantages that they had over customers and therefore no longer have as much power. Incumbents who face any of these changes have to be careful how they go about the change since old capabilities can handicap the decision to change. As Compaq found out, for example, a firm's links with channels that were critical in the bricks-and-mortar world can stifle its attempts to take full advantage of the Internet. The PC dealers that had served Compaq so well successfully resisted the company's efforts to sell directly to customers like its archrival Dell Computers.

Separate Entity or a Unit Within? In industries where the Internet is a radical technological change, incumbents often face the question of whether to develop the technology within the existing bricks-and-mortar organization or

create a separate legal entity. There are many arguments for creating a separate legal entity. Doing so avoids the dominant managerial logic and culture of the old bricks-and-mortar organization, which can only hurt the new endeavor. It avoids the political haggling that can crush a fledgling group within the incumbent. At the peak of the dot.com boom, a separate legal entity attracted more talent that would prefer to work in the entrepreneurial environment of a start-up and participate in the potential payoff of an initial public offering (IPO). The fear of the cannibalization of existing products/services takes attention away from the longer-term issues of the Internet. Finally, if the valuations of dot.com companies are high relative to their bricks-and-mortar competitors, a separate legal entity could raise a lot more and cheaper capital through an IPO. There are also good arguments for developing new technology within. Most incumbents have complementary assets that can be used. By developing the group within, the bricks-and-mortar personnel can learn from it. Moreover, the firm would not have to worry about the painful process of integrating the entity into the larger organization later. In any case, the option that is best for a firm depends on the firm, its business model, and its industry. A firm may decide, for example, to keep the unit within itself but physically locate it far away to reduce some of the cultural and political power problems.

Architectural Innovation Model

Professors Kim Clark and Rebecca Henderson were puzzled by why some incumbents have so much difficulty exploiting what appear to be incremental technological changes—seemingly minute changes in existing technologies: Xerox stumbled for many years before finally developing a good small plain-paper copier despite being the inventor of the core technology of xerography.¹⁰ RCA was never able to lead in the market for portable transistor radios despite its experience in the components (transistors, audio amplifiers, and speakers) that went into the portable radio. From their research, Clark and Henderson suggested that since products are normally made up of components connected together, building them must require two kinds of knowledge: knowledge of the components and knowledge of the linkages between them, which they called *architectural knowledge*. An architectural change is therefore one which requires different knowledge of linkages between components. Thus, although the core concepts that underpin the primary components of large and small copiers may be the same, knowledge of how these components interact in large copiers may be very different from knowledge of how they interact in small copiers. In moving from large copiers to small copiers, a Xerox that does not take the time to understand the changes in interactions between components (architectural knowledge) and change its processes and culture to match is likely to face more difficulties than a new entrant without a culture entrenched in large copiers.

An architectural change does not imply that there is no change in components at all. Quite the contrary. Architectural change is often triggered by a change in one component. For example, building a computer requires not only

knowledge of components such as the microprocessor, main memory, secondary memory, software, and input/output (component knowledge) but also knowledge of how these components interact (architectural knowledge). A new design that wants to take advantage of the speed of a much faster processor is an architectural innovation and must consider the changes in the linkages between this new processor and other components of the computer.

With an understanding of the concept of architectural innovation, it became clear why firms had problems with what appeared to be incremental innovations. They may have mistaken architectural innovation for incremental innovation. While the component knowledge required to exploit the innovations had not changed (and therefore the semblance of incremental innovation), architectural knowledge had changed. Architectural knowledge is often tacit and embedded in the routines and procedures of an organization, making changes in it difficult to discern and respond to.

Implications for the Internet The architectural innovation model can help us explore the potential impact of the Internet on some industries. Take the automobile industry, for example, where distribution can account for one-third of the sticker price of an automobile in the industry's bricks-and-mortar value system.¹¹ The primary reason for the high distribution cost is the industry's supply-push system—especially in the United States—in which automakers have been known to build large numbers of cars without paying enough attention to customer needs and then put pressure on dealers to sell the cars. Where supply outweighs demand, automakers offer huge discounts and marketing promotions. With the Internet, firms can better collect and analyze data on their customers and offer them the cars they want. This reduces unnecessary discounting, marketing promotion, and inventory holding costs. But offering customers the cars that they want may require so-called build-to-order, where car-makers build cars to customers' specifications when customers want them. Thus, although the core concepts that underpin the different functions of an automaker's value chain have not changed, the linkages between the functions have changed. That is, although the core concepts that underpin R&D, manufacturing, marketing, and other primary functions of an automobile value chain may not have changed, knowledge of how these functions can more effectively interact using the Internet has changed. Architectural knowledge in this industry has changed. Automobile makers that see the Internet as just one more channel to sell cars may be missing out on critical information that could help them in their business models. Effectively, bricks-and-mortar firms, even in manufacturing industries such as automobiles, may have to adjust their business models appropriately so as to take advantage of the Internet. They may have to adjust their capabilities, especially architectural competencies.

