# The Discipline of Innovation

by Peter F. Drucker

How much of innovation is inspiration, and how much is hard work? If it's mainly the former, then management's role is limited: Hire the right people, and get out of their way. If it's largely the latter, management must play a more vigorous role: Establish the right roles and processes, set clear goals and relevant measures, and review progress at every step. Peter Drucker, with the masterly subtlety that is his trademark, comes down somewhere in the middle. Yes, he writes in this article, innovation is real work, and it can and should be managed like any other corporate function. But that doesn't mean it's the same as other business activities. Indeed, innovation is the work of *knowing* rather than *doing.*

Drucker argues that most innovative business ideas come from methodically analyzing seven areas of opportunity, some of which lie within particular companies or industries and some of which lie in broader social or demographic trends. Astute managers will ensure that their organizations maintain a clear focus on all seven. But analysis will take you only so far. Once you've identified an attractive opportunity, you still need a leap of imagination to arrive at the right response – call it "functional inspiration."

*In business, innovation rarely springs from a flash of inspiration. It arises from a cold-eyed analysis of seven kinds of opportunities.*

DESPITE much discussion these days of the "entrepreneurial personality," few of the entrepreneurs with whom I have worked during the past 30 years had such personalities. But I have known many people – salespeople, surgeons, journalists, scholars, even musicians – who did have them without being the least bit entrepreneurial. What all the successful entrepreneurs I have met have in common is not a certain kind of personality but a commitment to the systematic practice of innovation.

Innovation is the specific function of entrepreneurship, whether in an existing business, a public service institution, or a new venture started by a lone individual in the family kitchen. It is the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth.

Today, much confusion exists about the proper definition of entrepreneurship. Some observers use the term to refer to all small businesses; others, to all new businesses. In practice, however, a

Copyright © 2002 by Harvard Business School Publishing Corporation. All rights reserved.

great many well-established businesses engage in highly successful entrepreneurship. The term, then, refers not to an enterprise's size or age but to a certain kind of activity. At the heart of that activity is innovation: the effort to create purposeful, focused change in an enterprise's economic or social potential.

## Sources of Innovation

There are, of course, innovations that spring from a flash of genius. Most innovations, however, especially the successful ones, result from a conscious, purposeful search for innovation opportunities, which are found only in a few situations. Four such areas of opportunity exist within a company or industry: unexpected occurrences, incongruities, process needs, and industry and market changes.

Three additional sources of opportunity exist outside a company in its social and intellectual environment: demographic changes, changes in perception, and new knowledge.

True, these sources overlap, different as they may be in the nature of their risk, difficulty, and complexity, and the potential for innovation may well lie in more than one area at a time. But together, they account for the great majority of all innovation opportunities.

## 1 Unexpected Occurrences

Consider, first, the easiest and simplest source of innovation opportunity: the unexpected. In the early 1930s, IBM developed the first modern accounting machine, which was designed for banks. But banks in 1933 did not buy new equipment. What saved the company – according to a story that Thomas Watson, Sr., the company's founder and long-term CEO, often told – was its exploitation of an unexpected success: The New York Public Library wanted to buy a machine. Unlike the banks, libraries in those early New Deal days had money, and Watson sold more than a hundred of his otherwise unsalable machines to libraries.

Fifteen years later, when everyone believed that computers were designed for advanced scientific work, business unexpectedly showed an interest in a machine that could do payroll. Univac, which had the most advanced machine, spurned business applications. But IBM immediately realized it faced a possible unexpected success, redesigned what was basically Univac's machine for such mundane applications as payroll, and within five years became a leader in the computer industry, a position it has maintained to this day.

The unexpected failure may be an equally important source of innovation opportunities. Everyone knows about the Ford Edsel as the biggest new-car failure in automotive history. What very few people seem to know, however, is that the Edsel's failure was the foundation for much of the company's later success. Ford planned the Edsel, the most carefully designed car to that point in American automotive history, to give the company a full product line with which to compete with General Motors. When it bombed, despite all the planning, market research, and design that had gone into it, Ford realized that something was happening in the automobile market that ran counter to the basic assumptions on which GM and everyone else had been designing and marketing cars. No longer was the market segmented primarily by income groups; the new principle of segmentation was what we now call "lifestyles." Ford's response was the Mustang, a car that gave the company a distinct personality and reestablished it as an industry leader.

