INNOVATION

Predators and Prey: A New Ecology of Competition

by James F. Moore

From the May–June 1993 Issue

Successful businesses are those that evolve rapidly and effectively. Yet innovative businesses can't evolve in a vacuum. They must attract resources of all sorts, drawing in capital, partners, suppliers, and customers to create cooperative networks.

Much has been written about such networks, under the rubric of strategic alliances, virtual organizations, and the like. But these frameworks provide little systematic assistance for managers who seek to understand the underlying strategic logic of change. Even fewer of these theories help executives anticipate the managerial challenges of nurturing the complex business communities that bring innovations to market.

How is it that a company can create an entirely new business community—like IBM in personal computers—and then lose control and profitability in that same business? Is there a stable structure of community leadership that matches fast-changing conditions? And how can companies develop leadership that successfully adapts to continual waves of innovation and change? These questions remain unanswered because most managers still frame the problem in the old way: companies go head-to-head in an industry, battling for market share. But events of the last decade, particularly in high-technology businesses, amply illustrate the limits of that understanding.

In essence, executives must develop new ideas and tools for strategizing, tools for making tough choices when it comes to innovations, business alliances, and leadership of customers and suppliers. Anthropologist Gregory Bateson's definition of *coevolution* in both natural and social systems provides a useful starting place. In his book *Mind and Nature,* Bateson describes co-evolution as a process in which interdependent species evolve in an endless reciprocal cycle—in which "changes in species A set the stage for the natural selection of changes in species B"—and vice versa. Consider predators and their prey, for instance, or flowering plants and their pollinators.

Another insight comes from biologist Stephen Jay Gould, who has observed that natural ecosystems sometimes collapse when environmental conditions change too radically. Dominant combinations of species may lose their leadership. New ecosystems then establish themselves, often with previously marginal plants and animals at the center. For current businesses dealing with the challenges of innovation, there are clear parallels and profound implications.

To extend a systematic approach to strategy, I suggest that a company be viewed not as a member of a single industry but as part of a *business ecosystem* that crosses a variety of industries. In a business ecosystem, companies coevolve capabilities around a new innovation: they work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations.

For example, Apple Computer is the leader of an ecosystem that crosses at least four major industries: personal computers, consumer electronics, information, and communications. The Apple ecosystem encompasses an extended web of suppliers that includes Motorola and Sony and a large number of customers in various market segments.

Apple, IBM, Ford, Wal-Mart, and Merck have all been or still are the leaders of business ecosystems. While the center may shift over time, the role of the leader is valued by the rest of the community. Such leadership enables all ecosystem members to invest toward a shared future in which they anticipate profiting together.

Yet in any larger business environment, several ecosystems may vie for survival and dominance: the IBM and Apple ecosystems in personal computers, for example, or Wal-Mart and Kmart in discount retailing. In fact, it's competition among business ecosystems, not individual companies, that's largely fueling today's industrial transformation. Managers can't afford to ignore the birth of new ecosystems or the competition among those that already exist.

Whether that means investing in the right new technology, signing on suppliers to expand a growing business, developing crucial elements of value to maintain leadership, or incorporating new innovations to fend off obsolescence, executives must understand the stages that all business ecosystems pass through—and, more important, how to direct the changes.• • •

A business ecosystem, like its biological counterpart, gradually moves from a random collection of elements to a more structured community. Think of a prairie grassland that is succeeded by stands of conifers, which in turn evolve into a more complex forest dominated by hardwoods. Business ecosystems condense out of the original swirl of capital, customer interest, and talent generated by a new innovation, just as successful species spring from the natural resources of sunlight, water, and soil nutrients.

Every business ecosystem develops in four distinct stages: birth, expansion, leadership, and self-renewal—or, if not self-renewal, death. In reality, of course, the evolutionary stages blur, and the managerial challenges of one stage often crop up in another. Yet I've observed the four stages in many companies over time, across businesses as diverse as retailing, entertainment, and pharmaceuticals. What remains the same from business to business is the process of co-evolution: the complex interplay between competitive and cooperative business strategies (see the table, "The Evolutionary Stages of a Business Ecosystem").

The Evolutionary Stages of a Business Ecosystem		
	Cooperative Challenges	**Competitive Challenges**
Birth	Work with customers and suppliers to define the new value proposition around a seed innovation.	Protect your ideas from others who might be working toward defining similar offers. Tie up critical lead customers, key suppliers, and important channels.
Expansion	Bring the new offer to a large market by working with suppliers and partners to scale up supply and to achieve maximum market coverage.	Defeat alternative implementations of similar ideas. Ensure that your approach is the market standard in its class through dominating key market segments.
Leadership	Provide a compelling vision for the future that encourages suppliers and customers to work together to continue improving the complete offer.	Maintain strong bargaining power in relation to other players in the ecosystem, including key customers and valued suppliers.
Self-Renewal	Work with innovators to bring new ideas to the existing ecosystem.	Maintain high barriers to entry to prevent innovators from building alternative ecosystems. Maintain high customer switching costs in order to buy time to incorporate new ideas into your own products and services.