Cisco is another less obvious example of how the Internet impacts knowledge of linkages between value-chain functions. It was estimated that Cisco, which earned \$1.4 billion in profits in 1999, saved about \$500 million that year by using the Internet.¹² Customers placed their orders on the company's

website. Prior to the creation of the site, as many as 33 percent of customer orders were inaccurate. The website eliminated nearly all the errors. After-sales support groups also use the Web for help in configuring and integrating the network equipment bought from Cisco into their own systems, freeing Cisco engineers to tackle other tasks. Furthermore, Cisco's customers not only share information with each other on how to use Cisco's products in different systems but also share information with Cisco so that the firm can develop better next-generation products. Closing the company's quarterly accounts, which used to take 10 days, was performed in only 2 days when Cisco started using the Web. Travel and expenses were also put on the Web and reimbursement time fell to two days. Procurement, employee benefits, and recruitment are also placed on the Web. Suppliers know which components to ship to what Cisco manufacturing site by accessing the company's custom software on its website. Most firms, like Cisco, not only save on costs but also gain in accuracy of performing activities and in offering better customer value.

Disruptive Change Model

The disruptive change model was advanced and championed by Professor Clayton Christensen.¹³ According to this model, **disruptive technologies** have the following four characteristics:

1. They create new markets by introducing a new kind of product or service.
2. The new product or service from the new technology costs less than existing products or services from the old technology.
3. Initially, the products perform worse than existing products when judged by the performance metrics that existing mainstream customers value. Eventually, however, the performance catches up and addresses the needs of mainstream customers.
4. The technology should be difficult to protect using patents.

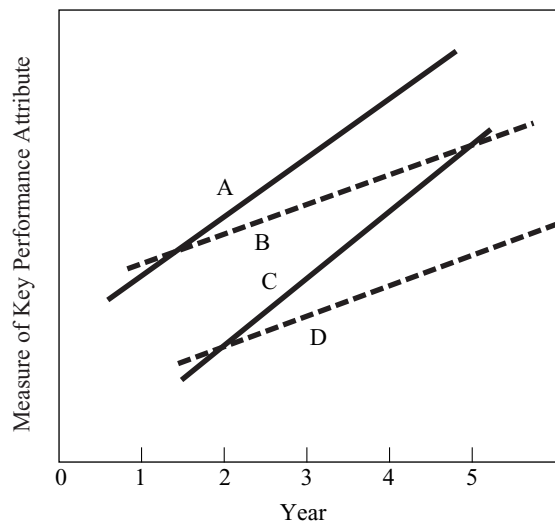
Incumbents fail to exploit disruptive technologies not so much because they do not “get it,” as suggested by the architectural innovation model, but because they spend too much time listening to and meeting the needs of their existing mainstream customers, who initially have no use for products from the disruptive technology.

To understand the disruptive change model, consider a firm that presently exploits a technology to offer products to its customers. Its capabilities—what it can or cannot do—are a function of three factors: resources, processes, and values. Its **resources** are assets such as product designs, brands, relationships with suppliers, customers, distribution, people, plants and equipment, technologies, and cash reserves. **Processes** are “patterns of interaction, coordination, communication, and decision making employees use to transform resources into products and services of greater worth.”¹⁴ Such processes are designed to make task performance more efficient and are not meant to change. If they must