Unexpected successes and failures are such productive sources of innovation opportunities because most businesses dismiss them, disregard them, and even resent them. The German scientist who around 1905 synthesized novocaine, the first nonaddictive narcotic, had intended it to be used in major surgical procedures like amputation. Surgeons, however, preferred total anesthesia for such procedures; they still do. Instead, novocaine found a ready appeal among dentists. Its inventor spent the remaining years of his life traveling from dental school to dental school making speeches that forbade dentists from "misusing" his noble invention in applications for which he had not intended it.

This is a caricature, to be sure, but it illustrates the attitude managers often take to the unexpected: "It should not have happened." Corporate reporting systems further ingrain this reaction, for they draw attention away from unanticipated possibilities. The typical monthly or quarterly report has on its first page a list of problems – that is, the areas where results fall short of expectations. Such information is needed, of course, to help prevent deterioration of performance. But it also suppresses the recognition of new opportunities. The first acknowledgment of a possible opportunity usually applies to an area in which a company does better than budgeted. Thus genuinely entrepreneurial businesses have two "first pages" – a problem page and an opportunity page – and managers spend equal time on both.

## 2 Incongruities

Alcon Laboratories was one of the success stories of the 1960s because Bill Conner, the company's cofounder, exploited an incongruity in medical technology. The cataract operation is the world's third or fourth most common surgical procedure. During the past 300 years, doctors systematized it to the point that the only "old-fashioned" step left was the cutting of a ligament. Eye surgeons had learned to cut the liga-

***Peter F. Drucker*** *is the Marie Rankin Clarke Professor of Social Science and Management at Claremont Graduate University's Peter F. Drucker Graduate School of Management in Claremont, California. He has written more than two dozen articles for HBR. This article was originally adapted from his book* Innovation and Entrepreneurship: Practice and Principles *(Harper & Row, 1985).*

ment with complete success, but it was so different a procedure from the rest of the operation, and so incompatible with it, that they often dreaded it. It was incongruous.

Doctors had known for 50 years about an enzyme that could dissolve the ligament without cutting. All Conner did was to add a preservative to this enzyme that gave it a few months' shelf life. Eye surgeons immediately accepted the new compound, and Alcon found itself with a worldwide monopoly. Fifteen years later, Nestlé bought the company for a fancy price.

Such an incongruity within the logic or rhythm of a process is only one possibility out of which innovation opportunities may arise. Another source is incongruity between economic realities. For instance, whenever an industry has a steadily growing market but falling profit margins – as, say, in the steel industries of developed countries between 1950 and 1970 – an incongruity exists. The innovative response: minimills.

An incongruity between expectations and results can also open up possibilities for innovation. For 50 years after the turn of the century, shipbuilders and shipping companies worked hard both to make ships faster and to lower their fuel consumption. Even so, the more successful they were in boosting speed and trimming their fuel needs, the worse the economics of ocean freighters became. By 1950 or so, the ocean freighter was dying, if not already dead.

All that was wrong, however, was an incongruity between the industry's assumptions and its realities. The real costs did not come from doing work (that is, being at sea) but from *not* doing work (that is, sitting idle in port). Once managers understood where costs truly lay, the innovations were obvious: the roll-on and roll-off ship and the container ship. These solutions, which involved old technology, simply applied to the ocean freighter what railroads and truckers had been using for 30 years. A shift in viewpoint, not in technology, totally changed the economics of ocean shipping and turned it into one of the major growth industries of the last 20 to 30 years.

