



The S-Curve and Its Strategic Lessons

What Curve Are You On?

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Innovator's Toolkit:

10 Practical Strategies to Help You Develop and Implement Innovation

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8

The S-Curve and Its Strategic Lessons

What Curve Are You On?

Key Topics Covered in This Chapter

- *The S-curve concept*
- *Lesson's from the S-curve for innovators*
- *Cautions in using the S-curve*

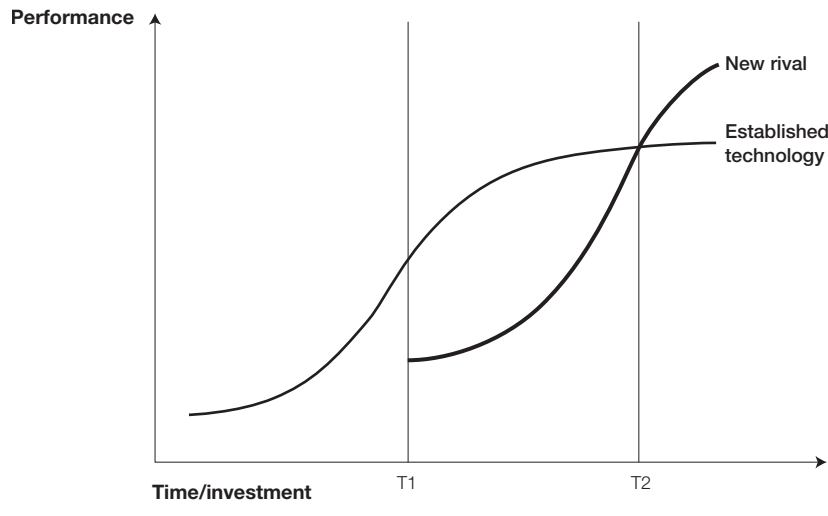
AS DESCRIBED IN chapters 1 and 2, incremental innovation that leverages or adapts a company's core technology is a safer and more predictable approach to keeping the cash registers ringing than is its radical counterpart. However, as the old saying goes, "every dog has his day," and many technologies eventually lose their competitive power and revenue-generating potency. Technologies (and services), like living things, produce cycles of growth and maturity; and as human needs change, or when new technologies emerge that satisfy need more effectively, those technologies enter a period of decline. This chapter uses the S-curve to describe these observations and to suggest how management can think about the life cycle of technology in strategic ways.

The S-Curve Explained

The course of successful technological innovation is often described through an S-shaped curve like the two shown in figure 8-1. An *S-curve* is plotted on a two-dimensional plane and demonstrates how the performance or cost characteristics of a technology change with time and continued investments. Here the horizontal axis reflects the unfolding history of technological innovations (investment over time), while the vertical axis indicates product/service performance or cost competitiveness.

The S-curve of the established technology is on the left in figure 8-1 and the curve of a newer rival technology is on the right. Notice

FIGURE 8-1

The S-curve: An established technology and a new rival

how the performance of the established technology has improved over time, at first rapidly and then at a modest pace. This is usually the result of investments and learning. Investments and learning by Hewlett-Packard, for example, have markedly reduced the costs and improved the performance of ink-jet printers over the years.

By the time the rival technology first enters the picture (T1), the established technology is already much improved and approaching its maturity. With maturity, the pace of improvement slows. Years of experimentation and incremental improvements have exhausted most of the opportunities to lower cost and improve performance. The proverbial “low-hanging fruit” has been picked. Every incremental gain in cost reduction and product performance is more and more difficult.

Now consider the S-curve of the new technology. Typically, the newly emerged rival technology is crude when compared with the established technology, with many issues yet unsolved—that’s what we see at T1 in the figure. These weaknesses may cause established companies to write it off as “not a real threat.” Most customers likewise ignore the new technology because it lacks the performance or

cost characteristics they require—at least at the moment. The first-generation roll-film cameras developed by George Eastman late in the nineteenth century fit this description. The images produced by Eastman's roll film couldn't hold a candle to the superb images produced by chemically coated glass plates, the technological standard of that era, so the professionals and serious amateurs who constituted the photographic market in those days overwhelmingly rejected Eastman's photo film product. The same can be observed with respect to many of the innovative high-tech products introduced over the years. If you used the first-generation word-processing program for Apple's personal computer, you probably said, "I think that I'll hang onto my old typewriter." And with good reason. That early word processor had only uppercase letters, and the printers available at the time were expensive and produced low-quality output.