change, however, there are other processes that must be used to effect the change. An organization's **values** are "the standards by which employees set priorities that enable them to judge whether an order is attractive or unattractive, whether a customer is more important or less important, whether an idea for a new product is attractive or marginal, and so on."¹⁵ A firm's capabilities allow it to offer products to its customers. Suppose one of those products is A, which in year 1 more than meets the key performance attributes that the firm's customers want (B) in the product (Figure 5.5). Also suppose that in year 2 a new product C, which costs less than A, is introduced. Initially, C's performance is inferior to that of A and clearly does not meet the performance requirements demanded by B. Producers of A—given their processes, values, and culture that rest partly on being good in offering A—focus their attention on satisfying the requirements of their key existing customers and therefore do not pay attention to developing the necessary capabilities, processes, and culture to build product C, which meets the performance attributes D that are needed by a different market. New entrants produce C and keep improving its performance. Eventually, say in year 5, C's performance has improved to a point where it also meets the needs of the market with demand B. By this time, it's too late for producers of A to shed the processes, values, and culture that served them so well with the old technology to develop C and gain a product advantage. New entrants who did not have the old baggage—the processes, values, culture, and cost structures associated with producing A—have taken the leadership position in producing C.

Professor Christensen used examples from the disk drive industry to develop this model. At some point, makers of 8-inch disk drives (A in Figure 5.5) produced disk drives that had storage capacity, measured in Megabytes, that met the needs of minicomputers with memory storage capacity demand B. When

FIGURE 5.5
Disruptive
Technological
Change



5.25-inch disk drives (C in Figure 5.5) were introduced, their storage capacity was below what minicomputers needed but was more than adequate for desktop PCs. In addition, 5.25-inch drives cost less than their 8-inch counterparts. Makers of 8-inch disk drives did not pay much attention to 5.25-inch disk drive technology; instead, they concentrated on satisfying the needs of their customers who wanted 8-inch drives for their minicomputers. Makers of 5.25-inch drives, however, kept improving the capacity of the drives. Eventually, 5.25-drives could meet the needs of minicomputer makers. By this time, it was too late for makers of 8-inch drives to beat their attackers, the makers of 5.25-inch drives.¹⁶

According to Professor Christensen, management that faces a disruptive technology must create a new organizational space that is conducive to developing the new capabilities that they need. Three options proposed by Professor Christensen are to (1) create a group within the firm in which new processes can be developed; (2) spin out an independent entity from the existing firm and develop new processes, values, and culture within this new entity; and (3) acquire another entity whose processes and values are a close match for what is needed. The option that a firm chooses is a function of the extent to which the firm's existing values and processes differ from the values and processes that are needed to exploit the disruptive technology. The larger the differences, the more a firm should think of acquisition rather than creating a group within the firm to develop the new processes and values needed.

Implications for the Internet In the late 1990s, the Internet exhibited many of the characteristics of disruptive technology in some industries. Take the stock brokerage industry. People could use the Internet to buy and sell stocks. Buying stocks on the Internet cost less than buying through a traditional bricks-and-mortar broker. Initially, buying stocks on the Internet did not have as much information as would be available through a broker with analysts' reports but that quickly changed as more information about firms became available online. Most implementations of the Internet were not protected by patents. This exhibition of the characteristics of disruptive technologies by online brokerages suggests that incumbents in the stock brokerage industry risked being replaced by new entrants if they did not pursue one of the organizational options stated above. As of 2002, many incumbent brokerage firms, such as Merrill Lynch, which had not pursued the suggested organizational arrangement, had not been replaced. One reason may be that these incumbents had complementary assets such as large client base, cash, relationships with clients, brand-name reputation, and so on that they could use to exploit the imitable technology.

Innovation Value-Added Chain

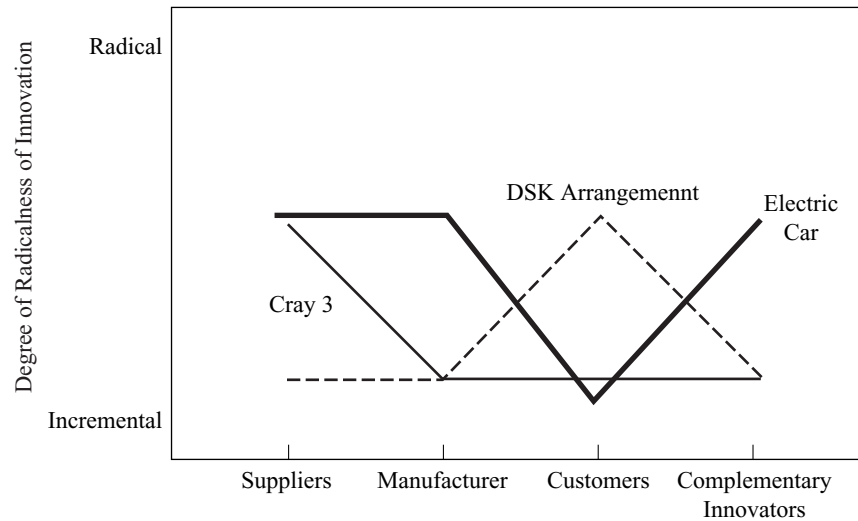
The **innovation value-added chain** model argues that the value that a firm offers its customers is often a function not only of the firm's capabilities but also of the capabilities of its suppliers, customers, and complementors.¹⁷ For example, the value that a customer gets from using a Dell personal computer