The Evolutionary Stages of a Business Ecosystem

During Stage 1 of a business ecosystem, entrepreneurs focus on defining what customers want, that is, the value of a proposed new product or service and the best form for delivering it. Victory at the birth stage, in the short term, often goes to those who best define and implement this customer value proposition. Moreover, during Stage 1 of a business ecosystem, it often pays to cooperate. From the leader's standpoint, in particular, business partners help fill out the full package of value for customers. And by attracting important "follower" companies, leaders may stop them from helping other emerging ecosystems.

The rise of the personal computer is a revealing example of ecological business development. In the early 1970s, a new technology—the microprocessor—emerged with the potential to spawn vast new applications and dramatically reduce the cost of computing. Yet this innovation sat dormant for several years. By 1975, hobbyist machines like the Altair and IMSAI had penetrated a narrow market. But these computers were not products that could be used by the average person.

Starting in the late 1970s, Tandy Corporation, Apple, and others introduced early versions of what would eventually become the personal computer. The seed innovation they all chose was the microprocessor, but these first designers also recognized that other

products and services had to be created to bring the whole package together. These ranged from hardware components to software to services like distribution and customer support.

Apple and Tandy each had a different strategy for creating a full, rich ecosystem. Apple worked with business partners and talked about "evangelizing" to encourage co-evolution. While the company tightly controlled its basic computer design and operating system software, it encouraged independent software developers to write programs for its machine. Apple also cooperated with independent magazines, computer stores, and training institutions—and even seeded a number of school districts with Apple IIs.

Tandy, on the other hand, took a more vertically integrated approach. It attempted to buy and then own its software, ranging from the operating system to programming languages and applications like word processors. The company controlled sales, service, support and training, and market development by selling exclusively through its Radio Shack stores. At the same time, it discouraged independent magazines devoted to its TRS-80 machines. Therefore, Tandy's simpler and more tightly controlled ecosystem did not build the excitement, opportunities, and inner rivalries of Apple's, nor did it harness as much capital and talent through the participation of other companies.

Tandy's approach got the company out front fast; in 1979, it had sales of $95 million compared with Apple's $47.9 million. However, Tandy's tight control of its ecosystem ultimately led to slower growth at a time when establishing market share and a large user base was essential to success. By 1982, Apple's $583.1 million in sales had decisively passed Tandy's $466.4 million.

Meanwhile, a third business ecosystem emerged in the early days of personal computing. It never rivaled Apple's or Tandy's in size, but it did help IBM enter the fray. This third ecosystem centered around two software companies: Digital Research and Micropro. In 1977, Digital Research made its software operating system CP/M available independent of hardware. That separation allowed almost any small manufacturer to assemble

components and put out a usable personal computer. Overnight, a variety of small companies entered the business, building on the same Zilog microprocessor used in the early Tandy machines.

In 1979, Micropro brought out a word processor that ran on CP/M-based machines. Wordstar was the first truly powerful word processor, and it took an important group of potential PC customers—writers and editors—by storm. Demand for CP/M machines soared, fueling the growth if not the fortunes of small companies like Morrow and Kaypro.

Automobiles: An Old-Fashioned Timeline

An ecological approach can be used to analyze the evolution of any major business. However, a look at how the old-line automobile companies evolved reveals a different time scale than that of almost any new business today. Historically, the evolutionary stages of an established ecosystem like Ford's or GM's often took decades to play out; but now businesses can be born and die in a matter of years. Managers used to focus on directing the action within a particular stage rather than on how to move from one stage to another. Yet transition between stages has currently become a managerial fact of life.

The major U.S. automobile ecosystems took about three-quarters of a century to evolve, a phenomenal length of time compared with the rise and fall of hightech businesses like personal computers. However, early automobile

But during the first stage of any business ecosystem, co-evolving companies must do more than satisfy customers; a leader must also emerge to initiate a process of rapid, ongoing improvement that draws the entire community toward a grander future. In the Apple and Tandy ecosystems, the hardware companies provided such leadership by studying the market, defining new generations of functionality, and orchestrating suppliers and partners to bring improvements to market. In the CP/M ecosystem, however, the hardware companies were bedeviled by rivalry among themselves. Infighting kept down prices and profit margins, and none of the CP/M companies could afford heavy advertising programs.

In Stage 1, established companies like IBM are often better off waiting and watching carefully as a new market sorts itself out. The iterative process of trying out innovative

executives were well aware of the need to forge a community of suppliers and customers.