If the first-generation word processors were clunky, history tells us that the first typewriters were also unsatisfactory. Samuel Clemens (a.k.a. Mark Twain) was one of the first typewriter owners, and he complained often about its shortcomings. As he wrote to his literary friend, W. D. Howells, "*I dont know whether i am going to make this type-writing machine go or nto.*"

Many of the problems first associated with a new technology, however, are gradually solved. Manufacturing process improvements and scaled-up production cause costs to fall. The same often happens in the world of services; people work the bugs out of service innovations to the point of providing near-flawless delivery. Again, the performance/cost characteristics of the new technology improve with time and investment—typically slow in the beginning, but gaining speed thereafter. At a certain point (T2), the new technology matches its older rival in performance and/or cost features. But unlike the established technology, the new one has plenty of opportunities for continued improvement. If all goes well, it will improve to the point that its older rival will be displaced from the main marketplace.

This reversal of fortunes describes the observable plight of chemical-based photography today as it faces the challenge of digital imaging. Barring some technological breakthrough, the major opportunities for film improvement have been exploited. Those that remain will be costly and difficult to implement. Meanwhile, digital

imaging can look forward to many years of improvements. It's already happening. The price of digital cameras keeps dropping, and performance gets better every year. It is very conceivable that film photography will survive only in a number of specialized niches, with digital imaging dominating all others.

The most dangerous period for a new technology is in the early phase, when its price-performance characteristics are below that of the established technology. If it can find and serve a niche market or lead users who, for one reason or another, value it, the technology may survive. If it can continue to improve its price-performance characteristics, it may even force its way into the mainstream market. The now-popular hybrid-powered vehicle provides an example.

The hybrid-powered cars first introduced by Honda and Toyota were revolutionary in concept—major departures from the century-old internal combustion-engine technology that dominates the existing auto fleet. When first introduced in 2000, these hybrid vehicles lacked some of the performance characteristics (acceleration and top speed) cherished by most drivers. But for the minority of motorists who really cared about fuel economy and the health of the ecosystem, traditional performance characteristics didn't matter. They were willing to take a risk on this new technology and even pay a premium for it. As a result, hybrid cars found a niche and within just a few years were rapidly expanding into the mainstream. The fuel-cost crisis that struck like a lightning bolt in 2008 gave hybrids' market acceptance a huge boost. As the technology improves and as more drivers familiarize themselves with these new automobiles, it's likely that their sales will take a larger share of the broader market. This pattern is fairly typical of how successful innovations eventually displace established technologies and the companies that cling to them.

Successful innovations can also gain markets by following paths of diffusion:

- From military to civilian applications (e.g., GPS technology)
- From scientific to consumer uses (e.g., the Internet)
- From early adopter “techies” to lagging adopter non-technical users (e.g., personal computers)

It's worth noting, however, that older technologies do not always fade into the sunset as their challengers burst onto center stage. So we must approach this business of the S-curve with a certain amount of judgment and caution. The radio industry, after all, hasn't disappeared in the wake of television broadcasting; people still pack movie theaters, even though thousands of movie DVDs are available for less than half the price of a theater ticket; and millions of amateur astronomers still train their small telescope barrels skyward each night, despite the fact that immensely better images of planets and deep-sky objects are freely available on the Internet. In these and similar cases, the marketplace appears to have room for all.

Four Lessons

The scenario described by the two curves in figure 8-1 points to important lessons for business strategists. How can they migrate from the old, mature technology to the new? It is helpful to use the terminology of Richard Foster in describing companies associated with the established technology as “defenders” and adherents to the emerging technology as “attackers.”¹

Lesson #1: Defenders face difficult choices.

Companies that live off an established technology face difficult choices:

1. Abandon the business they already own, with all its cash flow and certainty, in favor of the rival technology, or
2. Hold onto what they have, and work hard to make it better or useful to more customers, or
3. Hold onto the existing business *and* begin investing in the new technology as a hedge against the future.

Of these options, the first (abandon the old) is the most difficult and is almost always impractical. How can any company afford to

abruptly walk away from its current investments in skills and physical assets and still survive? When discount retailers emerged in the U.S. marketplace in the 1960s, for example, the big department stores like Sears, Filene's, and Marshall Field's, which dominated the market, could not abruptly follow suit: they had huge investments in properties, supplier relationships, and loyal customers. Only Minneapolis-based Dayton Hudson Corporation successfully made the transition to discount retail (Target).

Switching to an emerging technology usually requires new internal competencies and new facilities. The customer base may even be different and unfamiliar. Dropping everything to jump onto the new S-curve would be financial suicide in most cases. Also, commitment to the new S-curve is required exactly when doing so is most perilous—when the technology is still relatively crude and unsettled.

The second option—sticking to the current technology—is the easiest choice for decision makers. In the short run it produces no severe disruption. And it is quite possible that improvements to the current technology may extend its competitive life for a number of years. The nineteenth-century gas lighting industry managed to do this even as it developed new markets for its product (see “The Gas Industry Fights Back”). In the long run, however, sticking with an aging technology usually guarantees declining fortunes.