is a function not only of Dell's capabilities but also of the capabilities of Intel (the maker of the microprocessor), of Microsoft (the maker of the Windows operating system), and of the customer's skill in using the computer. Therefore, in the face of a technological change, it is important also to consider the impact of the change on suppliers, customers, and complementors as well, not just the impact on the focal firm.¹⁸ This differs from previous models in that while these other models focus on the impact of a technological change on firm capabilities and competitiveness, the value-added chain model focuses on the effects to the competitiveness and capabilities of co-opetitors—of the suppliers, customers, and complementors with whom the firm must often cooperate and compete at the same time. That is, previous models addressed the question, What does the electric car do to the capabilities and competitiveness of automobile makers such as Ford? Is it disruptive, radical, or architectural to Ford? This model emphasizes the fact that the electric car will not only have a direct impact on Ford, but will also have an impact on suppliers of mechanical components for the internal combustion engine automobile, on complementors such as gas station owners and oil companies, and on users of cars. The model explores the impact of a technological change on co-opetitors and the resulting impact on focal firms.¹⁹ An innovation that is incremental to a manufacturer can be radical to its customers and complementors but incremental to its suppliers. For example, the DSK (Dvorak Simplified Keyboard) arrangement that by many estimates performed 20 to 40 percent better than the QWERTY arrangement that most of today's keyboards have, was competence-enhancing to its innovator, Dvorak, and other typewriter manufacturers.²⁰ All they had to do was rearrange the position of the keys if they wanted to manufacture the DSK. But it was competence-destroying to customers who had already learned how to type with the QWERTY keyboard, since to use the new keyboard, they would have to relearn how to touch-type again. The various faces of this innovation at the different stages of the innovation value-added chain are shown in Figure 5.6.

Another example (also illustrated in Figure 5.6) is Cray Computer's decision in 1988 to develop and market a supercomputer that would use gallium arsenide (GaAs)²¹ chips—a technology that yields very fast chips and consumes very little power but that was still relatively unproven then—instead of proven silicon chip technology that its suppliers had built their competencies in. While the supercomputer design was competence-enhancing to Cray, its decision to use gallium arsenide was competence-destroying to its traditional silicon chip supplier base.

These examples suggest that an innovation which is incremental to the manufacturer may not be to suppliers, customers, or complementors. Thus, incumbents for whom an innovation is competence-destroying may still do well if the innovation is competence-enhancing to their co-opetitors, and relations with co-opetitors are important and difficult to establish. The implications are that a firm's success in exploiting an innovation may depend as much on what the innovation does to the capabilities of the firm as on what it does to the capabilities of its co-opetitors.