Birth of the Horseless Carriage. The late 1800s were a time of experimentation, as the first automobile pioneers struggled to grasp the potential of individualized, motorized transportation. Ransom E. Olds and a handful of others established viable automobile business ecosystems by the turn of the century. Their machines worked reasonably well, were accepted by a small but dedicated number of customers, and could be profitably produced.

Expansion Battles. The next 20 years carried the automobile business deep into the second stage of ecological competition. In 1904, William C. Durant began building what would become General Motors. Henry Ford founded the Ford Motor Company, and, in 1908, he introduced his mass-produced, mass-marketed Model T. Near-legendary battles between Ford and GM ensued—struggles as much for soul and future definition of the business as for simple market share.

Ford's approach was based on vertical integration, carefully engineered production, and product simplicity. Ford's ecosystem had what we now would call

ideas and discovering which solutions are attractive to customers is hard to accomplish in a traditional corporate culture. And the diverse experimentation that thrives in an entrepreneurial scene provides more "genetic diversity" from which the market can ultimately select the fittest offering.

Established companies can subsequently replicate successful ideas and broadcast them across a wider market. In other words, they can enter the market at Stage 2 by appropriating the developmental work of others. Meanwhile, original ecosystems that succeed, like Apple's, do so by consciously nurturing a full community of partners and suppliers right from the start.• • •

In Stage 2, business ecosystems expand to conquer broad new territories. Just as grasses and weeds rapidly cover the bare, scorched ground left after a forest fire, some business expansions meet little resistance. But in other cases, rival ecosystems may be closely matched and choose to attack the same territory. Direct battles for market share break out. Fighting can get ugly as each ecosystem tries to exert pressure on suppliers and customers to join up.

"scalability"; by 1914, his company produced over 267,000 cars and held 48% of the market.

Durant's strategy for GM, however, was based on acquisitions of early companies, marketing might, sales coverage, and product variety. Durant's ecosystem captured market share by pooling and integrating the markets and the production facilities of a variety of smaller companies. However, by 1920, General Motors had nearly collapsed because of the inability of Durant's management systems to control such a complex collection of business entities.

From about 1910 to 1930, industry leaders directed the large expansion of the automobile market, reconfiguring the major ecosystems in the process. Alfred P. Sloan's design for General Motors, initiated in 1920, is most notable and involved the simultaneous ouster of Durant. Sloan's design specifically allowed for the management of a complex business ecosystem by breaking up the diverse company into product lines, which, in turn, could be focused like Ford's mass-produced lines. Sloan also centralized financial oversight of decentralized product lines, and GM became the prototype of the modern multidivisional company.

In the end, one business ecosystem may triumph, or rival ecosystems may reach semistable accommodations. Think of a hardwood forest that borders a grassland. The zone of conflict at the boundary may shift from year to year, but it never completely wipes out either ecosystem.

In general, two conditions are necessary for Stage 2 expansion: (1) a business concept that a large number of customers will value; and (2) the potential to scale up the concept to reach this broad market. During the expansion stage, established companies can exercise enormous power in marketing and sales, as well as in the management of large-scale production and distribution, literally crushing smaller ecosystems in the process.

IBM, for example, entered the personal computer business in 1981. In contrast to its own history and culture of vertical integration, IBM followed and extended the Apple model of building a community of supporters. IBM took on partners and opened its computer architecture to outside suppliers. Moreover, it adopted a microprocessor from Intel that incorporated all of the instructionsavailable in the Zilog microprocessor in Tandy and CP/M machines. And IBM licensed MSDOS, a software operating system from then tiny

Community Leadership. By the 1930s, battles for community leadership and bargaining power revolved around the principal supplier to the auto industry: labor. In the late 1920s, around 500,000 people worked in the Detroit area car factories. Working conditions were dangerous; one auto body plant was known as "the slaughterhouse." But by the mid-1930s, the United Auto Workers Union had formed. In 1937, the UAW achieved a landmark victory when GM recognized the union as an official representative of its employees.

Over time, organized labor brought workers crucial bargaining power, which the union used to force the companies to share the spoils of victory. The tug-of-war between workers and companies continued for decades, mediated with varying effectiveness by the U.S. government. While it protected workers, this form of ecosystem struggle also carried with it high costs: work-rule rigidity and the polarization of workers and management. These costs would come back to haunt the U.S. automobile business in the next stage of ecosystem development.

The Threat of Obsolescence. Labor-management struggles continued into the 1970s, until both sides were driven together by a much deeper crisis: the obsolescence of the management approaches, business practices, and

Microsoft, which was almost a near clone of CP/M. As a result, Wordstar and other popular application programs could easily be ported over to the IBM PC.

