

R&D in Industry

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HIGHLIGHTS

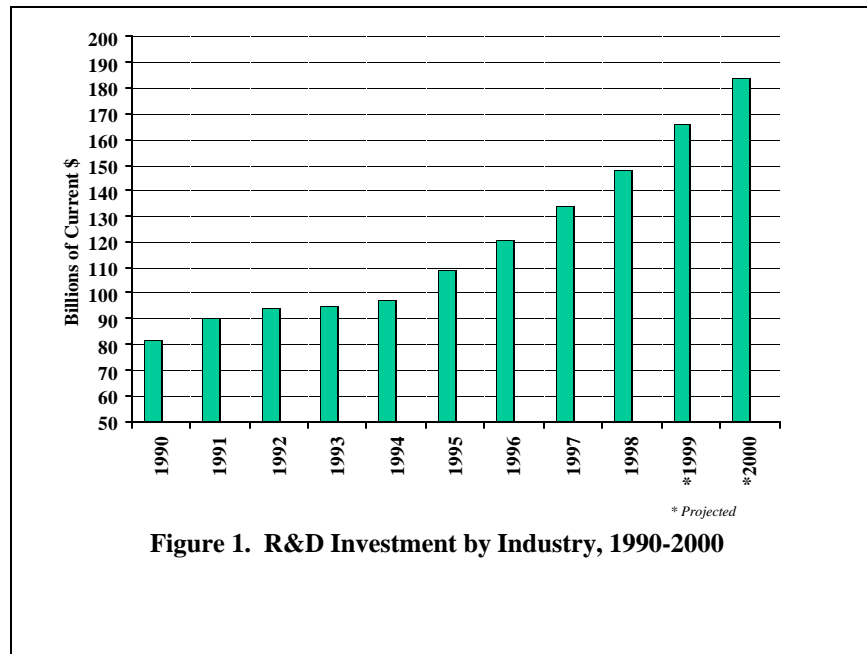
- Industrial R&D investment in the United States has been increasing at double-digit levels over the past five years; this pattern is expected to continue through 2000 and beyond.
- Growth rates for applied research and directed basic research in industry over the past five years have been higher than that for development.
- Industry support of university research is also growing at double-digit annual levels; this pattern is also expected to continue.
- R&D carried out by industrial firms in other countries is expanding rapidly, to customize products for local markets and to seek knowledge not otherwise available.
- Venture capital virtually exploded in 1999, rising over 150 percent from 1998 and an order of magnitude higher than it was just four years before.

INTRODUCTION

This chapter covers R&D investment by U.S. industry in recent years, indicates projections for industrial R&D investment during 2000, describes some of the recent trends in globalization and venture capital, and summarizes results of the Industrial Research Institute's (IRI) annual R&D trends forecast for 2000.

R&D INVESTMENT

R&D investment by industry extended its healthy growth rate in 1999, making it the fifth consecutive year with increases at or above double-digit levels. The increase estimated for 1999 by the National Science Foundation's (NSF) Science Resources Studies Division was 12 percent, bringing industry's R&D funding to \$166 billion. IRI's trends forecast for 2000 indicates that the recent growth will continue, but perhaps at a slower rate, which is supported by Battelle Memorial Institute's forecast that industry's funding will rise 10.5 percent, to \$184 billion this year. The growth of R&D investment by industry since 1990 is shown in Figure 1. Year-to-year percentage changes are shown in Figure 2, indicating that 1993 was a significant turning point for industrial R&D investment in the U.S. It is expected that the recent strong growth will continue into 2001 and beyond. (For a discussion of industrial R&D in the context of total U.S. R&D, please see Chapter 1 and Tables I-11 through I-14.)



Including government funding (*i.e.*, from the Department of Defense, Department of Energy, the National Aeronautics and Space Administration, the National Institutes of Health and others) of industrial

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R&D with industry's own funding of R&D, Battelle indicates that total industry performance of R&D will be \$205 billion in 2000. Government-funded R&D in industry is expected to decrease slightly, continuing the downward trend seen since 1988. Thus, industry will *fund* over 70 percent and will *perform* more than 77 percent of the total of \$266 billion that Battelle estimates will be spent on R&D in the U.S. during 2000. The \$205 billion of R&D that U.S. industry will perform this year represents over one-third of the entire world's R&D effort.

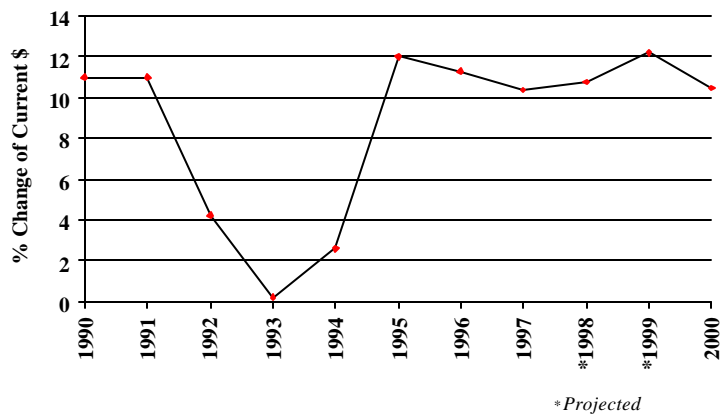


Figure 2. Change in R&D Investment by Industry, 1990-2000

NSF data for the past five years, presented in Table 1, show aggregate investment in R&D by industry grew at double-digit levels each year, with a cumulative increase of 71 percent. The fastest rising component of this growth was not development, as one might expect, but applied research, which increased 91 percent in the period, followed by basic research, which rose 79 percent. Development was the slowest-growing segment, rising only 65 percent. Thus, the trend indicates a renewed emphasis on research, particularly applied research, in industry.