FIGURE 5.6 Impact of a Technological Change on Co-opetitors

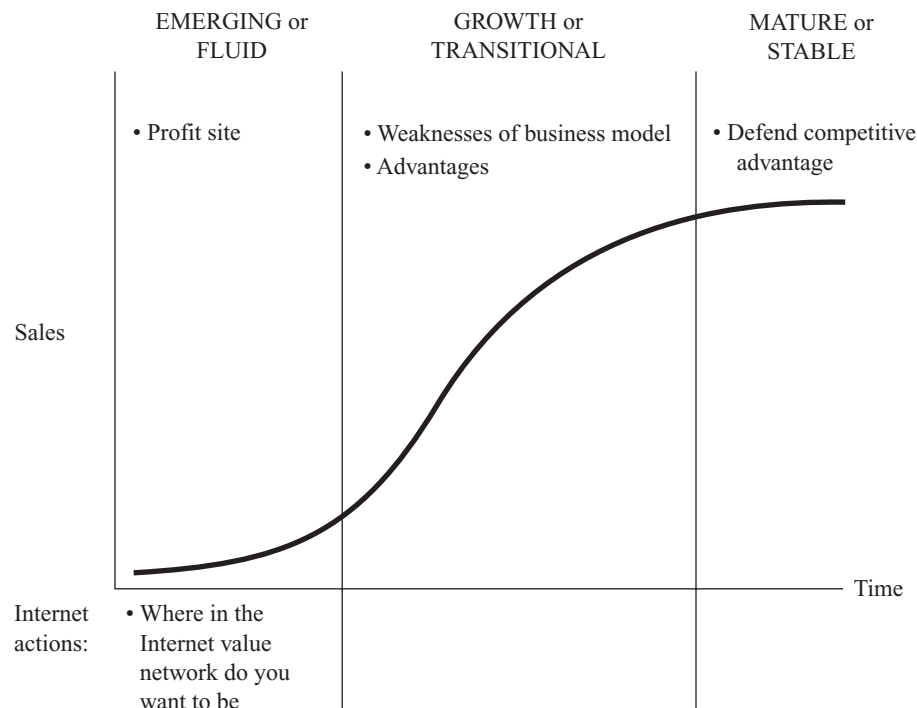


Implications for the Internet The innovation value-added chain model suggests that a book publisher that wants to exploit the Internet should be concerned not only about the extent to which the technology is disruptive to it, but also about the extent to which it is disruptive to its suppliers (e.g., authors, copy editors, and printers), customers (book wholesalers and resellers), and complementors. A book publisher that does not include in its strategy what Amazon.com has done to book wholesalers and retailers may be missing important strategic information.

Technology Life Cycle Model

The technological change models that we have explored so far have been about one-shot change: there is a change, and depending on the type of change—whether it is incremental, radical, architectural, value-added chain-based, or disruptive—one can make certain decisions to better exploit the change. The models do not take into consideration the fact that following a technological change, the new technology usually evolves. **Technology life cycle** models have been used as a framework for understanding the evolving competitive landscape following a technological change and the consequences for firm strategy (see Figure 5.7). According to these models, a technology usually goes through three phases: Fluid, transitional, and stable.²² In the **fluid phase**, at the onset of an innovation, there is a great deal of product and market uncertainty. Firms are not quite sure what should go into the product. Customers too may not know what they want in the product. There is competition between the new and old technologies as well as between different designs using the new technology. Firms interact with their local environment of suppliers, customers, complementors, and competitors to resolve both technological and market

FIGURE 5.7 Internet Technology Life Cycle



uncertainties. Product quality is low, and cost and prices are high, as economies of scale and learning have yet to set in. Market penetration is low and customers are largely **lead users**—customers whose needs are similar to those of other users except that they have these needs months or years before most of the marketplace²³—or high-income users. At this time, firms must place their strategic bets by choosing where in the value chain or network of the technology they want to exploit the technological change.

As a vision of the type of customer value that can be offered and the potential profits that can be made are articulated, profit-motivated entrepreneurs flock to different profit sites. Since product/service and market requirements are still ambiguous, there are very few failures. Early in the life of the U.S. automobile industry, for example, over a thousand firms entered. As more and more firms enter, there is competition to develop products or services. There is also competition for resources—for capital, for talented employees—and for customers and suppliers. There may, for example, be tens or hundreds or even thousands of firms in an industry, each of which wants, say, a 20 percent market share. By the year 2001, this stage had passed for many industries using the Internet. This was the stage when firms made their initial decisions about their location in the Internet value network: as, for example, an ISP, backbone supplier, content supplier, network provider, network infrastructure provider,

network utility provider, applications service provider (ASP), online content provider, or user of the Internet such as online brokers, online retailers, online market makers, B2B exchanges, B2C, and C2C.

The technology enters the **transitional phase** when some standardization of components, market needs, and product design features takes place, and a standard or common framework for offering products or services emerges signaling a substantial reduction in uncertainty, experimentation, and major changes. The customer base increases from lead and high-income users to mass market during the growth phase. Many firms find out that they do not have what it takes to compete for customers, suppliers, and resources and then are forced to file for bankruptcy, be bought, or merge. Thus the number of entries decreases drastically while the number of exits increases tremendously. Firms that win the standard or happen to have the capabilities that underpin the common framework are likely to fare better. In the automobile industry example, hundreds of firms were forced to exit the market when a dominant design emerged. In the transitional phase, a firm should determine where it excels or wants to excel and try to reinforce or build upon that.

