The Innovators
by Harold Evans

Assaying Edison... and His Equals

Who belongs in the Innovation Hall of Fame: Shockley, who invented the transistor; Moore and Noyce, who left his lab to found Intel; or Grove, who managed the company to greatness?

At the beginning of the last century, when the United States inched out Britain for top place in the world's share of manufacturing, Andrew Carnegie exulted, "The old nations of the earth creep on at a snail's pace, the Republic thunders past with the rush of the express." His generation of Social Darwinists, the likes of John D. Rockefeller and George M. Pullman, put it all down to the spirit of enterprise, the freedom of the fittest to survive and succeed without meddling from law or government. That romantic notion of the individual entrepreneur taking on the world, celebrated in the novels of Ayn Rand, still has a grip on the American business imagination.

But the heroic icon does not do justice to the complexity of innovation. It is overlooked, for instance, that the transforming event that made America a single marketplace — the transcontinental railroad — would never have been completed in 1869 without the federal government. The railroad men were titans, but they looked to the Republican administrations in Washington for money and land. They got 23 million acres and $64 million in easy loans. James J. Hill, creator of the Great Northern Railroad, was the only transcontinental builder who dispensed with government funding.

To the Europeans, America owed its business success to a vast closed market created both by the railways and by the imposition of high tariffs. American business was a protected business. Rapid expansion across the landmass also owed as much to government as it did to Daniel Boone. The gift of 160 acres of land to every homesteader, and the protection of the U.S. Army, was critical to the settlement of the West, and with it, the production of food for the burgeoning population. Government also made it relatively easy for individuals and companies to exploit a continent rich in minerals, oil, gas, water, and timber.

America, of course, was hardly unique in its physical resources; Russia, China, Australia, Canada, Brazil, Argentina, and South Africa, among others, were similarly well endowed. Why did those nations fail to develop as rapidly as the United States? Was there something special about the way American administrations provided incentives and protection for enterprise, or was there also a special

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get-up-and-go quality in America's people?

I think there was. Certainly America was distinctive in the way it embraced millions of immigrants from Europe. They provided cheap labor, but more than that, they were self-selected for their determination and enterprise. They were ready to jettison old values and practices. They were natural innovators. The same was true of immigrants to Canada, and, to a lesser extent, to Australia, but nothing approaches the American importation of bright eager beavers. Alexander Graham Bell came from Scotland to Boston to teach the deaf. Hunchbacked Charles P. Steinmetz only narrowly escaped being sent back to Germany and was spurned by Thomas A. Edison ("too many electricians are coming here"), but his inventiveness sped electricity over great distances to factories.

In writing my history *The American Century* (Alfred A. Knopf, 1998), which focused on the second hundred years of the Republic, from 1889 to 1989, I became increasingly intrigued by innovators like Steinmetz, individuals who made a difference. One fact alone is suggestive: The number of patents granted to inventors doubled every year from the end of the Civil War to the end of the century. As *Scientific American* celebrated in 1896, it was "an epoch of invention and progress unique in the history of the world." The historian Thomas P. Hughes neatly dubbed it the "American Genesis," the creation of the modern technological nation. But who, precisely, were the creators? I decided to look into the lives and work of the innovators over more than a century of progress, and accepted the invitation of the publisher Little, Brown to treat the subject at length, in a book I am entitling *The Innovators*. I propose to touch on the complexity of innovation, but the emphasis will be on individuals.

The first piece of enterprise I have imposed on myself is to determine a time frame and identify the innovators. A key date is May 10, 1869, since that was the moment the lines of the Central Pacific and Union Pacific finally kissed at Promontory Point, Utah, creating the essential bone in the skeleton of a railway network that made the mass market a practical possibility. The railways and the people who made them will be one bookend. The other bookend is the new electronic network of the Internet and the World Wide Web. Here again we have to acknowledge the role of government, since it was an agency of the U.S. Defense Department — the Advanced Research Projects Agency (ARPA) — that funded the academic engineers and scientists who at the end of the 1960s created a national information network. Richard DeLauer, then U.S. Undersecretary of Defense, established the transmission control protocol and the Internet protocol as essential for linking networks. Is he an innovator? It is tempting to tell the stories of such innovative public servants as Mr. DeLauer and New Dealers like Harry L. Hopkins and Harold L. Ickes, but I am persuaded that it is better to confine the individual studies to people in private enterprise, where the name of the game is risk.

Another consideration: the sheer multitude of individuals to consider. My intention is to fine down a working list of entrepreneurs to 100, for something like an Innovators' Hall of Fame. They are hard to select. There are thousands and thousands of them, and they cover a wide spectrum of activity. The people who came to pay homage to Thomas Edison in 1929, on the 50th anniversary of his first incandescent light, are suggestive of the range of American prowess. Watching Edison re-enact

his first moment of triumph were Henry Ford, Orville Wright, Marie Curie, Harvey S. Firestone, and President Herbert C. Hoover — the Indiana Jones of the turn of the century, who found a fortune in an abandoned silver mine in Burma marked by fresh tiger tracks.