## 3 Process Needs

Anyone who has ever driven in Japan knows that the country has no modern highway system. Its roads still follow the paths laid down for – or by – oxcarts in the tenth century. What makes the system work for automobiles and trucks is an adaptation of the reflector used on American highways since the early 1930s. The reflector lets each car see which other cars are approaching from any one of a half-dozen directions. This minor invention, which enables traffic to move smoothly and with a minimum of accidents, exploited a process need.

What we now call the media had its origin in two innovations developed around 1890 in response to process needs. One was Ottmar Mergenthaler's Linotype, which made it possible to produce newspapers quickly and in large volume. The other was a social innovation, modern advertising, invented by the first true newspaper publishers, Adolph Ochs of the *New York Times,* Joseph Pulitzer of the *New York World,* and William Randolph Hearst. Advertising made it possible for them to distribute news practically free of charge, with the profit coming from marketing.

## 4 Industry and Market Changes

Managers may believe that industry structures are ordained by the good Lord, but these structures can–and often do – change overnight. Such change creates tremendous opportunity for innovation.

One of American business's great success stories in recent decades is the brokerage firm of Donaldson, Lufkin & Jenrette, recently acquired by the Equitable Life Assurance Society. DL&J was founded in 1960 by three young men, all graduates of the Harvard Business School, who realized that the structure of the financial industry was changing as institutional investors became dominant. These young men had practically no capital and no connections. Still, within a few years, their firm had become a leader in the move to negotiated commissions and one of Wall Street's stellar performers. It was the first to be incorporated and go public.

In a similar fashion, changes in industry structure have created massive innovation opportunities for American health care providers. During the past ten or 15 years, independent surgical and psychiatric clinics, emergency centers, and HMOs have opened throughout the country. Comparable opportunities in telecommunications followed industry upheavals – in transmission (with the emergence of MCI and Sprint in long-distance service) and in equipment (with the emergence of such companies as Rolm in the manufacturing of private branch exchanges).

When an industry grows quickly – the critical figure seems to be in the neighborhood of 40% growth in ten years or less – its structure changes. Established companies, concentrating on defending what they already have, tend not to counterattack when a newcomer challenges them. Indeed, when market or industry structures change, traditional industry leaders again and again neglect the fastest growing market segments. New opportunities rarely fit the way the industry has always approached the market, defined it, or organized to serve it. Innovators therefore have a good chance of being left alone for a long time.

## 5 Demographic Changes

Of the outside sources of innovation opportunities, demographics are the most reliable. Demographic events have known lead times; for instance, every person who will be in the American labor force by the year 2000 has already been born. Yet because policy makers often neglect demographics, those who watch them and exploit them can reap great rewards.

The Japanese are ahead in robotics because they paid attention to demographics. Everyone in the developed countries around 1970 or so knew that there was both a baby bust and an education explosion going on; about half or more of the young people were staying in school beyond high school. Consequently, the number of people available for traditional blue-collar work in manufacturing was bound to decrease and become inadequate by 1990. Everyone knew this, but only the Japanese acted on it, and they now have a ten-year lead in robotics.

Much the same is true of Club Mediterranee's success in the travel and resort business. By 1970, thoughtful observers could have seen the emergence of large numbers of affluent and educated young adults in Europe and the United States. Not comfortable with the kind of vacations their working-class parents had enjoyed – the summer weeks at Brighton or Atlantic City – these young people were ideal customers for a new and exotic version of the "hangout" of their teen years.

Managers have known for a long time that demographics matter, but they have always believed that population statistics change slowly. In this century, however, they don't. Indeed, the innovation opportunities made possible by changes in the numbers of people – and in their age distribution, education, occupations, and geographic location – are among the most rewarding and least risky of entrepreneurial pursuits.

## 6 Changes in Perception

"The glass is half full" and "The glass is half empty" are descriptions of the same phenomenon but have vastly different meanings. Changing a manager's perception of a glass from half full to half empty opens up big innovation opportunities.