As of the year 2002, the Internet was in the transitional phase for many industries. The Web had emerged as a standard. The dot.com burst had taken place with many firms being forced to file for bankruptcy, merge with others, or totally restructure their business models. Firms continued building their networks (for externalities), establishing brands, winning customers, and modifying their initial bets as uncertainty unfolded. Thus, even as many firms died, others like eBay gained yet more registered users and boosted their brands, and America Online (AOL) merged with Time Warner to form AOL Time Warner.

In the **stable phase** (or mature phase), products built around the common framework or standard proliferate. Products are highly defined with differences fewer than similarities between competing products. Demand growth slows considerably with most output earmarked to satisfy replacement needs. The total number of firms in each industry decreases considerably from the peak of the growth phase. In the automobile industry, for example, there were only three U.S. firms that remained from the thousands that had entered the market at one time or another. In this phase, a firm's strategies focus on defending its position and watching out for the next technological change that could start the life cycle over again. As of 2002, this next phase had yet to arrive for most of the new markets created by the Internet.

Implications for Internet business models Before exploring the implications of the life cycle model for Internet firm strategies, it is important to note that different industries usually experience a technological change at different times.²⁴ For example, computers, cash registers, calculators, and watches were mechanical or electromechanical devices before their transformation to electronic devices. The technological change from mechanical to electronic took place at different times for each industry. Thus, we can expect the technology life cycle of the Internet to vary from industry to industry with, for

example, backbone suppliers, content suppliers, and network providers all having different life cycles.

In the fluid phase, potential new entrants make their bets concerning where they want to locate in the value network that we discussed in Chapter 2. Choosing where to locate is not an exact science, but an entrepreneur can make a more informed decision with data on three factors. First, an entrepreneur can brainstorm with customers, especially lead users, on the problems that can be solved at each of the potential product-market positions, what kind of value the firm can offer customers in solving the problem, and what it takes to get the other components of a business model in place. Second, an entrepreneur should perform an industry analysis to learn more about the attractiveness of the industry in question. (We will say more about industry analysis in Chapter 10.) Third, it should evaluate its capabilities and capabilities gaps in what it takes to craft and execute a winning business model for each product-market position. Data from all three factors are critical in making a choice of what product-market position to locate in. Since a standard or dominant design/solution has not yet emerged in the fluid phase, it is important for the firm to learn as much as possible about the different design/solution options while establishing relationships with those who can tip the scales in the standards/dominant design race. In particular, teaming up with lead users can be critical because a firm can learn much from such customers about the emerging applications of the technology. It is also important to pay attention to lead products/services or so-called killer applications. Adult entertainment appears to be one of the early killer applications in the B2C and C2C businesses and can provide some valuable lessons. The choice of revenue can also be critical. Many dot.coms chose to go after advertising revenues. This turned out not to be a very good decision.

During the growth phase, when a dominant solution or design has emerged, a firm should appraise its business model and determine its strengths and weaknesses. From this appraisal, the firm can determine which elements to reinforce and which ones to build. In the case of the Internet, this may mean teaming up with firms that have complementary assets. It may also mean teaming up to build a larger network of clients, customers, or community. Advertising (to build brand equity) and nonreversible investments all prepare for blocking later in the life cycle. Given how easy it is to imitate Internet business models, firms may have to keep introducing changes in the models or their components. Amazon.com's continuous extension of its capabilities illustrates how a firm keeps making incremental innovations in its business model.

EXAMPLE: THE DOT.COM BOOM AND BURST

In 1998, 1999, and early 2000, just about any dot.com that went to the public to raise money through initial public offerings (IPOs) was very well received. For example, on November 13, 1998, theGlobe.com went public with its shares priced at \$9 each. The stock price shot up to \$90 before eventually closing at

\$63.50. Slightly more than a year later on December 9, 1999, VA Linux Systems, a company that built computer servers, also went public with an IPO offer price of \$30. Again, investors wanted to pay about 10 times as much and the price shot up to \$299 before settling down to \$239.25 at the end of the day. There was nothing distinctive about VA Linux's business model either. It planned to build systems using commodity components and a free operating system in Linux. It seemed no dot.com company could go wrong even though most of them did not make any money and had no potential to do so. Sometimes, all it took to get investors to invest was the suffix ".com" in a company name. Many dot.coms were touted as attackers who would destroy the bricks-and-mortar firms that they targeted.