The third option—holding onto the existing business *and* investing in the new technology—is often the most practical course. The company can continue to operate the existing business and serve current customers as the new one develops. This is what Kodak has attempted as digital photography eats away at its existing film and photo-processing businesses. It is the choice that RCA, Sylvania, and others attempted decades earlier when their vacuum tube businesses were threatened by the appearance of solid-state transistors. The choice seems logical, but it has practical problems:

- The company may not have the competencies to develop the new technology. The film photography business, for example, is based on deep knowledge of chemicals, papers, mass production, and retail distribution; digital photography, in

contrast, demands knowledge of advanced electronics and computing.

- The culture of the organization may not welcome the new technology. IBM ruled the world of mainframe computing and mainframe people ruled IBM. So when the decision was made in the 1980s to develop a PC business to serve the growing desktop computing market, that business was never treated seriously. The IBM PC had to be developed through a distant research lab. Later, IBM would go through a successful though wrenching migration from mainframes to e-business computing.
- Existing customers may pressure the company to stay in the old business. The discussion in chapter 2 of the “tyranny of served markets” pointed out that many, if not most, customers have a strong bias toward the established technology and will stick with it until the new one is demonstrably superior and less costly. Until that time these customers will urge companies to continue supplying them with parts and upgrades—in effect, telling them to stay in their old businesses.

In many cases, the best solution to these practical problems is for the established enterprise to develop the new technology within a separate subsidiary or operating unit.

**Lesson #2: Leaders in one generation of technology
are seldom leaders in the next.**

Given the problems with each of the choices described above, it is not surprising that leaders of one generation of technology are seldom leaders of the next. The electronics business provides a fitting example. As described by Tushman and O'Reilly: “In the mid-1950s, vacuum tubes represented roughly a \$700 million market. Leading firms . . . included such great technology companies as RCA, Sylvania, Raytheon, and Westinghouse. Yet from 1955 to 1982, there was almost a complete turnover in industry leadership, a remarkable shakeout brought on by the advent of the transistor.”² The same

The Gas Industry Fights Back

As described by James Utterback in his engaging book, *Mastering the Dynamics of Innovation*, the many gas companies that produced and distributed illuminating gas for America's towns and cities enjoyed a comfortable monopoly until the 1880s, when incandescent electric lamps first appeared. Recognizing the threat, the gas companies fought back with incremental improvements to gas production and distribution. They also launched a public relations campaign that emphasized the dangers of electricity, and used their political influence to impede electric distribution. Those efforts, however, did little to hold back adoption of electric lighting.

The gas industry got a big break when Austrian inventor Carl von Welsback created a burner mantle that produced a fivefold improvement in gas lighting efficiency and a one-third reduction in operating costs. "This single improvement," writes Utterback, "threatened to sink the nascent electric light industry and explains why it took Edison twelve years to turn a profit in his fast-expanding electric lighting business."

Welsback's improvement gave gas lighting a momentary reprieve. But subsequent improvements were few and insignificant, leaving its cost/performance characteristics on a plateau. Meanwhile, electric lighting was making regular and substantial improvements in cost and performance, dooming gas as a form of lighting. The industry, however, survived and prospered by finding new markets in residential/commercial heating and process heat for industry.

SOURCE: James M. Utterback, *Mastering the Dynamics of Innovation* (Boston: Harvard Business School Press, 1994), 64–66.

phenomenon has been observed in many other industries. Here are a few examples:

- When mini-computers came along, upstart Digital Equipment became the leader, not IBM, the then-dominant computer company. When PC technology rose to the top, Digital missed

the turn and lost its leadership to Dell, Hewlett-Packard, and other makers.

- Car rental companies around the globe had developed a finely tuned business model for providing auto transportation to customers for short periods of time—usually for one to seven days. They had the vehicles, multiple locations, and systems for making transactions. Zipcar created a new model for a very similar customer, urban dwellers who occasionally needed a car for an hour or a day. The innovative system it developed, which is now well entrenched in many U.S. cities and in the United Kingdom, caught the established car rental companies flat-footed. As of late 2008 they were still trying to figure out how to get into the short-term rental game.
- When eBay created its online auction site, traditional markets for used and collector items (classified newspaper ads, flea markets, and so forth) were never able to compete at the same level.
- As DVD videos became more popular in the United States, it wasn't the industry leaders (e.g., Blockbuster) that created a new business model for distributing them. An outsider, Netflix, stepped in with a better solution for most customers.

These examples may be disheartening if your company currently leads its industry. But while long-term decline is likely, it is not inevitable. Defenders, according to Richard Foster, can enlist various strategies to defeat upstart technological challengers:

- Leapfrog the attacker's technology: During the early stage of the S-curve, a new technology and its markets are undeveloped. If the attacker is a small company with limited resources, full development may be slow in coming. That leaves the large defender with greater resources an opportunity to jump onto the S-curve and capture the lead.
- Acquire the attacker: If the attacker's new technology appears poised to eat up your business, consider buying the attacker. If

you follow this course, however, be sure to give the acquired company the autonomy it needs to succeed. Alternatively, consider licensing the attacker's technology.