One of the most important managerial challenges in Stage 2 is to stimulate market demand without greatly exceeding your ability to meet it. IBM certainly stimulated demand for its new machine through a combination of heavy brand advertising, distribution through Sears and other channels, and building its own network of specialty stores. By anyone's measure, IBM's approach to expanding its PC ecosystem was a major success. Its personal computing business grew from $500 million in 1982 to $5.65 billion by 1986, and IBM's ecosystem rapidly dominated the market.

However, IBM also generated much more demand than it could meet. The company maintained high prices, which encouraged others to enter the market by setting a high price umbrella under which they could thrive. Compaq, for example, became the fastest company to join the *Fortune* "500" based on supplying machines to meet demand in the IBM ecosystem.

systems of production that had been only incrementally improved since the 1920s. The near collapse of the U.S. automobile business came, of course, at the hands of the Japanese. The Toyota ecosystem, for one, was capable of unheard-of levels of product variety, quality, and efficiency at the time. This powerful new business ecosystem was based on a combination of customer-focused design, concurrent engineering, flexible manufacturing, dedicated workers, and networks of suppliers, all tied together through statistically refined management practices.

Therefore, the automobile industry, as traditionally defined, found itself in a full-fledged ecological war, defending against a new wave of business ecosystems. Self-renewal proved difficult, and companies like Ford and Chrysler had nearly collapsed by the late 1970s. The superiority of Japanese approaches ultimately forced the transformation of the world automobile business into what we know today.

IBM did its best to keep up with demand. In the early 1980s, it invested directly in several key suppliers to help it grow fast enough to meet the market. Intel, for example, received $250 million from IBM in 1983. Concerned about its image as an insensitive behemoth, as well as possible antitrust objections, IBM managers carefully assured these suppliers that the help came without any strings attached.

IBM's relationships with suppliers were basically nonexclusive. Obviously, suppliers like Intel, Microsoft, and Lotus were happy to help the success of Compaq and others because it allowed them to diversify the risk of overdependence on IBM. For its part, IBM was flush with more demand and success than it knew what to do with. Top managers didn't focus on slowing the development of clone makers and nonexclusive suppliers—or keeping crucial elements of value like the microprocessor in-house. At first, IBM didn't attack new competitors within its ecosystem through the courts, through special promotions, or by lowering its own prices.

However clear the threat from the rest of the pack appears to us now, at the time, IBM and its business partners were pleased. By 1986, the combined revenues of companies in the IBM ecosystem were approximately $12 billion, dwarfing the Apple ecosystem's revenues

of approximately $2 billion. IBM's leadership also forced Tandy and essentially every other non-Apple maker of personal computers to dump their proprietary designs and offer IBM PC compatibles.

In contrast with IBM, the story of Wal-Mart's retailing ecosystem shows how top management can take the right precautions when a business is expanding (see the insert "The Evolution of Wal-Mart: Savvy Expansion and Leadership"). In general, Stage 2 rewards fast expansion that squeezes competing ecosystems to the margin. But managers must also prepare for future leadership and leverage in the next stage. To do so, companies need to maintain careful control of customer relationships and core centers of value and innovation. Moreover, they must develop relationships with their suppliers-that constrain these followers from becoming leaders in Stage 3.

The Evolution of Wal-Mart: Savvy Expansion and Leadership

An ecological analysis of Wal-Mart reveals how a relatively small company, starting in a rural area of the United States, could turn its original isolation to advantage by creating a complete business ecosystem. Wal-Mart developed and continues to refine an offer that customers find nearly irresistible: low prices on a variety of brands as diverse as Gitano jeans and Yardman lawn mowers. Moreover, CEO Sam Walton managed the company's expansion superbly and increased bargaining power during the leadership stage.

The Birth of Discounting. In the early 1960s, Kmart, Wal-Mart, and other discounters recognized that the Main Street

five-and-dime was giving way to the variety store. And variety stores, in turn, were threatened by the large discount store. In order to buy a wide range of goods at low prices in one location, customers were increasingly willing to get into cars and drive to malls or other non-Main Street locations.

Kmart and Wal-Mart appeared on the discount scene at about the same time. The Kmart stores were actually owned by old-style S.S. Kresge, which reinvented itself as a suburb-oriented discount retailer, with big stores located near existing malls and towns of more than 50,000 people. Kmart stores carried items aimed at the lower end of suburban tastes.

By the late 1960s, Wal-Mart had worked out the basic structure of its own business ecosystem: Wal-Mart stores, which supplied a variety of well-known brands, were located in relatively sparsely populated areas. The company went into towns of 5,000 people, particularly where several of these towns might be served by one store. Wal-Mart products were up to 15% cheaper than those available in “mom-and-pop” stores.

While the original Wal-Mart locations could support one store, the customer population wasn’t large enough to maintain two rival

discounters. Thus once Wal-Mart established a store in a particular area and had beaten back weak local retailers, it was seldom threatened with future local competition from other discounters, including Kmart.

