

## INDEX

- accountability, public, 18  
 Acts, Hatch and Smith-Lever, 42  
 agribusiness, 6  
 agriculture, xi, 5–7, 10–11, 42. *See also*  
   Australia  
 AIDS (Acquired Immune Deficiency  
   Syndrome), 93  
 anarchists, 29n3, 91. *See also* society  
 anthrax, 102–3  
 Apple (computer), 77, 84, 85  
 applications, 77–78, 84, 86  
 Arnold, Christian, 43  
 ARPA (Advanced Research Projects  
   Agency), 49, 82–84, 85–86  
 ARPANET, 49–50, 85; Department of  
   Defense and, xiii, 82; IBM and, 82–83;  
   Internet and, xiii, 82–84  
 Arrow, Kenneth J., xix, xvii–xviii  
 astrophysics, 35, 50  
 AT & T Bell Labs, 75, 79  
*Atlas Shrugged* (Rand), 28, 54  
 Australasian Association for the  
   Advancement of Science, 11  
 Australia, industry in, 6–7, 12; research  
   in, 9–17. *See also* agriculture  
 Australian Research Council (ARC), 22,  
   23  
  
 Babbage, Charles, 3  
 Bacon, Francis, 2  
 bacteria, 110–12  
 bandwidth, 50  
 Best, Frederic, 109  
 bidding, competitive, 85  
  
 bioterrorism, 102–3  
 Bissett Berman, 71–72  
 Bolt Beranek and Newman, 85  
 bombs, 66–67, 68  
 Brezhnev, Leonid, 46  
 Britain, 2, 66, 69, 105  
 BSD (Berkeley software distribution), 79  
 budgets, appropriations, 118  
 bureaucracies, xv–xvi, 36, 37, 40, 53, 74,  
   87  
 Bush, George W., 39–40, 64  
 Bush, Vannevar, 45, 67–68  
 Business Expenditure and Research and  
   Development (BERD), 14–15, 16t3,  
   17t4, 24  
  
 Cal Tech, 52  
 cancer, 116–17  
 capitalists, 4. *See also* society  
 cargo cult, 19  
 Carnegie Mellon University, 80  
 Carter, Jimmy, 64  
 Cato Institute, 100  
 Center for Disease Control (CDC), 94,  
   102, 115  
 CERN (European Laboratory for Particle  
   Physics), xii  
*ceteris paribus*, 36–41  
 charitable organizations, 114, 115–16  
 checks and balances, 58  
 CIA, 78  
 Cisco, 78, 84, 85  
 Civil Research and Development, 19. *See*  
   *also* laws