All factual evidence indicates, for instance, that in the last 20 years, Americans' health has improved with unprecedented speed – whether measured by mortality rates for the newborn, survival rates for the very old, the incidence of cancers (other than lung cancer), cancer cure rates, or other factors. Even so, collective hypochondria grips the nation. Never before has there been so much concern with or fear about health. Suddenly, everything seems to cause cancer or degenerative heart disease or premature loss of memory. The glass is clearly half empty.

Rather than rejoicing in great improvements in health, Americans seem to be emphasizing how far away they still are from immortality. This view of things has created many opportunities for innovations: markets for new health care magazines, for exercise classes and jogging equipment, and for all kinds of health foods. The fastest growing new U.S. business in 1983 was a company that makes indoor exercise equipment.

A change in perception does not alter facts. It changes their meaning, though – and very quickly. It took less than two years for the computer to change from being perceived as a threat and as something only big businesses would use to something one buys for doing income tax. Economics do not necessarily dictate such a change; in fact, they may be irrelevant. What determines whether people see a glass as half full or half empty is mood rather than fact, and a change in mood often defies quantification. But it is not exotic. It is concrete. It can be defined. It can be tested. And it can be exploited for innovation opportunity.

## 7 New Knowledge

Among history-making innovations, those that are based on new knowledge – whether scientific, technical, or social – rank high. They are the superstars of entrepreneurship; they get the publicity and the money. They are what people usually mean when they talk of innovation, although not all innovations based on knowledge are important.

Knowledge-based innovations differ from all others in the time they take, in their casualty rates, and in their predictability, as well as in the challenges they pose to entrepreneurs. Like most superstars, they can be temperamental, capricious, and hard to direct. They have, for instance, the longest lead time of all innovations. There is a protracted span between the emergence of new knowledge and its distillation into usable technology. Then there is another long period before this new technology appears in the marketplace in products, processes, or services. Overall, the lead time involved is something like 50 years, a figure that has not shortened appreciably throughout history.

*Knowledge-based innovations can be temperamental, capricious, and hard to direct.*

To become effective, innovation of this sort usually demands not one kind of knowledge but many. Consider one of the most potent knowledge-based innovations: modern banking. The theory of the entrepreneurial bank – that is, of the purposeful use of capital to generate economic development – was formulated by the Comte de Saint-Simon during the era of Napoleon. Despite Saint-Simon's extraordinary prominence, it was not until 30 years after his death in 1825 that two of his disciples, the brothers Jacob and Isaac Pereire, established the first entrepreneurial bank, the Credit Mobilier, and ushered in what we now call finance capitalism.

The Pereires, however, did not know modern commercial banking, which developed at about the same time across the channel in England. The Credit Mobilier failed ignominiously. A few years later, two young men – one an American, J.P. Morgan, and one a German, Georg Siemens – put together the French

theory of entrepreneurial banking and the English theory of commercial banking to create the first successful modern banks: J.P. Morgan & Company in New York, and the Deutsche Bank in Berlin. Ten years later, a young Japanese, Shibusawa Eiichi, adapted Siemens's concept to his country and thereby laid the foundation of Japan's modern economy. This is how knowledge-based innovation always works.

The computer, to cite another example, required no fewer than six separate strands of knowledge:

- binary arithmetic;
- Charles Babbage's conception of a calculating machine, in the first half of the nineteenth century;
- the punch card, invented by Herman Hollerith for the U.S. census of 1890;
- the audion tube, an electronic switch invented in 1906;
- symbolic logic, which was developed between 1910 and 1913 by Bertrand Russell and Alfred North Whitehead;
- and concepts of programming and feedback that came out of abortive attempts during World War I to develop effective antiaircraft guns.

*Innovation requires knowledge, ingenuity, and, above all else, focus.*

Although all the necessary knowledge was available by 1918, the first operational digital computer did not appear until 1946.

Long lead times and the need for convergence among different kinds of knowledge explain the peculiar rhythm of knowledge-based innovation, its attractions, and its dangers. During a long gestation period, there is a lot of talk and little action. Then, when all the elements suddenly converge, there is tremendous excitement and activity and an enormous amount of speculation. Between 1880 and 1890, for example, almost 1,000 electric-apparatus companies were founded in developed countries. Then, as always, there was a crash and a shakeout. By 1914, only 25 were still alive. In the early 1920s, 300 to 500 automobile companies existed in the United States; by 1960, only four of them remained.