Expansion: Planning for a Chokehold. Once its business strategy was up and running in a number of discount stores in the American South and Mid-West, Wal-Mart's top executives concentrated on developing organizational capabilities that would let it scale up successfully. They were obsessed with three things:

- Building a set of incentives that would ensure employee commitment to local stores, which led to a complex system of training, oversight, bonuses, and stock-purchase plans for workers.

- Managing communication and control of a network of remotely located stores, which required close monitoring of a carefully drawn set of measures that were transmitted daily to Wal-Mart headquarters in Bentonville, Arkansas.

- Setting up an efficient distribution system that allowed for joint purchasing, shared facilities, systematic ordering, and store-level distribution of a large number of

different goods. This third obsession ultimately became Wal-Mart's trademark hub-and-spoke distribution system: warehouses served constellations of stores located no more than a day's drive from the center.

In 1970, Wal-Mart went public to raise funds for its expansion. That same year, the company built its first hub-and-spoke distribution center—embarking on a strategy of targeting a large geographic area, setting up a distribution center, and then populating the area with as many stores as the territory would support. Wal-Mart not only filled the needs of customers in small towns but also saturated entire regions, making it uneconomical for competitors to enter as either distributors or local store owners.

The number of Wal-Mart stores grew rapidly, from 32 in 1970 to 195 in 1978—when the first fully automated distribution center opened—to 551 in 1983—when Wal-Mart launched its own satellite, creating a communication network to keep in daily touch with its now far-flung empire.

Leadership: Building Bargaining Power. By 1984, Wal-Mart's managerial agenda changed. What was in the birth and expansion stages a race to develop systems

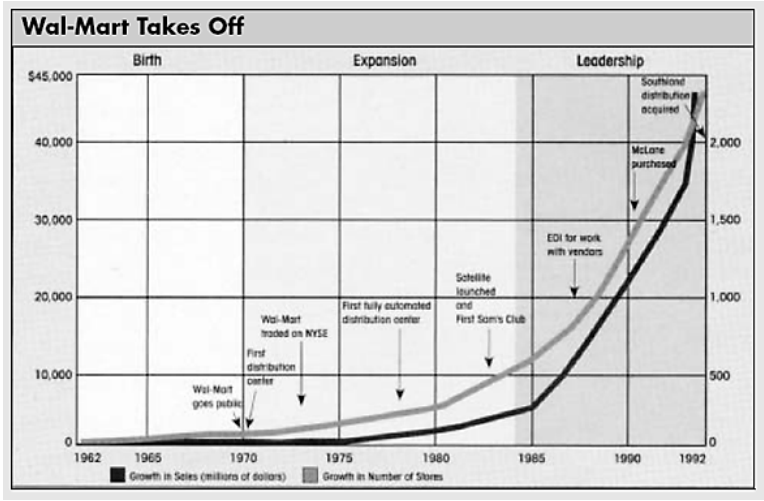
and conquer territory now became a concerted effort to build bargaining power. As the leaders of a highly successful and visible business ecosystem, Wal-Mart managers worked on continuing to assert the company's vision over other community members, including suppliers like Procter & Gamble, Rubbermaid, and Helene Curtis Industries.

First, Wal-Mart resisted the temptation to charge higher prices in the markets and regions it dominated. Instead, top managers still viewed each market as "contestable"—as a potential opening for rivals if Wal-Mart ceased to give the maximum possible value to customers. Continued customer leadership, in turn, enhanced the Wal-Mart brand and further cemented the company's place in the minds and buying habits of consumers. Wal-Mart's system of "everyday low prices," in which there's no need for weekly sales or special promotions, has now become a standard in discount retailing.

Second, Wal-Mart—now a very large and powerful channel to customers—started putting heavy pressure on suppliers to keep their prices down. Moreover, Wal-Mart compelled its suppliers to set up cross-company distribution systems to attain maximum manufacturing efficiency. For

example, in 1987, Wal-Mart and Procter & Gamble reached an unprecedented accord to work together through extensive electronic ordering and information sharing between the companies. In return, Wal-Mart gives better payment terms than the rest of the retailing industry: on average, Wal-Mart pays its suppliers within 29 days compared with 45 days at Kmart.

Third, Wal-Mart continued to invest in and enhance its own fundamental economies of scale and scope in distribution. By the leadership stage, distribution had become the crucial ecological component of the Wal-Mart ecosystem. In fact, Wal-Mart's distribution chokehold has allowed the ecosystem as a whole to triumph over others like Kmart's. While suppliers, big and small, may chafe under Wal-Mart's heavy hand, it's also clear that most of them need this particular leader to survive. The graph "Wal-Mart Takes Off" is a testament to the company's dominance and bargaining power in the leadership stage.