## 120 / Index

- classical-liberal perspective, 27, 41, 42, 55; funding and, 50, 51; of libertarians, 29n3; government and, 36
- classical-liberal political science, 28–29, 37
- Clinton, Bill, 54, 64
- Co-operative Research Centre Program, 22, 23
- code-breaking, 66, 69, 72, 76
- Cold War, 32, 40, 46–51
- collective need, theory of, xv
- commerce, 2, 41
- Commonwealth Scientific and Industrial Research Organization (CSIRO), 6, 11, 12, 13t1, 14, 15t2
- commercial enterprise, 10
- companies, xviii, 2; computer, 77–78, 84–85; pharmaceutical, 114, 116. *See also specific companies*
- competition, 39, 42, 45, 85
- Computer Science Corporation, 85
- computer(s), 35; companies, 77–78, 84–85; history of, 72–73; networks and, xiii; tracking and, 76n17; types of, 71, 77–78. *See also database; Department of Defense (DoD); disk drives; DRAM; information technology (IT); microprocessors; software systems; specific companies; supercomputers; technologies*
- Congress, U.S., 46, 48, 51, 69, 77, 118
- conservatives, v. libertarians, 27–28
- Constitution, U.S., 28, 58, 63
- contracts, 30, 40, 45, 74, 89
- corporations. *See companies*
- cost overruns, xv
- Council for Scientific and Industrial Research, 11
- countries, comparisons among, 20, 33–34, 105
- DARPA (Defense Advanced Research Projects Agency), 49
- Darwin, Charles, 8
- database, 78, 84
- David, P.A., 18, 20–21
- decentralization, xiii, 45
- defense, 4, 41, 59, 103, 116; funding and, 48, 70, 96; general welfare and, 46; mission of, 32, 36; need for, 29, 46, 98–99; problems, 33–34; products for, 98–99. *See also science*
- Department of Agriculture. *See USDA*
- Department of Defense (DoD), xii, 85, 96; information technology and, 62, 79, 80, 81. *See also ARPANET*
- Department of Transportation, 57
- Department of War, 66, 67, 72
- deregulation, 27. *See also regulation*
- design, overall, 77, 84
- Diamond, Nancy, 44
- diseases, 93, 100–101, 102–3, 114. *See also specific diseases*
- disk drives, 78, 84
- diversity, lack of, 85–87
- DNA, 109–12
- DOE (Department of Energy), 52, 53, 54, 96; information technology and, 62, 79, 80, 81
- Dollo's Law, 20
- DRAM, 78, 80–81, 84
- drugs, development of, 92–94, 108–14
- earmarking, 39, 49
- Economic Laws of Scientific Research, The* (Kealey), xiii2
- Economic Outlook 2002*, 65, 69
- economics, 105; growth and, 62, 65, 69; innovations and, 3, 9, 13; markets and, xiv, xvii; universities and, xviii, 44
- economy, central planning of, xvii
- education, 2, 4–5, 12; in Europe, 43; evolution of, 42–43; and private sector, 8; state support of, 3; taxpayers and, 5; in third world countries, 33–34. *See also schools; universities*
- EECS (electrical engineering and computer sciences), 71
- Eisenhower, Dwight D., 68, 69
- Eli Lilly, 109
- Enders, John, 117
- environment, 55, 99–100, 103
- EPA (Environmental Protection Agency), 57, 58
- erythropoietin (EPO), 108
- European Laboratory for Particle Physics (CERN), xii
- expenditures, 17, 18, 19, 22. *See also*

## Index / 121

- research and development; taxes; taxpayers  
expropriation, xvi, xvii
- Farber, Sidney, 116–17  
fellowships, increase in, 22  
FFRDCs (Federally Funded Research and Development Centers), 52, 53, 59  
findings, selling v. giving away, xix  
Food and Drug Administration, 58, 103  
foundations, 2, 7–8, 96  
France, 4  
freedom, 104–5, 106; v. central planning, xvii  
funding, arguments for and against, 3–9, 17–24; effectiveness of, 69–71, 84; fads and, 117–18; government and, xi, 44–45; of individuals v. projects, 114; inefficiency and, 18, 31; of information technology, 70–71; joint, 86–87; laws of, 19–20, 21; as monopoly, 87–89; moral reason for, 18; by nongovernment employees, 42; for peaceful technology, xix; pitfalls in, 88–89; private sector and, 7, 8–9, 17, 86, 95, 101, 108, 114, 115; of projects, 114, 116; by public, xix; recommendations for, 22–24; v. under funding, 85; throughout world, 48. *See also* companies; defense; foundations; investment; research; *specific companies*; *specific institutes*  
*Funding Science in America* (Savage), xviii
- General Dynamics, 85  
General Welfare clause, 28, 35–36, 51, 58  
Georgia Tech, 57  
Germany, 3, 8, 66  
Gilbert, Walter, 111, 112  
Gnu, 79  
Golden Decade, 47  
Gore, Al, 39–40, 49, 54  
Government Expenditures on Research and Development (GERD), 14, 16*t*3, 17*t*4, 23–24  
government(s), agents for, 40, 57; pros/cons of funding by, xi, 3–9, 17–24, 44–45; *dirigiste*, 13; encroachment of social life by, xvii; foundations and, 2; inefficiency of, 18, 31; involvement by, 37, 40; policies of, 21; v. private sector, xiii, xvi, 14, 17, 38, 86–87; roles of, 28–32, 63, 68, 72, 97; science and, 68; subsidies by, xi, xviii, 98; universities and, xviii, 34, 74. *See also* laboratories; *specific agencies*; taxes; taxpayers
- Graham, Hugh Davis, 44  
grants, 45, 89, 113; competition and, 22, 23; incentives and, xviii; projects and, 43, 45. *See also* universities  
Great Depression, 12  
Groopman, Jerome, 116–17  
Gross Domestic Product (GDP), 12, 17*t*4, 19, 63  
Gulf War, 44
- Hatch Act, 42  
Hayek, F.A., xiii–xiv, xix  
Hewlett Packard, 71, 74  
HIV (Human Immunodeficiency Virus), 93, 102, 117  
Hollerith, Herman, 73  
Howard Hughes Medical Institute, 114, 117  
HUD, 64  
Humboldt, Wilhelm von, 3
- IBM, 72, 73, 75, 77, 78, 80; ARPANET and, 82–83; funding of, 84, 85  
incentives; for grants in universities, xviii; for private sector, 21; taxes and, 23  
individuals, 114; choices/needs of, xiv, xv, xvii, xx  
industrial revolution, technology and, 4  
industry, 2; in Australia, 6–7, 12; biotechnology and, 114; matching money and, 86; novel, 20–21; support by, 6, 12, 115–16; and technology, 19, 20; telecommunications and, 50. *See also* products  
information technology (IT), 62, 75; Department of Defense and, 62, 79, 80, 81; funding of, 70–71; jobs in, 74; National Science Foundation and, 62  
innovations, 84; economics and, 3, 9, 13; improvement of, 22; prevention of, 42