Lesson #3: Attackers enjoy important advantages.

New technologies and innovative business models are often introduced through small, entrepreneurial firms. Industry powerhouses Virgin Atlantic, Hewlett-Packard, Intel, Apple, Microsoft, Amgen, Southwest Airlines, Dell, and eBay all began in this way.

Though entrepreneurial firms are generally weak in terms of brand recognition, manufacturing, and financing in their early stages, they often enjoy substantial advantages. Here are the most important:

- An undivided focus: Managers of upstart companies do not have to divide their attention between the ongoing business and the innovation because there is no ongoing business to speak of. Consequently, they can devote most of their attention to development of the new technology or business model.
- An ability to attract talent: Capable technical and managerial talent is often attracted to new ideas with promising futures, especially when stock options are a significant portion of compensation.
- Freedom from the influence of powerful customers: Many established companies fail to make the leap to the new technology because powerful customers persuade them to continue doing what they are doing. This is what happened to Goodyear Tire and Firestone when radial tire technology appeared. Not wanting to change their suspension designs, the Big Three U.S. automakers urged their suppliers to stick with bias ply tires. Michelin Tires, which had no supplier relationship with the Big Three, pressed forward, establishing leadership in the field.
- Little bureaucracy: Almost by definition, small entrepreneurial companies are unencumbered by the bureaucracy that burdens their larger rivals. That makes them fast and flexible.

- No need to protect investments in unrelated skills or assets: Established companies can find many reasons to not adopt new technologies or business models, such as:

“We can’t sell it through our existing distribution network.”

“It would cannibalize our current sales.”

“We just invested \$50 million in facilities to manufacture our current product.”

“Our sales people wouldn’t understand it; they’d have to be retrained.”

- Entrepreneurial attackers do not have these concerns.

Lesson #4: Management should be alert to the next curve.

If you’re a defender, take measures to know where an attack will come from. Are there nascent technologies on the horizon that, if perfected, would sink your business? Some companies use technology “scanners” to answer that question.

Limits to These Lessons

The S-curve is a useful thinking tool for managers. It describes generalized development paths for new and established products and technologies. But use it with this important caution: nothing about these paths is preordained; not every innovative technology overcomes its established rival. As Jay Paap and Ralph Katz have put it, “Success [with an existing technology] need not be paralyzing.”³ Indeed, we could probably fill a book with descriptions of innovative technologies that appeared promising but failed to make a sizeable inroad in the market. Gallium arsenide, for example, hasn’t made a dent in the silicon-based chip business, as many had forecasted. Optical storage hasn’t bested its entrenched magnetic rival as many predicted. And the list goes on. So look before you leap from one S-curve to another.

Nevertheless, management should always be alert for change and challengers. It must find the future and pursue it, the subject of chapter 9.

Summing Up

This chapter has explained the concept of the S-curve and its implications for managers and innovators. Here are the key points:

- An S-curve describes how the performance or cost characteristics of a technology change with time and continued investments. In the generalized model, a newly introduced technology is crude and not particularly competitive with established rivals, except in specialized niche markets.
- Performance and/or cost characteristics enjoy a period of rapid and steady improvement as technical issues are solved. Eventually, a new technology's performance or costs may eventually equal—and perhaps exceed—those of the established rival.
- A new technology does not stay new forever, but enters a period of maturity in which improvements are small, infrequent, and increasingly costly. At this point it becomes vulnerable to attack by still newer technologies that address problems or needs in different ways.

The S-curve concept was shown to have a number of lessons:

- Defenders face difficult choices with respect to how they should react to the appearance of a new technology.
- Leaders in one generation of technology are seldom leaders in the next.
- Attackers enjoy important advantages over established rivals: an undivided focus, an ability to attract talent, freedom from the “tyranny of service markets,” little bureaucracy, and no need to protect investments in unrelated skills or assets.

To grasp the lessons of the S-curve, managers should:

- Stand back and contemplate where their companies and their key technologies are on the S-curve.
- Do the same for rival technologies, particularly those with promising futures.
- Determine which strategic option is most promising.

Glossary

BREAKEVEN ANALYSIS: A financial method for determining how much (or how much more) you need to sell of a product or service in order to pay for a fixed investment—in other words, at what point you will break even on the cash flow produced by the new product or service.

BREAKTHROUGH INNOVATION: See *Radical innovation*.

BUSINESS CASE: The information and argumentation needed to demonstrate the merits of an innovative idea to management and other stakeholders.

CATCHBALL: A cross-functional method for accomplishing two things: idea enrichment/improvement and buy-in among participants.

CHAMPION: A person who assumes responsibility for moving a promising innovative idea or project along a path toward the market. The champion need not be the idea's creator, but must have the enthusiasm and commitment needed to promote and implement it on the road to success.