It may be difficult, but knowledge-based innovation can be managed. Success requires careful analysis of the various kinds of knowledge needed to make an innovation possible. Both J.P. Morgan and Georg Siemens did this when they established their banking ventures. The Wright brothers did this when they developed the first operational airplane.

Careful analysis of the needs – and, above all, the capabilities – of the intended user is also essential. It may seem paradoxical, but knowledge-based innovation is more market dependent than any other kind of innovation. De Havilland, a British company, designed and built the first passenger jet, but it did not analyze what the market needed and therefore did not identify two key factors. One was configuration – that is, the right size with the right payload for the routes on which a jet would give an airline the greatest advantage. The other was equally mundane: How could the airlines finance the purchase of such an expensive plane? Because de Havilland failed to do an adequate user analysis, two American companies, Boeing and Douglas, took over the commercial jet-aircraft industry.

## Principles of Innovation

Purposeful, systematic innovation begins with the analysis of the sources of new opportunities. Depending on the context, sources will have different importance at different times. Demographics, for instance, may be of little concern to innovators of fundamental industrial processes like steelmaking, although the Linotype machine became successful primarily because there were not enough skilled typesetters available to satisfy a mass market. By the same token, new knowledge may be of little relevance to someone innovating a social instrument to satisfy a need that changing demographics or tax laws have created. But whatever the situation, innovators must analyze all opportunity sources.

Because innovation is both conceptual and perceptual, would-be innovators must also go out and look, ask, and listen. Successful innovators use both the right and left sides of their brains. They work out analytically what the innovation has to be to satisfy an opportunity. Then they go out and look at potential users to study their expectations, their values, and their needs.

To be effective, an innovation has to be simple, and it has to be focused. It should do only one thing; otherwise it confuses people. Indeed, the greatest praise an innovation can receive is for people to say, "This is obvious! Why didn't I think of it? It's so simple!" Even the innovation that creates new users and new markets should be directed toward a specific, clear, and carefully designed application.

Effective innovations start small. They are not grandiose. It may be to enable a moving vehicle to draw electric power while it runs along rails, the innovation that made possible the electric streetcar. Or it may be the elementary idea of putting the same number of matches into a matchbox (it used to be 50). This simple notion made possible the automatic filling of matchboxes and gave the Swedes a world monopoly on matches for half a century. By contrast, grandiose ideas for things that will "revolutionize an industry" are unlikely to work.

In fact, no one can foretell whether a given innovation will end up a big business or a modest achievement. But even if the results are modest, the successful innovation aims from the beginning to become the standard setter, to determine the direction of a new technology or a new industry, to create the business that is–and remains–ahead of the pack. If an innovation does not aim at leadership from the beginning, it is unlikely to be innovative enough.

Above all, innovation is work rather than genius. It requires knowledge. It often requires ingenuity. And it requires focus. There are clearly people who are more talented innovators than others, but their talents lie in well-defined areas. Indeed, innovators rarely work in more than one area. For all his systematic innovative accomplishments, Thomas Edison worked only in the electrical field. An innovator in financial areas, Citibank for example, is not likely to embark on innovations in health care.

In innovation, as in any other endeavor, there is talent, there is ingenuity, and there is knowledge. But when all is said and done, what innovation requires is hard, focused, purposeful work. If diligence, persistence, and commitment are lacking, talent, ingenuity, and knowledge are of no avail.

There is, of course, far more to entrepreneurship than systematic innovation–distinct entrepreneurial strategies, for example, and the principles of entrepreneurial management, which are needed equally in the established enterprise, the public service organization, and the new venture. But the very foundation of entrepreneurship is the practice of systematic innovation.

Reprint R0208F
To place an order, call 1-800-988-0886.