## 122 / Index

- inquiry, continuum of, 92  
 institutions, private v. public, 43  
 insulin, 108–12  
 Intel, 78, 81, 84, 85  
 Internet, xii, 62, 88; ARPANET and, xiii, 82–84; development of, xiii, 49–50, 81–84. *See also* investment  
 Interstate Commerce clause, 28n2  
 investments, 16–17; Internet and, xiii; policies of, 21. *See also* funding; private sector  
 issues, 20, 103  
 IT. *See* information technology (IT)
- Jefferson, Thomas, 2–3  
 jobs, creation of, 65, 67, 69–70. *See also* information technology (IT)  
 journals, 105, 112  
 JPL (Jet Propulsion Laboratory), 52
- Kealey, Terence, 18–20, 48, 48n24  
 Kilgore, Senator, 45  
 Kornberg, Arthur, 111, 112
- laboratories, defense and nuclear, 13; governmental, 12, 52–53, 54–55, 59, 76; large-scale research and, 51–55. *See also* DOE (Department of Energy); *specific labs*  
 laissez-faire, xvii  
 Lasker, Mary, 117  
 Lawrence Livermore Lab, 52, 53, 54  
 law(s), 53; of funding, 19–20, 21; for patents, 30; of supply and demand, xiii–xiv. *See also* Civil Research and Development; Dollo's Law; Kealey, Terence  
 Lewis and Clark, 2–3, 68  
 libertarian(s), 5; anarchists and, 91; as anarcho-capitalists, 97; classical-liberal perspective of, 29n3; v. conservatives, 27–28; models for growth and self-regulation, xiii; politics of, 29; principles of, 106, 107; think tanks and, 56  
 liberty, human, xx  
 Licklider, J.C.R., 49  
 lobbying, 48  
 Lockheed Martin, 52, 85
- Los Alamos, 53
- Manhattan project, 66, 77  
 market(s); competition and, 42, 85; economics and, xiv, xvii; failure, 5, 6, 7, 12, 18, 22; free, xvii, 19, 27, 86; value, 108, 113, 114, 115  
 Mayo, O., 18  
 McClelland, C., 3  
 MCH (melanin concentrating hormone), 108, 114  
 microprocessors, 78, 81, 84  
 Microsoft, 78, 79–80, 84, 85  
 middleware, 78–79, 84  
 military, xix, 47; technologies in, 43–44, 50, 65, 66, 68–69  
 Mill, John Stuart, 7–8  
 Mises, Ludwig von, xiii–xiv, xix  
 Monash, John, 11  
 monopoly, 85, 87–89  
 Moore, Francis, 117  
 Morrill Act, xi  
 Mosaic, xii
- NASA (National Aeronautics Space Administration), xii, 50–51, 52, 72, 81, 85, 96. *See also* space program  
 National Center for Supercomputing Applications, xii  
 National Institutes of Health (NIH), 64, 67–68, 94, 107, 115; founding of, xii; funding of, 96, 116, 117  
 National Science Board, 65  
 National Science Foundation (NSF); founding of, xii, 45, 67; funding of, 64, 85–86, 96; information technology and, 62  
 National Security Agency, 69  
 nature, and research, 2–3  
 Nelson, R. R., 18  
 Netscape, 78  
 networking, 78, 80, 83  
 networks, computers and, xiii  
*New Atlantis* (Bacon), 2  
 Newman, John Henry, 3  
 Nixon, Richard, 116–17  
 Nobel prizes, 65, 77, 88, 109, 110, 113  
 North American Aviation, 85  
 nuclear weapons, 32, 34, 50, 54, 70, 77