COMMUNITY OF INTEREST: An informal group whose members share an interest in some technology or application.

CONTRIBUTION MARGIN: The amount of money that every sold unit contributes to paying for fixed costs. It is defined as net unit revenue minus variable (or direct) costs per unit.

CONVERGENT THINKING: Thinking that evaluates new ideas to determine which are genuinely novel and worth pursuing.

COST OF CAPITAL: The weighted average cost of the organization's different sources of capital, both debt and equity, expressed as a percentage.

CREATIVITY: A process of developing and expressing novel ideas that are likely to be useful.

DIFFERENTIATION: Deliberately setting one's product or service apart from those of rivals in a way that customers value.

DISCONTINUOUS INNOVATION: See *Radical innovation*.

DISCOUNTED CASH FLOW (DCF) ANALYSIS: A method for determining the monetary value of a commercial idea or cash flows over a particular span of time based on time-value-of-money concepts.

DISCOUNT RATE: In discounted cash flow analysis, the annual rate, expressed as a percentage, at which a future payment or series of payments is reduced to its present value.

DISCOVERY-DRIVEN PLANNING: A method of evaluation in which decision makers focus their attention on the assumptions that must prove true if the venture or innovation is to reach an acceptable level of profitability.

DISRUPTIVE INNOVATION: An innovation that brings to the market a new and different value proposition with the potential to upset the status quo in a competitive market. A term coined by Clayton Christenson.

DIVERGENT THINKING: Thinking that breaks away from familiar or established ways of seeing and doing.

EMPATHETIC DESIGN: An idea-generating technique whereby innovators observe how people use existing products and services in their own environments.

EXPERIENCE CURVE: A concept that holds that the cost of doing a repetitive task decreases by some percentage each time the cumulative volume of production doubles.

EXTRINSIC REWARD: A reward that appeals to a person's desire for attainment distinct from the work itself: a cash bonus, a promotion, or stock options.

FIXED COSTS: Costs that stay mostly the same, no matter how many units of a product or service are sold—costs such as the cost of product development, insurance, management salaries, and rent or lease payments.

GROUPTHINK: A phenomenon often observed in cohesive or homogeneous groups that produces unanimity of opinion, resistance to contrary

viewpoints, and antagonism to group members who disagree with the prevailing view.

HURDLE RATE: The minimal rate of return that all investments for a particular enterprise must achieve.

IDEA FUNNEL: A concept used in product development to illustrate how many innovative ideas are gradually reduced down to a very few that proceed to commercialization.

INCREMENTAL INNOVATION: Innovation that either improves on something that already exists or reconfigures an existing form or technology to service some other purpose. In this sense, it is innovation that exploits some existing form.

INFLUENCER: An individual who provides advice and information to key stakeholders and decision makers.

INNOVATION: The embodiment, combination, and/or synthesis of knowledge in original, relevant, valued new products, processes, or services.

INTERNAL RATE OF RETURN (IRR): The discount rate at which the NPV of an investment equals zero.

INTRINSIC REWARD: A reward that appeals to a person's desire for self-actualization, curiosity, enjoyment, or interest in the work itself.

KAIZEN: A philosophy of continuous process improvement that encourages everyone, at every level, to seek out ways to improve what they are doing.

LEAD USER: A company or individual whose needs are far ahead of market trends. Lead users often modify off-the-shelf products to suit their special needs.

NET PRESENT VALUE (NPV): The present value of one or more future cash flows less any initial investment.

NETWORK EFFECT: A phenomenon in which the value of a product increases as more products are sold and the network of users increases. The telephone was an innovation that benefited from the network effect.

OPEN MARKET INNOVATION: The practice of reaching outside one's company for new product and service ideas.

OPINION LEADER: A person respected for his or her expertise, judgment, and insights. This is the “go-to” person to whom others turn when seeking information or making decisions. The opinion leader’s endorsement of an idea lends credibility and helps accelerate its acceptance.

OPPORTUNITY RECOGNITION: A mental process that answers the question “Does this idea represent real value to current or potential customers?”

PERCEPTUAL MAPPING: A market research tool used to compare products or product ideas against the perceptions of customers. A perceptual map is (usually) a two-dimensional space on which alternative product or product ideas are plotted against their attributes or the primary needs of customers.

PORTFOLIO MANAGEMENT: A methodology widely used by both corporations and individual business divisions to create a proper mix of new product/service or technology projects.

PREFERRED THINKING STYLE: The unconscious way a person looks at and interacts with the world. When faced with a problem or dilemma, a person will usually approach it through a preferred thought style.

PROCESS REENGINEERING: An improvement concept that aims for large breakthrough change—either through wholesale change or the elimination of existing processes.

PRODUCT (SERVICE) PLATFORM: The functional core of a product—usually described as the subsystems and interfaces that form a common structure from which many derivative products can be efficiently developed and produced.