Wal-Mart Takes Off

Finally, Wal-Mart has extended its reach into adjacent territories and ecosystems. In 1983, Wal-Mart entered the membership discount market with its Sam's Club, which by 1992 included 208 clubs that contributed over $9.4 billion in revenues. In 1990, Wal-Mart incorporated another ecosystem by acquiring McLane Company, the nation's largest distributor to the convenience store industry. McLane, under Wal-Mart's control, now serves about 30,000 retail stores, including 18,000 convenience stores. And in 1992, Wal-Mart also acquired the distribution and food processing divisions of Southland Corporation. Southland operates a large chain of 7-Eleven convenience stores, and this acquisition added as many as 5,000 more 7-Eleven stores to the McLane/Wal-Mart customer base.

. . .

While the lion and antelope are both part of a healthy savanna ecosystem, they also struggle with each other to determine to what extent each species expands within it. Similarly, in business ecosystems, two conditions contribute to the onset of the leadership struggles that are the hallmark of Stage 3. First, the ecosystem must have strong enough growth and profitability to be considered worth fighting over. Second, the structure of the value-adding components and processes that are central to the business ecosystem must become reasonably stable.

This stability allows suppliers to target particular elements of value and to compete in contributing them. It encourages members of the ecosystem to consider expanding by taking over activities from those closest to them in the value chain. Most of all, it diminishes the dependence of the whole ecosystem on the original leader. It's in Stage 3 that companies become preoccupied with standards, interfaces, "the modular organization," and customersupplier relations.

For example, by the mid-1980s, the IBM PC technical architecture defined the de facto business structure for the personal computer business as a whole. Virtually any company could figure out how to make components and services that would dovetail effectively with other elements of the PC ecosystem. Of course, this was a mixed blessing for IBM. The openness of its computer architecture encouraged third parties to support it, dramatically accelerating the ecosystem's growth. Yet this same openness decreased the dependence of suppliers on IBM's leadership, laying the foundations for Stage 3 "clone wars."

Lotus, Intel, Microsoft, and other suppliers started working together to determine common standards for hardware and software, with and without IBM's involvement. Other ecosystem members welcomed this new leadership since it seemed fairer to suppliers and more innovative than IBM's.

Belatedly, IBM sought to enforce its patents against clone makers, seeking licenses from major players—one of the many strategies that failed. A grim milestone of sorts was achieved in 1989 when clone shipments and product shipments from other smaller

companies bypassed those of major personal computer manufacturers. Thus IBM was relegated to competing head-on with myriad "box makers." IBM still retained a large share of the market but only through offering extensive discounts to large volume purchasers.

Which brings us to the new structure of today's "Microsoft-Intel" ecosystem: Microsoft, with gross margins estimated at 80%; Intel, with gross margins of 40% and 50% on its new chips; and IBM's PC business with margins of about 30%, a far cry from the 70% to 90% margins in its mainframe business.

In Stage 3, bargaining power comes from having something the ecosystem needs and being the only practical source. Sometimes this sole-source status can be established contractually or through patent protection. But fundamentally, it depends on constant innovation—on creating value that is critical to the whole ecosystem's continued price/performance improvement. During expansion, IBM didn't find a way to keep innovating or even to achieve economies of scale. Power shifted to chips and software, areas in which IBM did not excel.

Now both Intel and Microsoft have bargaining power through control of a critical component. Each is a strong leader and plays the role of *central ecological contributor*. Central contributors maintain the much-coveted chokehold within a business ecosystem. In short, other members can't live without them. This central position enables them to bargain for a higher share of the total value produced by the ecosystem. For example, Intel and Microsoft have gross margins that are almost double the average for their whole ecosystem.

Central contributor status is maintained in part by the investments others have made in being followers. Hardware and software vendors have made heavy investments in Microsoft operating systems and in applications that work with Intel chips. Switching to other vendors would be risky and expensive; if possible, other co-evolving companies don't want the burden of learning how to work with a new leader.

In addition, central companies reinforce their roles by making important innovative contributions to the performance of the ecosystem as a whole. Intel, for instance, has enormous scale advantages in the fabrication of microprocessors. Its chip volumes allow it to work out fabrication-process advances sooner than other chip vendors. Ironically, IBM held a license to manufacture Intel-designed microprocessors. With its large volumes during the expansion stage, IBM could have been the one taking the fabrication and price/performance lead in chips—and it could have denied Intel the scale to keep up.

Finally, followers value a central contributor because of its grip on customers. End users are drawn to Microsoft operating systems and Intel chips because so many software applications are available for them. In turn, developers keep turning out such applications because they know Microsoft and Intel are customer gateways.

To some extent, these two companies achieved their current central position by being in the right place at the right time—that is, by serving IBM. Intel and Microsoft clearly appreciate what they have now and are working effectively to maintain their central contributions. Still, some companies like Wal-Mart have systematically gone about building a strong ecosystem, one that guarantees a leading role for themselves.