Industry support of university research has likewise been strong, growing from \$1.45 billion in 1994 to \$2.16 billion in 1999, an annual increase of

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nearly 10 percent. Industry's support of research in universities as a fraction of the total academic effort grew from 6.7 percent to 7.6 percent over this period. The increase is not dramatic, but projections show continued growth of this funding by industry, particularly important in establishing closer links for the transfer of people and ideas between industry and universities.

Table 1.
Allocation of Funds for Industrial R&D by Category, 1994-1999
(billions of current \$)

Category	1994	1995	1996	1997	1998	1999*	% Chg. 94-99
Basic Research	6.08	5.38	6.85	8.77	9.71	10.89	79.1
Applied Research	19.37	23.76	25.37	29.78	33.00	36.9	91.0
Development	71.68	79.52	88.80	95.06	105.33	118.09	64.7
Total R&D	97.13	108.66	121.02	133.61	148.04	165.96	70.9

Source: National Science Foundation

*Preliminary data

GLOBALIZATION OF R&D

R&D investment in other countries by U.S.-based companies is also increasing at a healthy pace. Globalization of R&D has followed the globalization of markets, and is essential for customizing products to meet local demands as well as gaining new knowledge and effectively utilizing cultural differences. Thus, the question is not when or why, but how best to organize and conduct R&D in other countries in concert with one's domestic R&D efforts. According to a recent Arthur D. Little survey of chief technology officers, globalization is one of the highest priorities on their agenda. This finding is not a surprise given that a Council on Competitiveness survey of CEOs two years ago indicated that globalization was their number one challenge.

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In an update of their study on “Globalizing Industrial Research and Development,” the Office of Technology Policy at the U.S. Department of Commerce (DOC) reported last year that R&D investments in other countries by both foreign-owned and U.S. companies approximately tripled from 1987 to 1997. Foreign-owned companies spent \$19.7 billion on R&D in the U.S. in 1997, up from \$6.5 billion in 1987 and \$14.6 billion in 1993. This work was conducted in 715 R&D laboratories owned by 375 foreign firms. Japanese companies had the highest number of these labs, with 251, followed by German companies with 107 and French companies with 44.

Over 80 U.S.-based companies invested \$14.1 billion on R&D in other countries during 1997, up from \$5.2 billion in 1987 and \$9.6 billion in 1993. These companies had more than 200 R&D labs, primarily in Europe (88), Japan (45), and Canada (26). The DOC report concluded that this acceleration of industry investment in global R&D shows that firms believe they need a presence in foreign markets if they are to grow. To be effective in these markets, they also need to benchmark themselves against the best performers in the world. Globalization of R&D is an excellent way for firms to utilize the world’s growing stock of resources and knowledge, and to support business growth.

VENTURE CAPITAL

The availability of venture capital for individual entrepreneurs and small firms has been one of the driving forces in our current record-breaking economic expansion. Funding sources have traditionally been partnerships or individuals that invest funds for themselves and colleagues. Passage of the Small Business Innovation Research (SBIR) Act by Congress in 1982 brought 11 government departments and agencies into the process. That program still continues, with the major R&D funding agencies required to set aside 2.5 percent of their extramural R&D budgets for funding of R&D, including proposal preparation and concept development, performed by small businesses.

A relatively new source of venture capital is large firms, such as Microsoft, AT&T, Lucent, Texas Instruments, Intel, and numerous others. Corporate venture funding is now seen as a necessity in many companies’ quest for growth. Their investment in start-ups is also viewed

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as a type of external research. According to the National Venture Capital Association, venture capital soared to \$48.3 billion in 1999, up from \$19.2 billion the year before and nearly 10 times the level just four years before. Internet-related companies led the way with \$31.9 billion, primarily in northern California and the northeastern U.S., although every region in the country experienced at least 60 percent growth in venture funding.

2000 FORECAST

IRI's annual trends forecast for industrial R&D in 2000,¹ based on replies from 90 IRI member companies during August and September 1999, indicates continued growth for industrial R&D in the U.S. Seventy-nine percent of respondents planned increases in R&D during 2000, up slightly from the 75 percent expecting increases for 1999. Consistent with these data, 78 percent expected their R&D capital spending to increase in 2000, versus the 75 percent expecting increases the year before. About 79 percent expected R&D professional staffing to increase and 81 percent planned increased hiring of new graduates in 2000. IRI's forecast also indicates a continued high level of attention to R&D by top management and a continuing strong commitment to participation in alliance and joint R&D ventures.

CONCLUSIONS

R&D investment by industry will reach some \$184 billion in 2000, extending for six years the significant increases first seen in 1995. Particularly notable has been in the growth of research, especially applied research, but also directed basic research. This growth is leveraged by continued increases in industry support of university research. Industrial R&D is also globalizing rapidly, following strong increases in foreign sales. But the newest emerging trend is the huge surge in venture capital last year, to nearly \$50 billion. As long as global sales and profits continue to grow, industrial R&D in the U.S. is expected to remain on an upward trend in the coming years.

¹ Industrial Research Institute's Annual R&D Trends Survey for 2000, RESEARCH·TECHNOLOGY MANAGEMENT, January-February 2000, pp. 11-15.