RADICAL INNOVATION: An innovation that represents something new to the world and a departure from existing technology or method. Also referred to as *breakthrough* and *discontinuous* innovation.

S-CURVE: A curve plotted on a two-dimensional plane that models the performance or cost characteristics of a technology change with time and continued investments. The plan’s horizontal axis reflects time and investment, while the vertical axis indicates product/service performance or cost competitiveness.

SKUNK WORKS: A team of people brought together to generate an innovative solution or to solve a particular problem. In some cases, these

are sited in remote settings to keep team members focused on their mission, to minimize interference from the rest of the organizations, or to maintain secrecy.

SPONSOR: Usually a senior person who holds a position of power and who controls some level of resources. This person often provides help with implementation problems and suggests ways in which the champion can present an idea most effectively to management. The sponsor frequently works behind the scenes to supply resources and to protect it from premature extermination.

STAGE-GATE SYSTEM: The stage-gate system is an alternating series of development stages and assessment gates that aims for early elimination of losing ideas and faster time-to-market for potential winners.

SUSTAINING INNOVATION: An innovation that improves the performance of established products. The term was coined by Clayton Christenson.

TEAM ROOM: A dedicated physical space within which full- or part-time members of a work team can congregate to do their work, share information, brainstorm, and so forth. It serves as a central “node” in the communication network that holds participants together and facilitates the information and idea sharing.

TRIZ: Acronym for *theory of inventive problem solving*, which systematically solves problems and creates innovation by identifying and eliminating technical contradictions.

VARIABLE COSTS: Those costs that change with the number of units produced and sold; examples include utilities, labor, and the costs of raw materials.

For Further Reading

- Altshuller, Genrich; Lev Shulyak, translator. *And Suddenly the Inventor Appeared: TRIZ, the Theory of Inventive Problem Solving*, 2nd edition. Worcester, MA: Technical Innovation Center, Inc., 1996. Altshuller's take on how to become an inventor and how to solve technical problems.
- Csikszentmihályi, Mihály. *Creativity: Flow and the Psychology of Discovery and Invention*. New York: Harper Collins, 1996. Csikszentmihályi focuses on the creativity of exceptional people—the paradoxical traits they possess and the unique aspects of their development over the life cycle—but he also suggests ways for enhancing creativity in everyday life.
- Davis, Howard, and Richard Scase. *Managing Creativity: The Dynamics of Work and Organization*. Buckingham, UK: Open University Press, 2001. The creative industries are a growing economic as well as cultural force. This book investigates their organizational dynamics and shows how companies structure their work processes to incorporate creative employees' needs for autonomy while at the same time controlling and coordinating their output.
- Florida, Richard, and Jim Goodnight. "Managing for Creativity." *Harvard Business Review* OnPoint Enhanced Edition. Boston: Harvard Business School Publishing, 2007. How do you accommodate the complex and chaotic nature of the creative process while increasing efficiency, improving quality, and raising productivity? Most businesses haven't figured this out. A notable exception is SAS Institute, the world's largest privately held software company. SAS has learned how to harness the creative energies of all its stakeholders, including its customers, software developers, managers, and support staff. Its framework for managing creativity rests on three guiding principles. First, help employees do their best work by keeping them intellectually engaged and by removing distractions. Second, make managers responsible for sparking creativity and eliminate arbitrary distinctions between "suits" and "creatives." And third, engage customers as creative partners so you can deliver superior products.

- Harvard Business School Publishing. *Continuous Innovation: No Genius Required*. Harvard Business Review OnPoint Collection. Boston: Harvard Business School Publishing, 2001. This Harvard Business Review OnPoint Collection shows you how to approach innovation by systematically: (1) generating new possibilities through applying old, proven ideas to new situations; (2) gathering additional ideas by identifying and learning from individuals and companies well ahead of market trends; and (3) testing the merits of those ideas through rapid, inexpensive experimentation.
- Harvard Business School Publishing. “Debriefing Luc de Brabandere: Boost Your Company’s Creativity.” *Harvard Management Update*, April 2006. Today, popular tastes mutate constantly and technologies advance at a blistering pace. Businesses must continually innovate to keep up. But leaders who can’t detect and respond to rumblings of change—that is, who can’t be creative—stand little chance of generating these innovations. The key to creativity, according to Luc de Brabandere, a partner in The Boston Consulting Group, is learning to articulate and change the stereotypes that limit us. In this debriefing, he outlines four rules managers can follow to circumvent these blocks and hone creative powers.
- Harvard Business School Publishing. *Harvard Business Review on Breakthrough Thinking*. Boston: Harvard Business School Press, 1999. This collection of Harvard Business Review articles highlights leading ideas for incorporating the power of creativity into your strategic outlook.
- Kanter, Rosabeth Moss. “The Middle Manager as Innovator.” *Harvard Business Review OnPoint Enhanced Edition*. Boston: Harvard Business School Publishing, 2001. Kanter’s study of 165 effective middle managers in five leading corporations explores creative managerial contributions and the conditions that stimulate innovation. This article points out that enterprising, entrepreneurial middle managers share a number of characteristics: comfort with change, clarity of direction, thoroughness, a participative management style, as well as persuasiveness, persistence, and discretion.
- Katz, Ralph, editor. *The Human Side of Managing Technological Innovation*, 2nd edition. New York: Oxford University Press, 2002. This collection of articles hits all the bases that a manager of innovation must understand, such as how to motivate R&D professionals and how to manage innovative groups, project teams, and organizational projects. It’s a handy reference for the important people part of innovation.
- Kim, W. Chan and Renée Mauborgne, “Knowing a Winning Idea When You See One,” *Harvard Business Review*, September-October 2000. Identifying which business ideas have real commercial potential is

