

13.2: An Introduction to Research and Development (RandD)

Learning Objectives

1. Know what constitutes research and development (R&D).
2. Understand the importance of R&D to corporations.
3. Recognize the role government plays in R&D.

Research and development (R&D) refers to two intertwined processes of research (to identify new knowledge and ideas) and development (turning the ideas into tangible products or processes). Companies undertake R&D in order to develop new products, services, or procedures that will help them grow and expand their operations. Corporate R&D began in the United States with Thomas Edison and the Edison General Electric Company he founded in 1890 (which is today's GE). Edison is credited with 1,093 patents, but it's actually his invention of the corporate R&D lab that made all those other inventions possible. Andrea Meyer, "High-Value Innovation: Innovating the Management of Innovation," *Working Knowledge* (blog), August 20, 2009, accessed February 22, 2011, <http://workingknowledge.com/blog/?p=594>. Edison was the first to bring management discipline to R&D, which enabled a much more powerful method of invention by systematically harnessing the talent of many individuals. Edison's 1,093 patents had less to do with individual genius and more to do with management genius: creating and managing an R&D lab that could efficiently and effectively crank out new inventions. For fifty years following the early twentieth century, GE was awarded more patents than any other firm in America. Gary Hamel, "The Why, What and How of Management Innovation," *Harvard Business Review*, February 2006, accessed February 24, 2011, <http://hbr.org/2006/02/the-why-what-and-how-of-management-innovation/ar/1>.

Edison is known as an inventor, but he was also a great innovator. Here's the difference: an **invention** brings an idea into tangible reality by embodying it as a product or system. An **innovation** converts a new idea into revenues and profits. Inventors can get patents on original ideas, but those inventions may not make money. For an invention to become an innovation, people must be willing to buy it in high enough numbers that the firm benefits from making it. A. G. Lafley and Ram Charan, *The Game-Changer* (New York: Crown Publishing Group, 2008), 21.

Edison wanted his lab to be a commercial success. "Anything that won't sell, I don't want to invent. Its sale is proof of utility and utility is success," A. G. Lafley and Ram Charan, *The Game-Changer* (New York: Crown Publishing Group, 2008), 25. Edison said. Edison's lab in Menlo Park, New Jersey, was an **applied research** lab, which is a lab that develops and commercializes its research findings. As defined by the National Science Foundation, applied research is "systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met." National Science Foundation, "Definitions of Research and Development," Office of Management and Budget Circular A-11, accessed March 5, 2011, <http://www.nsf.gov/statistics/randdef/fedgov.cfm>. In contrast, **basic research** advances the knowledge of science without an explicit, anticipated commercial outcome.

History and Importance

From Edison's lab onward, companies learned that a systematic approach to research could provide big competitive advantages. Companies could not only invent new products, but they could also turn those inventions into innovations that launched whole new industries. For example, the radio, wireless communications, and television industry grew out of early-twentieth-century research by General Electric and American Telephone and Telegraph (AT&T, which founded Bell Labs).

The heyday of American R&D labs came in the 1950s and early 1960s, with corporate institutions like Bell Labs, RCA labs, IBM's research centers, and government institutions such as NASA and DARPA. These labs funded both basic and applied research, giving birth to the transistor, long-distance TV transmission, photovoltaic solar cells, the UNIX operating system, and cellular telephony, each of which led to the creation of not just hundreds of products but whole industries and millions of jobs. Adrian Slywotzky, "How Science Can Create Millions of New Jobs," *BusinessWeek*, September 7, 2009, accessed May 11, 2011, http://www.businessweek.com/magazine/content/09_36/b4145036678131.htm. DARPA's creation of the Internet (known at its inception as ARPAnet) and Xerox PARC's Ethernet and graphical-user interface (GUI) laid the foundations for the PC revolution. Adrian Slywotzky, "How Science Can Create Millions of New Jobs," *BusinessWeek*, September 7, 2009, accessed May 11, 2011, http://www.businessweek.com/magazine/content/09_36/b4145036678131.htm.

Companies invest in R&D to gain a pipeline of new products. For a high-tech company like Apple, it means coming up with new types of products (e.g., the iPad) as well as newer and better versions of its existing computers and iPhones. For a pharmaceutical

company, it means coming out with new drugs to treat diseases. Different parts of the world have different diseases or different forms of known diseases. For example, diabetes in China has a different molecular structure than diabetes elsewhere in the world, and pharmaceutical company Eli Lilly's new R&D center in Shanghai will focus on this disease variant. "2011 Global R&D Funding Forecast," *R&D Magazine*, December 2010, accessed February 27, 2011, www.battelle.org/aboutus/rd/2011.pdf. Even companies that sell only services benefit from innovation and developing new services. For example, MasterCard Global Service started providing customers with emergency cash advances, directions to nearby ATMs, and emergency card replacements. Lance Bettencourt, *Service Innovation* (New York: McGraw-Hill, 2010), 99.