By April of 2000, however, things had changed. The Internet bubble, as the inflated stock prices had come to be known, had burst. On March 20, for example, theGlobe.com's share price had dropped to \$3.56, a decline of 94 percent from its first day closing price, while that of VA Linux Systems had dropped to \$38.02, a drop of 84 percent from its first day closing price. By 2001, the valuations of many dot.coms had dropped considerably and many had filed for bankruptcy. In fact, VA Linux Systems' value had dropped to less than \$5.00. Many more firms had died without reaching the IPO stage and with them the dreams of many entrepreneurs. Many individuals who invested in these dot.coms lost a lot of money.

These events raise some interesting questions: Should we have expected the boom and burst of the dot.coms? Can we better predict when dot.coms are likely to successfully attack bricks-and-mortar firms and when they are not likely to? The technological change models that we have explored in this chapter can help us answer these questions.

Should the Dot.com Bubble and Burst Have Been Expected?

According to the technology life cycle model that we explored, we should have expected the dot.com bubble and burst. The Internet allowed firms to offer new customer value in existing markets and new ones. Entrepreneurs who recognized this value, or its potential, located at different profit sites. In the fluid phase of the technology, there is a lot of entry. In 2000, for example, there were over nine thousand ISPs, and ISPs are just one of many profit sites. As the number of entries increased, competition for resources such as capital, talented employees, and standards increased. So did competition for market share, customers, and suppliers. Each firm wanted to win. Each one wanted a 20 percent market share. As competition heated up, some firms were forced to exit or to be bought by rivals with better potential.

Who Wins in a Dot.com versus Bricks-and-Mortar Battle?

Who is expected to win in a new entrant versus incumbent battle? One answer to this important question can be arrived at by using the complementary asset model. First, we determine how easy it is to imitate the technology. In the case

of the Internet, the technology is easy to imitate for most industries. Second, we take a look at complementary assets. If complementary assets are important and difficult to come by, then the owner of the complementary assets will make money. Thus, in a dot.com versus bricks-and-mortar battle in any industry, who wins depends on who has the complementary assets. In most industries, bricks-and-mortars have such complementary assets as brands, relationships with customers and suppliers, etc. They can leverage these assets in formulating and executing their business models. Dot.coms that do not have such assets are not likely to do as well.

Summary

Most business models are not static. The technology on which they rest and the environments in which they operate continually change. The firms and competitors who design them initiate or react to change. In responding to or initiating change to sustain or attain a competitive advantage, it is important to understand the nature of change so as to better take advantage of it in crafting and executing a business model. Where that change is from a new technology such as the Internet, one of the first things to remember is that profiting from the new technology will take more than mastering the new technology. Profiting from a new technology depends both on how easy it is to imitate the new technology and the extent to which complementary assets are important and readily available. In short, it takes more than technology to make money from technology. It also takes complementary assets. Imitable or not, being able to develop the new technology is important since many firms that fail to profit from a new technology, despite having complementary assets, do so because they do not know how to develop the new technology. Various models have explored who is most likely to more effectively develop a new technology. The incremental/radical, architectural innovation, disruptive change, innovation value-added chain, and technology life cycle models all argue that the type of firm that can best exploit a technological change depends on the type of change. Table 5.1 summarizes the elements of these models.

TABLE 5.1 Summary of Models

Model	Key Points about Model	Implications for the Internet
Complementary assets	• It takes more than technology to profit from a technology. The imitability of the technology and complementary assets are also important. • Explains why inventors are not always the ones that profit from an innovation.	• Since the Internet is an imitable technology, we can expect bricks-and-mortar firms that have complementary assets to win bricks-and-mortar versus dot.com battles in those industries where such assets are important and difficult to acquire.

(continued)

TABLE 5.1 (continued)