## Index / 123

- Office of Scientific Research and Development, 45, 67  
Oracle, 78, 84  
Organization for Economic Cooperation and Development (OECD), 14, 16, 17*t*4, 21, 23  
*Origins of CSIRO, The* (Currie and Graham), 10–11, 11*n*7  
  
Pasteur, Louis, 10  
patents, 87, 107, 113. *See also* laws  
peace dividend, 48  
physics, xiv, 66, 68, 76  
planning, central, xv, xvii  
police research, xix, 55  
policies; on government investment, 21; public, xviii  
politics, 88; influence of, 37, 39–40, 45–46, 64–65, 116–17; of libertarians, 29; regulation and, 56–57  
pork, federal, 49, 85, 118  
price controls, xiv  
price systems, xiv, xv  
Priestley, Joseph, 18  
principles; of human liberty, xx; of wisdom, 36–41, 54  
priorities; data on, xiv; determination of, xv, xx  
private sector, education and, 8; funding and, 7, 8–9, 17, 19, 86, 95, 101, 108; v. government, xiii, xvi, 14, 17, 38, 86–87; incentives for, 21. *See also* laboratories  
privatization, 31, 37, 38–39, 42  
productivity, 65, 69–70  
products, 108, 113, 115; for defense, 98–99; development of, 92–93, 114, 116; for technology, 106  
profit, 8–9, 28  
projects; funding of, 114, 116; grants and, 43, 45; interdisciplinary, 51–52; large-scale, 51–55; proposals for, 85–86  
proposals, 85–86  
protocols, 106  
public domain, xix  
public health, 98, 99–103, 115  
Public Expenditures on Research and Development (PERD), 14, 16*t*3, 17*t*4  
publication, scientific, 86, 87, 112–13  
qualitative issues, 20  
quantitative rationale, 23  
  
radar, 66, 69  
RAID (reliable array of inexpensive disks), 80  
Reagan, Ronald, 47, 64  
regulation, 55–58  
research, academic, 95–96, 106–7, 113; applied, 92–93, 98, 108–9; biomedical, 92, 114; definition of, 92, 106; diseases and, 114; environmental, 100; health, 41, 70; independent, 58, 94; investment in, 16–17; large-scale, 51–55; limits on, 58; medical, 102; minorities in, 117; motivations for, 4–5, 8–9, 56; nature and, 2–3; nonprofit, 18, 94; police, xix, 55; scientific, xi, 31–32, 33–36, 105; scope of, 27–28; support of, 33; World War II and, 31–32. *See also specific countries*; defense; universities  
research, basic, 40, 41–46, 51, 63; definition of, 92–93, 112; funding of, 116; need for, 98, 118; purpose of, 108–9, 115, 117  
research and development, xi, 65. *See also* expenditures; FFRDCs (Federally Funded Research and Development Centers); expenditures for, xii, 14, 15*t*2, 16*t*3, 66–69, 94–96, 105, 107  
research centers, universities as, 4, 5, 12, 32, 35, 40, 94  
Reserve Officer Training Corps, 34  
resources, misallocation of, xvi  
review, peer, 39, 85, 86, 118  
rights, citizen, 30, 33–34, 42, 98  
Roberts, Larry, 82  
Roosevelt, Franklin, 67  
royalties, 113  
  