Innovation also includes new product and service combinations. For example, heavy-equipment manufacturer John Deere created a product and service combination by equipping a GPS into one of its tractors. The GPS keeps the tractor on a parallel path, even under hands-free operation, and keeps the tractor with only a two-centimeter overlap of those parallel lines. This innovation helps a farmer increase the yield of the field and complete passes over the field in the tractor more quickly. The innovation also helps reduce fuel, seed, and chemical costs because there is little overlap and waste of the successive parallel passes. Lance Bettencourt, *Service Innovation* (New York: McGraw-Hill, 2010), 110.

Did You Know?

Appliance maker Whirlpool has made innovation a strategic priority in order to stay competitive. Whirlpool has an innovation pipeline that currently numbers close to 1,000 new products. On average, Whirlpool introduces one hundred new products to the market each year. "Every month we report pipeline size measured by estimated sales, and our goal this year is \$4 billion," said Moises Norena, director of global innovation at Whirlpool. With Whirlpool's 2008 revenue totaling \$18.9 billion, that means roughly 20 percent of sales would be from new products. Jessie Scanlon, "How Whirlpool Puts New Ideas through the Wringer," *BusinessWeek*, August 3, 2009, accessed January 17, 2011, http://www.businessweek.com/innovate/content/aug2009/id2009083_452757.htm.

Not only do companies benefit from investing in R&D, but the nation's economy benefits as well, as Massachusetts Institute of Technology (MIT) professor Robert Solow discovered. Solow showed mathematically that, in the long run, growth in gross national product per worker is due more to technological progress than to mere capital investment. Solow won a Nobel Prize for his research, and investment in corporate R&D labs grew.

Although R&D has its roots in national interests, it has become globalized. Most US and European *Fortune* 1000 companies have R&D centers in Asia. "2011 Global R&D Funding Forecast," *R&D Magazine*, December 2010, accessed February 27, 2011, www.battelle.org/aboutus/rd/2011.pdf. You'll see the reasons for the globalization of R&D in [Section 13.3](#).

The Role of Government

Governments have played a large role in the inception of R&D, mainly to fund research for military applications for war efforts. Today, governments still play a big role in innovation because of their ability to fund R&D. A government can fund R&D directly, by offering grants to universities and research centers or by offering contracts to corporations for performing research in a specific area.

Governments can also provide tax incentives for companies that invest in R&D. Countries vary in the tax incentives that they give to corporations that invest in R&D. By giving corporations a tax credit when they invest in R&D, governments encourage corporations to invest in R&D in their countries. For example, Australia gave a 125 percent tax deduction for R&D expenses. The Australian government's website noted, "It's little surprise then, that many companies from around the world are choosing to locate their R&D facilities in Australia." The government also pointed out that "50 percent of the most innovative companies in Australia are foreign-based." Committee on Prospering in the Global Economy of the 21st Century (U.S.), Committee on Science, Engineering, and Public Policy (U.S.), *Rising Above the Gathering Storm* (Washington, DC: National Academies Press, 2007), 195.

Finally, governments can promote innovation through investments in infrastructure that will support new technology and by committing to buy the new technology. China is doing this in a big way, and it is thus influencing the course of many companies around the world. Since 2000, China has had a policy in place "to encourage tech transfer from abroad and to force foreign companies to transfer their R&D operations to China in exchange for access to China's large volume markets," reported *R&D Magazine* in its 2010 review of global R&D. "2011 Global R&D Funding Forecast," *R&D Magazine*, December 2010, accessed February 27, 2011, www.battelle.org/aboutus/rd/2011.pdf. For example, any automobile manufacturer that wants to sell cars in China must enter into a partnership with a Chinese company. As a result, General Motors (GM), Daimler, Hyundai, Volkswagen (VW), and Toyota have all formed joint ventures with Chinese companies. General Motors and Volkswagen, for example, have

both formed joint ventures with the Chinese company Shanghai Automotive Industry Corporation (SAIC), even though SAIC also sells cars under its own brand. Brian Dumaine, “China Charges into Electric Cars,” *Fortune*, November 1, 2010, 140. The Chinese government made another strategic decision influencing innovation in the automobile industry. Because no Chinese company is a leader in internal combustion engines, the government decided to leapfrog the technology and focus on becoming a leader in electric cars. Bill Russo, Tao Ke, Edward Tse, and Bill Peng, *China’s Next Revolution: Transforming The Global Auto Industry*, Booz & Company report, 2010, accessed February 27, 2011, [www.booz.com/media/file/China’s Next Revolution en.pdf](http://www.booz.com/media/file/China's_Next_Revolution_en.pdf). “Beijing has pledged that it will do whatever it takes to help the Chinese car industry take the lead in electric vehicles,” notes industry watcher Brian Dumaine. Brian Dumaine, “China Charges into Electric Cars,” *Fortune*, November 1, 2010, 140. That includes allocating \$8 billion in R&D funds as well as another \$10 billion in infrastructure (e.g., installing charging stations). Gordon Orr, “Unleashing Innovation in China,” *McKinsey Quarterly*, January 2011, accessed January 2, 2011, [www.mckinseyquarterly.com/Strategy/Innovation/Unleashing innovation in China 2725](http://www.mckinseyquarterly.com/Strategy/Innovation/Unleashing_innovation_in_China_2725). The government will also subsidize the purchase of electric cars by consumers and has committed to buying electric cars for government fleets, thus guaranteeing that there will be buyers for the new electric vehicles that companies invent and develop.