fraught with uncertainty. This article introduces three tools that managers can use to help strip away some of that uncertainty. The first is the buyer utility map (described in chapter 3 of this book). The second, the price corridor of the mass, identifies what price will unlock the greatest number of customers. The third, the business model guide, offers a framework for figuring out whether and how a company can profitably deliver the new idea at the targeted price.

Laduke, Patty, Tom Andrews, and Keith Yamashita. “Igniting a Passion for Innovation.” *Strategy & Innovation*, July–August 2003. Innovation isn’t simply about a great new thing; it often requires change, and change encounters barriers—some quite powerful. These authors describe how innovators can overcome those barriers by explaining both the why and what: a compelling purpose for an innovation (the *why*) that speaks to both the hearts and minds of one’s audience is often the key to success.

Leifer, Richard, Christopher M. McDermott, Gina Colarelli O’Connor, Lois S. Peters, Mark Rice, and Robert W. Veryzer. *Radical Innovation: How Mature Companies Can Outsmart Upstarts*. Boston: Harvard Business School Press, 2000. This book reveals the patterns through which game-changing innovation occurs in large, established companies, and identifies the new managerial competencies firms need to make radical innovation happen. The authors, experts in a variety of areas such as entrepreneurship, R&D management, product design, marketing, organizational behavior, and operations and project management, distill a comprehensive, interdisciplinary approach to mastering each of these challenges, from the conceptualization of viable ideas to the commercialization of radical innovations.

Leonard, Dorothy, and Walter Swap. *When Sparks Fly: Igniting Creativity in Groups*. Boston: Harvard Business School Press, 1999. Where do the best creative ideas come from? Most managers assume that it’s the readily identifiable “creative types” that offer the quickest route to out-of-the-box, breakthrough thinking, and if you don’t have an eccentric genius on your team, your group is doomed to mediocrity. Yet, say Leonard and Swap, most innovations today spring from well-led group interactions. In this book, the authors reveal that any group—if designed and managed effectively—can produce more innovative services, products, and processes. Unlike most books on creativity, *When Sparks Fly* focuses on the process as it applies to groups of people who may not fit the stereotype of right-brained “creatives.” Leonard and Swap offer managers strategies for generating the group dynamics that lie at the heart of innovative thinking, including specific techniques for rechanneling the tensions of conflicting points of view into new ideas and alternative options.

When Sparks Fly explores how all aspects of the work environment, from leadership style to the use of space, sound, even smell, can enhance innovation.

Levitt, Theodore. "Creativity Is Not Enough," *Harvard Business Review* OnPoint Enhanced Edition. Boston: Harvard Business School Publishing, 2002. Creativity is often touted as a miraculous road to organizational growth and affluence. But creative new ideas can hinder rather than help a company if they are put forward irresponsibly. In this article, the author, a professor emeritus at Harvard Business School offers suggestions for the person with a great new idea. First, work with the situation as it is—recognize that the executive is already bombarded with problems. Second, act responsibly by including in your proposal at least a minimal indication of the costs, risks, manpower, and time your idea may involve.

Michalko, Michael. *Cracking Creativity: The Secrets of Creative Genius*. Berkeley, CA: Ten Speed Press, 1998. Michalko divides the topic into two sections—seeing what no one else sees and thinking what no one else is thinking—and provides concrete examples, strategies, and exercises for each. For example, strategies for novel thinking include connecting the unconnected, looking at the other side, and finding what you're not looking for.

Robinson, Alan G., and Sam Stern. *Corporate Creativity*. San Francisco: Berrett-Koehler, 1997. An in-depth analysis of six elements that make for creativity in the work environment: alignment, self-initiated activity, unofficial activity, serendipity, diverse stimuli, and in-company communication.