Model	Key Points about Model	Implications for the Internet
Incremental/Radical dichotomy	• Focuses on technological component of innovation. • Bundles component and architectural knowledge. • The type of technological change determines the type of firm that is able to exploit it. • Capabilities and cultures that are embedded in the old technology are likely to handicap firms in the face of radical technological change. Incumbents are more likely to exploit incremental technological changes while new entrants are more likely to exploit incremental changes.	• Whether the Internet is radical or incremental depends on the industry. • Where the Internet is radical, firms with capabilities and cultures that are embedded in the old technology run the risk of these capabilities handicapping Internet efforts. Different organizational arrangements can alleviate the problem. • Complementary assets are likely to help bricks-and-mortar firms in battles with dot.coms
Architectural innovation	• Unbundles technological knowledge into component and architectural innovations. • Explains why incumbents fail at what appear to be incremental innovations—they are actually architectural innovations.	• Can expect impact of the Internet to have a larger long-term effect on value chains of manufacturing companies than would appear at first glance. • Knowledge of interactions between value-chain functions likely to change enough to influence functional activities and firm performance.
Disruptive change	With disruptive technologies, • New markets are created by introducing new products or services. • The new products or services cost less than existing products or services. • New products initially perform worse than existing products when judged by the performance metrics that existing mainstream customers value. Eventually, performance catches up. • The technology should be difficult to protect using patents.	• This model suggests that the Internet is a disruptive technology in many industries. In such industries, firms need organizational arrangements that allow for development of Internet resources, processes, and values without being handicapped by bricks-and-mortar resources, processes, and values. • Some firms may need to have separate Internet entities.
Innovation value-added chain	• The impact of a technological change on co-opetitors may be just as important as that on focal firms. (Recall that co-opetitors are the suppliers, customers, and complementors with whom the firm must cooperate and compete.) • Explains why incumbents may fail at incremental innovations and why they may succeed at radical innovations.	To really understand the impact of the Internet on a firm's business model, it is important to understand the impact on the firm's co-opetitors as well.

(continued)

TABLE 5.1 (continued)

Model	Key Points about Model	Implications for the Internet
Technology life cycle	There are three phases in an innovation's life cycle: - In the <i>fluid</i> phase, firms place their bets: e.g., new entrants choose the profit sites in which they want to locate. - In the <i>transitional</i> phase, where a standard or dominant design defines a critical point in the life of an innovation, competition forces many firms to exit. - In the <i>specific</i> phase, firms may want to determine their competitive advantage and focus on it.	- We should have expected the dot.com boom and burst to take place although the timing was not predictable. - Firms that want to improve their chances of survival during a burst need a good business model.

Key Terms

architectural innovation model, 87	fluid phase, 93	product-market position, 82
competence-destroying, 85	imitability, 79	radical in the economic sense, 84
competence-enhancing, 86	incremental in the economic sense, 84	radical/incremental change model, 84
complementary assets, 79	incremental innovation, 86	resources, 89
culture, 85	innovation value-added chain, 91	stable phase, 95
disruptive technologies, 89	lead users, 94	technology life cycle, 93
	new entrants, 85	transitional phase, 95
	processes, 89	values, 90

Discussion Questions

1. What is the significance of this statement from the text: "It takes more than technology to profit from a technology"?
2. Consider a bricks-and-mortar retailer that wants to enter the online retailing business. Is it better off (1) creating a separate legal firm, (2) establishing a separate unit within the firm, or (3) scattering employees with Internet skills in its bricks-and-mortar units? Would it be different for a bank or an automaker? Does industry matter for each of the three possibilities?
3. When would you advise a start-up Internet firm to offer itself for acquisition by another firm? Does the type of purchaser matter?
4. Why might an incumbent want to buy a start-up Internet firm?
5. What are the differences between an architectural technological change and a disruptive technological change?

6. Why have so many bricks-and-mortar firms survived the Internet despite the disruptive technology model's predictions otherwise?
7. Can you think of bricks-and-mortar innovations that are radical in the organizational sense but incremental in the economic sense?

Notes

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11. This example is from "Breakdown," *The Economist*, May 22, 1999, pp. 69–70.
12. The Cisco case comes from "Cisco Business and the Internet," *The Economist*, July 26, 1999, p. 12.

13. C. M. Christensen, *The Innovator's Dilemma*. See also C. M. Christensen and M. Overdorf, "Meeting the Challenge of Disruptive Change," *Harvard Business Review* (March–April 2000), pp. 67–76.
14. C. M. Christensen and M. Overdorf, "Meeting the Challenge."
15. C. M. Christensen and M. Overdorf, "Meeting the Challenge."
16. C. M. Christensen, *The Innovator's Dilemma*.
17. Complementors are firms that provide complementary products or technologies for the manufacturer's product or technology, usually directly to customers. For example, Microsoft is a complementary innovator for makers of personal computers.
18. A. N. Afuah, "Do Your Co-opetitors' Capabilities Matter in the Face of a Technological Change?" *Strategic Management Journal* 21, no. 3 (2000), pp. 387–404.
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