Another role of government is to set high targets that require innovation. In the 1960s, the US Apollo space program launched by President John F. Kennedy inspired US corporations to work toward putting a man on the moon. The government’s investments in the Apollo program sped up the development of computer and communications technology and also led to innovations in fuel cells, water purification, freeze-drying food, and digital image processing now used in medical products for CAT scans and MRIs. Adrian Slywotzky, “How Science Can Create Millions of New Jobs,” *BusinessWeek*, September 7, 2009, accessed May 11, 2011, http://www.businessweek.com/magazine/content/09_36/b4145036678131.htm. Today, government policies coming from the European Union mandate ambitious environmental targets, such as carbon-neutral fuels and energy, which are driving global R&D to achieve environmental goals the way the Apollo program drove R&D in the 1960s. Martin Grueber and Tim Studt, “A Battelle Perspective on Investing in International R&D,” *R&D Magazine*, December 22, 2009, <http://www.rdmag.com/Featured-Articles/2009/12/Global-Funding-Forecast-A-Battelle-Perspective-International-R-D>.

After the 1990s, US investment in R&D declined, especially in basic research. Governments in other countries, however, continue to invest. New government-corporate partnerships are developing around the world. IBM, which for years closely guarded its R&D labs (even IBM employees were required to have special badges to enter the R&D area), is now setting up “collaboratories” around the world. These collaboratories are partnerships between IBM researchers and outside experts from government, universities, and even other companies. “The world is our lab now,” says John E. Kelly III, director of IBM Research. Steve Hamm, “How Big Blue Is Forging Cutting-edge Partnerships around the World,” *BusinessWeek*, August 27, 2009, accessed January 2, 2010, http://www.businessweek.com/print/magazine/content/09_36/b4145040683083.htm. IBM has deals for six future collaboratories in China, Ireland, Taiwan, Switzerland, India, and Saudi Arabia.

The reason for the collaboratory strategy is to share R&D costs—IBM’s partners must share 50 percent of the funding costs, which means that together the partners can participate in a large-scale effort that they’d be hard pressed to fund on their own. An example is IBM’s research partnership with the state-funded Swiss university ETH Zurich. The two are building a \$70 million semiconductor lab for nanotech research with the goal of identifying a replacement for the current semiconductor-switch technology. Steve Hamm, “How Big Blue Is Forging Cutting-Edge Partnerships around the World,” *BusinessWeek*, August 27, 2009, accessed January 2, 2010, http://www.businessweek.com/print/magazine/content/09_36/b4145040683083.htm. Such a breakthrough could harken the creation of a whole new industry.

Did You Know?

Of all the countries in the world, the United States remains the largest investor in R&D. One-third of all spending on R&D comes from the United States. Just one government agency—the Department of Defense—provides more funding than all the nations of the world except China and Japan. Nonetheless, other countries are increasing the amounts of money they spend on R&D. Their governments are funding R&D at higher levels and are giving more attractive tax incentives to firms that spend on R&D.

Governments can also play a big role in the protection of intellectual property rights, as you’ll see in [Section 13.2](#).

KEY TAKEAWAYS

- R&D refers to two intertwined processes of research (to identify new facts and ideas) and development (turning the ideas into tangible products and services.) Companies undertake R&D to get a pipeline of new products. Breakthrough innovations can create whole new industries, which can provide thousands of jobs.

- Invention is the creation of a new idea embodied in a product or process, while innovation takes that new idea and commercializes it in a way that enables a company to generate revenue from it.
- Government support of R&D plays a significant role in innovation. It has been generally accepted that it's desirable to encourage R&D for reasons of economic growth as well as national security. This has resulted in massive support from public funds for many sorts of laboratories. Governments influence R&D not only by providing direct funding but also by providing tax incentives to companies that invest in R&D. Governments also stimulate innovation through supporting institutions such as education and providing reliable infrastructure.

EXERCISES

(AACSB: Reflective Thinking, Analytical Skills)

1. What benefits does a company get by investing in R&D?
2. Why do organizations make a distinction between basic research and applied research?
3. Describe three ways in which government can influence R&D.

This page titled [13.2: An Introduction to Research and Development \(RandD\)](#) is shared under a [CC BY-NC-SA 3.0](#) license and was authored, remixed, and/or curated by [Anonymous](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

- **13.1: An Introduction to Research and Development (R&D)** by Anonymous is licensed [CC BY-NC-SA 3.0](#). Original source: <https://2012books.lardbucket.org/books/challenges-and-opportunities-in-international-business/>.