Skarzynski, Peter, and Rowan Gibson. *Innovation to the Core: A Blueprint for Transforming the Way Your Company Innovates*. Boston: Harvard Business School Press, 2008. Peter Skarzynski and business strategist Rowan Gibson share the accumulated wisdom from Strategos—the consulting firm founded by Gary Hamel and led by Skarzynski that helps clients instill innovation into their very core. Drawing on a wealth of stories and examples, the book shows how companies of every stripe have overcome the barriers to successful, profitable innovation. Readers will find parts devoted to crucial topics, such as how to organize the discovery process, generate strategic insights, enlarge the innovation pipeline, and maximize return on innovation. Frameworks, checklists, and probing questions help put the book's ideas into action.

Sutton, Robert I. *Weird Ideas That Work*. New York: Free Press, 2002. The title says it all. This Stanford professor builds a convincing case for why the standard rules of business management suffocate innovation. In their

place he offers unconventional ways to promote and enhance creativity, many of them counterintuitive. He discusses new approaches to hiring, managing creative people, and dealing with risk and randomness in innovation. These practices succeed, he believes, because they increase the range of a company's knowledge, allow people to see old problems in new ways, and help companies break from the past.

Utterback, James M. *Mastering the Dynamics of Innovation*. Boston: Harvard Business School Press, 1994. This work by a noted scholar provides a practical model for business leaders striving to innovate. It anticipated by many years some of the ideas popularized by Clayton Christensen and others. The author draws from historical cases of innovation to illustrate how an innovation enters an industry, how mainstream firms typically respond, and how new and old players wrestle for dominance. He documents the pace of innovation, showing how a wave of process innovation often follows in the footsteps of product innovations that have preceded it. Of special interest is Utterback's notion of the "dominant design," and how such a design gradually evolves from the great variety that often characterizes the early years of ferment associated with the market introduction of new-to-the-world products.

Von Hippel, Eric. *Democratizing Innovation*. Cambridge, MA: MIT Press, 2005. Improvements in computer and communications technology are giving users opportunities to develop or improve their own products and services, and to share what they've learned with others—including product companies. This is a must-read for anyone who wants to better tap the knowledge and insights of customers and potential adopters of new products and services.

_____. *The Sources of Innovation*. New York: Oxford University Press, 1997. This book presents studies showing that end-users, material suppliers, and others—and not always manufacturers—are the typical sources of innovation in some fields. These findings suggest that R&D people search out lead users as sources of innovative ideas.

Zelinski, Ernie J. *The Joy of Thinking Big*. Berkeley, CA: Ten Speed Press, 1998. This book lacks a cohesive conceptual framework, but its strength lies in the dozens of hands-on tips and strategies for individuals that get at the heart of the creative paradox. Sample topics include how to develop a great memory for forgetting, how to fail successfully, and how to be a creative loafer.

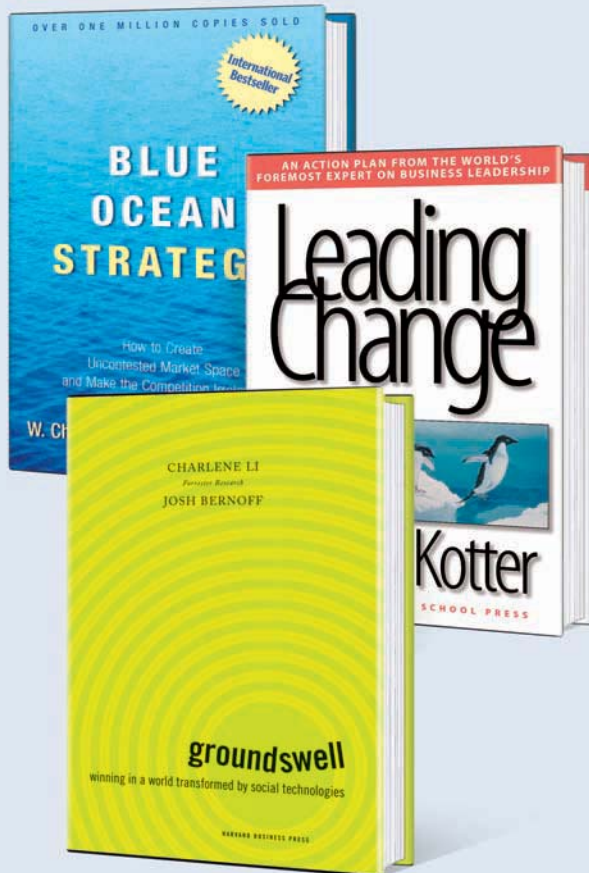
Notes

Chapter 8

1. See Richard Foster, *Innovation: The Attacker's Advantage* (New York: Summit Books, 1986).
2. Michael L. Tushman and Charles A. O'Reilly III, *Winning Through Innovation* (Boston: Harvard Business School Press, 1997), 17.
3. Jay Paap and Ralph Katz, "Anticipating Disruptive Innovation," *Research-Technology Management* 47, no. 5 (September–October 2004): 13–22.

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