But who are the most important and illustrative of the thousands? What are their origins and their inspirations? Is any common motivation discernible? How much were they original and alone, how much were they the lucky inheritors of a legacy of research by others? What was their contribution to American civilization? What, for instance, gave Gustavus Swift the idea that made the refrigerator railcar work (1874)? Why was Christopher Soule's typewriter the one that E. Remington and Sons developed (1873)? Who was the genius behind the marketing of George Eastman's 1889 Box Brownie ("You take the picture, we do the rest")? What was special about Jonathan O. Armour's mechanization of the nation's meat processing industry? How did King Camp Gillette find the money for his new use of steel? Would Alexander Graham Bell have beaten the Wright brothers to flight if he hadn't become obsessed with the telephone? Why didn't the Wright brothers become more successful businessmen?

I have come to appreciate more acutely the difference between invention and innovation, between making a discovery and making a business. Philo T. Farnsworth transmitted the first all-electronic television image, but David Sarnoff built the RCA Corporation. Chester F. Carlson invented a process he called electrophotography, the basis of the modern photocopier, yet it was the Haloid Company men, Joseph C. Wilson and Dr. John F. Dessauer, who made the idea work (but only after putting in $75 million and endless hours of frustrating experiment between 1947 and 1960). Weren't they the innovators? The genius of William B. Shockley expressed itself in the invention of the transistor with John Bardeen and Walter H. Brattain at the Bell Laboratories in Murray Hill, N.J., but his brilliance did not translate to running a business — he could not get along with people. The scientific/business innovators are Gordon E. Moore and Robert N. Noyce, two of the "traitorous eight," who left the Shockley Semiconductor Laboratory and in 1968 founded the company that became the Intel Corporation, and the microchip business. Then again, to what extent would Intel have flourished without the innovating managerial energies of Andrew S. Grove? Alfred D. Chandler, the father of American business history, has long and persuasively argued that the secret of America's modern success ultimately lies with such innovators in corporate strategy and structure as Pierre S. duPont at DuPont, Theodore N. Vail at the AT&T Corporation, and Alfred P. Sloan, Jr. at the General Motors Corporation.

Management — and money. The innovators' eagerness to make money seems to have been as overplayed as the role of the financiers has been underplayed. Thomas Edison was never much interested in profit. He regarded interest as "the invention of Satan." He lost whole fortunes. The standard line used to be that he

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was a folksy genius done down by capitalists who could not see further than a week. In fact, more recent scholarship suggests that it was the money men who saved Edison. It was Grosvenor Lowery, a New York patent attorney, who formed the first syndicate of capitalists to back Edison's inventive research. When they went to Menlo Park to see where their money had gone, expecting a demonstration of incandescent lighting, they sat in darkness when the lamps fused. Lowery had the job of coaxing them to keep faith.

One characteristic in common from the robber barons of the Gilded Age through Silicon Valley's teenage tycoons is that all have been cussedly practical and pragmatic. "We have got to come up with something," Edison adjured the men in his Menlo Park lab. "We can't be like those German professors who spend their whole lives studying the fuzz on a bee." The experience of researching the life stories of inventors and innovators, however, does damage to the "Eureka!" concept, the notion that there was one blinding moment of original insight and then the money rolled in. Before the dot-com day, it seems never to have been quite like that. Innovators built on other innovators.

Take John Wanamaker of Philadelphia and New York, who is widely credited with creating the retail department store as we know it today. He replaced the customary haggling of the post-Civil War period by advertising fixed prices, guaranteed low prices, and money-back guarantees. Some of these elements were already manifest in the emporia of Alexander T. Stewart, Rowland H. Macy, Arthur Tappan, and Lord & Taylor; Wanamaker's distinction was to put them all together in a philosophy of service. He did not get it right all at once.

Few do. Indeed, the painstaking nature of much invention and innovation throughout the ages is manifest in a letter Edison wrote in November 1878 to describe his ever-present difficulties: "It has been so with all my inventions. The first step is an intuition — and comes with a burst, then difficulties arise. The thing gives out and then… 'bugs,' as such little faults and difficulties are called — show themselves and months of anxious watching, study, and labor are requisite before commercial success — or failure — is indeed reached. I have the right principle and am on the right track, but time, hard work and some good luck are necessary too..."

The Edison Electric Light Company, launched by "20 earnest men" in 1878, was the foundation of the General Electric Company, the most marvelous marriage of science and industry, the harbinger of the new age of American commercial supremacy. But what torment Edison had to endure. We live with the product of a successful innovator's genius, and take it for granted, but it is easy to forget the strength of character required to attempt something new and stay with it through the disappointments and the sniggers of mediocrity. In modern times, I think of the derision encountered in their industries, and in the press, by Ted Turner and Allen H. Neuharth when they started, respectively, CNN and *USA Today*. As the historian Frederic Maitland remarked, it is very hard to remember that what is now in the past was once in the future.

I look forward to celebrating those who took the leap in the dark for all of us — and I particularly welcome any nominations from the discerning readers of *Strategy+ Business*. Please e-mail them to me at evans_harold@strategy-business.com and I'll be sure to consider them. +

Reprint No. 00203