salaries, increase in, 113  
Sandia Laboratories, 52  
Sanger, Fred, 109  
SAS Institute, 78  
schools, graduate, 43  
science, xi, 6; agriculture and, 11; basic, 19, 113; defense and, 48; government and, 68; language of, 105; political, 55; technology and, 10. *See also* cargo cult

## 124 / Index

- Science and Engineering Indicators 2000*, 75, 88
- sciences, life/physical, 92, 94, 116
- scientific progress, 68
- scientific research, xi, 31–32, 33–36, 105
- scientists, 53, 54; advisory committee of, 58; training of, 51
- Seagate, 78, 84
- security, national, 47
- sinecures, 37, 38
- Smith, Adam, 2, 4, 85
- Smith-Lever Acts, 42
- social choice, democratic, xvii–xviii
- society; anarcho-capitalists in, 97; determining needs/wants of, xv, xvii, xx
- society, free, xi, xvi, xviii–xix, xx
- software systems, 78–80, 84
- SouthWest Research Institute, 53
- Soviet Union, 32, 46, 47, 48, 50, 54. *See also* nuclear weapons; scientists
- space program, 50–51, 69–70. *See also* NASA (National Aeronautics Space Administration)
- Spencer, Herbert, 18
- Stagnant Decade, 47
- Stanford Research Institute (SRI), 72, 74
- state; commercial enterprise and, 10; funding and, xix, 2, 91–92; minimalist, 97–99, 100, 103, 104; support of education, 3
- storage systems, 78, 80, 84
- Strategic Defense Initiative, 47
- subsidies, xi, xviii, 98
- Sun Microsystems, 79
- supercomputers, 62, 75–78, 88
- system architecture, 78
- System Development Corporation, 71
- System Network Architecture (SNA), 83
- 3Com, 78, 84
- taxes, xiv–xv; incentives and, 23; spending of, xiv–xv, xviii, 17
- taxpayers; education and, 5; funding by, 5, 63, 88, 107; perspective of, xvi; v. private capital, 19
- technologies; commercialization of, 23; improvement of, 32; industrial revolution and, 4; industry and, 19, 20; in military, 43–44, 50, 65, 66, 68–69; PCs and, 62, 77; peaceful, xix; products for, 106; science and, 10
- telecommunications, industry and, 50
- tenure, protection of, xviii
- think tanks, libertarians and, 56
- Todd, J., 9–10
- Truman, Harry, xii, 45
- United States, dominance of, 105–6
- Univac, 73
- universities, 47; economics and, xviii, 44; government and, xviii, 34, 74; grants and, 45; incentives in, xviii; as research centers, 4, 5, 12, 32, 35, 40, 94. *See also* ARPANET; education; Britain; Germany; Golden Decade; projects; research; schools; *specific universities*; Stagnant Decade
- University of California at Berkeley, 71, 72, 80
- Unix, 79
- USDA (Department of Agriculture), 96
- vaccines, 10, 103, 117
- value, short-term, 115
- Veterans Administration Hospitals, 94
- war, 13–14, 31. *See also* defense; *specific wars*
- wealth; distribution of, 104–5; enhancement of, 5, 106; model of, 19; spending of, xiv–xv
- Wealth of Nations, The* (Smith), 2
- welfare, general, defense and, 46; securing of, 37; support of, 42. *See also* General Welfare clause
- Wen Ho Lee incident, 53
- winners, picking, 7, 18, 85
- wizards, 66
- World War II, xi, xii, 12, 66–69; research and, 31–32, 41–42, 43–44
- World Wide Web, xii, 62, 83, 88