In any case, for dominant companies, the expansion and leadership stages of an ecosystem can make or break them. In Stage 3, lead producers must extend control by continuing to shape future directions and the investments of key customers and suppliers. And for healthy profits, any company in the ecosystem—leader or follower—must maintain bargaining power over other members.• • •

Stage 4 of a business ecosystem occurs when mature business communities are threatened by rising new ecosystems and innovations. Alternatively, a community might undergo the equivalent of an earthquake: sudden new environmental conditions that include changes in government regulations, customer buying patterns, or macroeconomic conditions. Moreover, these two factors reinforce each other. An altered environment is often more hospitable to new or formerly marginal business ecosystems.

In fact, how a dominant company deals with the threat of obsolescence is the ultimate challenge. Just because Microsoft and Intel are leaders now doesn't mean their current ecosystem is immortal. Nor does it mean that Microsoft NT ("New Technology" operating software) will form the basis for its successor. After all, Novell and UNIX Systems Laboratories have merged and will put forth a new generation of software, looking to strengthen a new ecosystem. Both Hewlett-Packard and Sun Microsystems remain strongly entrenched. And Motorola is now manufacturing a new generation microprocessor to be sold by both IBM and Apple, along with a jointly developed new software operating system.

Leading successive generations of innovation is clearly crucial to an ecosystem's long-term success and its ability to renew itself. Today's pharmaceutical companies provide some interesting insights into three general approaches to selfrenewal, which can be used alone or in combination: (1) dominant companies can seek to slow the growth of a new ecosystem; (2) they can try to incorporate new innovations into their own ecosystems; or (3) they can fundamentally restructure themselves to try coping with a new reality.

During the past few decades, pharmaceutical companies have operated under a relatively consistent, if largely implicit, social compact with government regulators. In exchange for investing heavily in product and process innovation, drug companies have been allowed comparatively high margins and protection from competition through patent laws and lengthy approval processes. Traditional pharmaceutical ecosystems, therefore, have evolved around three major functions: R&D, testing and approval management, and marketing and sales. Each of these functions is expensive, hard to perfect, and thus presents a barrier to new competitors. In the past, these functions were carried out within large, vertically integrated companies that did not, until recently, consider themselves networked organizations.

In the 1980s, generic drug manufacturers that specialized in producing off-patent drugs posed a threat to the established pharmaceutical houses. The dominant companies responded by blocking these rival ecosystems in order to minimize their expansion. This included lobbying to slow genericdrug enabling legislation and to reinforce the natural

conservatism of the U.S. Food and Drug Administration. Well-funded marketing and sales efforts convinced thousands of individual physicians to continue prescribing mostly branded drugs. While the generic drug manufacturers were able to establish alternative ecosystems, their penetration of the market has been held to about 30%, with little price cutting by the dominant companies.

Meanwhile, a variety of small biotechnology start-ups posed an even greater threat to the traditional pharmaceutical powerhouses. In general, biotech researchers concentrate on isolating complex substances that already exist in the human body and finding ways to manufacture them—for example, human insulin and human growth hormone. As many as one biotech try in ten may prove successful, which keeps the R&D cost down to between $100 million and $150 million per marketable product. Compare this with the traditional pharmaceutical average of 10,000 chemical tries to identify one marketable drug—and R&D costs of $250 million to $350 million per product.

Many of the founders of and investors in biotechnology start-ups believed that low R&D costs would provide the basis for creating whole new business ecosystems that could compete with the established drug companies. For example, Genentech, one of the pioneering biotech companies, clearly intended to establish itself as a full competitor. By the mid-1980s, Genentech had five products in the market and was marketing three itself. It licensed its first two products: alpha-interferon to Hoffmann-La Roche and insulin to Eli Lilly. Using the cash from these licenses, Genentech sought to manufacture and market human growth hormone and tissue plasminogen activator on its own. Yet in 1990, 60% of Genentech was sold to Hoffmann-La Roche for $2.1 billion. A similar fate has befallen almost all of the original biotech companies.

In essence, these companies misjudged the difficulties of mastering the testing and approval process. The first biotech managers bet on the assumption that testing and approval would, like R&D, be less expensive and problematic than it was for their traditional competitors. Since biotech products were existing molecules already resident in the human body, these products would presumably require much less testing than

synthetic chemical compounds. However, the FDA approval process in the United States, which grants access to the most important market worldwide, has not borne this out. From 1981 to 1991, only 12 biotech products were approved for general marketing.

Strapped for cash and unable to raise much more from their original investors, most biotech companies ended the 1980s in no position to lead their own business ecosystems. Biotech managers and investors were attracted to alliances with traditional companies and thus merged new business ecosystems with powerful existing ones. In turn, dominant companies like Merck, Eli Lilly, and Bristol-Myers began to think like business ecosystem builders. In order to snap up licenses, patents, and talent to strengthen their own R&D, these companies affiliated themselves with the biotech companies rather than simply blocking their new rivals.

Of course, the leaders of a mature business ecosystem sometimes have no choice but to undertake profound structural and cultural changes. Pharmaceutical ecosystems now face new threats and a profoundly altered environment. The social compact to protect drug company profits in exchange for product and process innovation is breaking down. The public, government, and corporations all want health care costs reduced. Drug company leaders see lean times ahead as they confront the possibility of price and profit caps, as well as consolidated purchasing of drugs by HMOs and government agencies.

Responding to this environmental shift will force changes across all major functions. Companies will probably have to limit R&D spending and focus it carefully. Managers are likely to design a testing and approval process that highlights not only efficacy but also cost/benefit performance of new treatments. Finally, companies will probably market and sell less directly to individual physicians, focusing instead on negotiations with experts who represent third-party payers and government.

But despite the difficulties of such a complex business environment, managers can design longevity into an ecosystem. During the expansion and leadership stages, for instance, companies can work hard to micro-segment their markets, creating close, supportive ties

with customers. These customers will then remain committed to a particular ecosystem long enough for its members to incorporate the benefits of new approaches.

And visionary executives like Merck's Roy Vagelos can sometimes lead an ecosystem so that it rapidly and effectively embraces anticipated developments—be they new technologies, regulatory openings, or consumer trends. Ultimately, there is no substitute for eternal vigilance. As Intel's Andy Grove noted recently, "Only the paranoid survive."• • •

Clearly, pharmaceutical companies—and any other venture threatened by continual innovations—can no longer allow their particular ecosystems to evolve without direction. Using an ecological approach, executives can start making strategic changes by systematically questioning their company's current situation: Is the company linked with the very best suppliers and partners? Is the company betting its future on the most promising new ideas? Are suppliers leading the way in commercializing innovation? Over the long run, how will the company maintain sufficient bargaining power and autonomy to guarantee good financial returns?

Examining a company's key competitors from a business ecological point of view is also important: What hidden web of customer and supplier relationships have competitors worked to develop? Who do they depend on for ideas and supplier support? What are the nature and benefits of those relationships? How do these compare with what the company has?

And to prepare the ground for organizational breakthroughs, managers need to consider how the work of their company might be radically different: What seed innovations might make current businesses obsolete? What would it take to catalyze a cluster of ideas into a new and vital business ecosystem? What type of community would be required to bring these new ideas to the widest possible market?

Asking these questions, let alone acting on the answers, has become a difficult necessity for all companies. Superficially, competition among business ecosystems is a fight for market share. But below the surface, these new competitive struggles are fights over who will direct the future.

Yet it's precisely in the role of conscious direction that a strictly biological metaphor is no longer useful. Business communities, unlike biological communities of co-evolving organisms, are social systems. And social systems are made up of real people who make decisions; the larger patterns are maintained by a complex network of choices, which depend, at least in part, on what participants are aware of. As Gregory Bateson noted, if you change the ideas in a social system, you change the system itself.

I anticipate that as an ecological approach to management becomes more common—as an increasing number of executives become conscious of co-evolution and its consequences—the pace of business change itself will accelerate. Executives whose horizons are bounded by traditional industry perspectives will find themselves missing the real challenges and opportunities that face their companies. Shareholders and directors, sensing the new reality, will eventually remove them. Or, in light of the latest management shifts, they may have already done so.

Unfortunately for employees and investors, this often occurs only after the companies involved have been deeply damaged. Companies that once dominated their industries, as traditionally defined, have been blindsided by new competition. Whether such companies can find the appropriate leadership to renew the ecosystems on which their future depends remains an open question. If they cannot, they'll be supplanted by other companies, in other business ecosystems, that will expand and lead over the next few years.

> **From an ecological perspective, it matters not which particular ecosystems stay alive; it's only essential that competition among them is fierce and fair.**

For the individuals caught up in these ecosystem struggles, the stakes are high. As a society, we must find ways of helping members of dying ecosystems get into more vital ones while avoiding the temptation of propping up the failed ecosystems themselves. From an ecological perspective, it matters not which particular ecosystems stay alive; rather, it's only essential that competition among them is fierce and fair—and that the fittest survive.

A version of this article appeared in the May–June 1993 issue of *Harvard Business Review*.

James F. Moore is a writer and advisor to enterprises of all kinds, from Muppet legend Jim Henson to the White House/US AID e-strategy for Africa, on the evolution of business ecosystems. His seminal *Harvard Business Review* article "Predators and Prey: A New Ecology of Competition" is often cited as the foundational article on the topic. Follow him on Twitter @jamesfmoore1.

This article is about INNOVATION

postings become the property of Harvard Business Publishing.