**Research and Development: What's Connecticut Got to Do with It?**

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## R&D: An Overview

Research is performed everyday by many people, which includes investigating an issue until the situation is better understood.[1] Scientific research involves experimentation in order to discover, interpret or revise facts and theories. The research leads to additional knowledge in the subject matter. There are two types of research:

- **Basic research** is a methodical study that leads to additional understanding of fundamental aspects of observable facts without first having specific applications toward new processes or products in mind.
- **Applied research** is an orderly study to obtain knowledge to meet the demand of a specific need.[2]

After research is conducted, development can occur. Development is the methodical application of the research applied toward the production of "materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements."[3] Research and development (R&D) are critical components of many organizations, because successful R&D leads to new products and processes that can improve quality of life and perhaps be profitable.

## Benchmarking Connecticut's R&D Performance

CERC's report *Benchmarking Connecticut 2007: A Comparative Analysis of Innovation and Technology* compares Connecticut to all states in metrics related to technology, finance, human capital, global links and entrepreneurial and business vitality. It was found, as seen in the chart below of business vitality metrics, that Connecticut ranks extremely high with R&D performed by the industry sector in terms of concentration and growth. However, Connecticut's R&D performed by universities and colleges ranks are

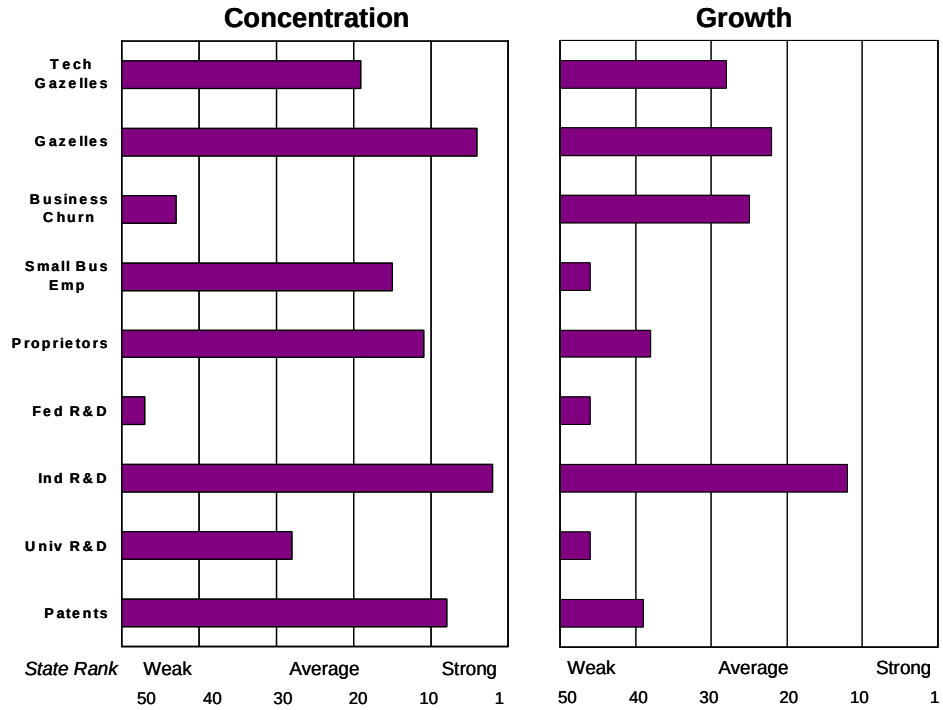
[1] http://www.merriam-webster.com/dictionary/research
[2] http://www.nsf.gov/statistics/nsf07332/content.cfm?pub_id=3798&id=1
[3] Ibid.

below average and the State's relative standing in R&D performed by the federal government sector is poor.

In 2004, Connecticut performed almost $30 million of the $21.4 billion federal R&D in the U.S., which was just 0.02 percent of the state's GSP. Connecticut's ratio of federal R&D to GSP was the 4th lowest in the nation. Connecticut's average growth rate was about -5.1 percent per year. In 1993, Connecticut's R&D level was just under $53 million, and in 2004 was $23 million less (in nominal dollars).

Connecticut performed more than $7.1 billion in industry R&D in 2004. This represented 3.8 percent of the state's GSP, which gave Connecticut the rank of 2nd. Industry R&D expenditures in Connecticut are stronger than the Northeastern states and the U.S. Michigan tops the list, with an industry R&D intensity of 4.1 percent. Connecticut's average growth rate was more than 10.5 percent per year, placing Connecticut 12th for the growth aspect of this variable.

**Connecticut's Entrepreneurial and Business Vitality Ranks: 2007**[4]




***CT Composite Rank*: Concentration: 9 Growth: 43**

[4] www.cerc.com/benchmarks

As a share of GSP, university R&D in Connecticut in 2004 was 0.35 percent, which approximates the nation's ratio of 0.34 percent. However, in terms of growth, Connecticut falls behind the pack. The state's average annual growth rate of 5.9 percent was considerably lower than the U.S. average of 7.7 percent, and the 5th lowest state rate in the country.

The *Benchmarking Connecticut* report uncovered some interesting findings. Let's delve deeper to better understand the R&D trends in Connecticut.

**A Closer Look at Connecticut's R&D Trends**

The table below presents information on R&D funding in Connecticut since 1987 (in millions of current dollars). Data for 2005 has been released since the publication of the *Benchmarking Connecticut* report, so it is included in the table below. The top row label shows the sector that is ***performing*** the R&D,[5] and the second row label shows the sector providing the ***funding***. This chart describes what type of organization performs the R&D and from where it receives funding.

**Distribution of Connecticut R&D Expenditures by Performing Sector and Funding Source[6]**

| Performing: | Total R&D | Fed. govt | Industry | | | Universities & colleges | | | | | | U&C FFRDCs | Other nonprofits | Nonprofit FFRDCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Funding: | Total R&D | Fed. govt | Total | Fed. govt | Industry | Total | Fed. govt | Nonfed. govt | Industry | U&C | Non-profits | Fed. govt | Fed. govt | Fed. govt |
| Year | Millions of current dollars | | | | | | | | | | | | | |
| 1987 | 2,471 | 18 | 2,216 | 632 | 1,584 | 231 | 156 | 2 | 9 | 40 | 24 | 0 | 7 | 0 |
| 1989 | 2,745 | 38 | 2,410 | 680 | 1,730 | 284 | 187 | 5 | 12 | 57 | 23 | 0 | 13 | 0 |
| 1991 | 1,917 | 47 | 1,535 | 504 | 1,031 | 321 | 197 | 6 | 16 | 74 | 28 | 0 | 15 | 0 |
| 1993 | 2,809 | 53 | 2,373 | 419 | 1,954 | 365 | 221 | 10 | 18 | 81 | 35 | 0 | 18 | 0 |
| 1995 | 4,311 | 18 | 3,906 | 389 | 3,517 | 377 | 228 | 19 | 20 | 78 | 32 | 0 | 10 | 0 |
| 1997 | 3,454 | 33 | 3,014 | 307 | 2,707 | 393 | 242 | 14 | 25 | 76 | 35 | 0 | 15 | 0 |
| 1998 | 3,559 | 18 | 3,113 | 179 | 2,935 | 404 | 262 | 13 | 26 | 67 | 35 | 0 | 24 | 0 |
| 1999 | 4,436 | 18 | 3,984 | 207 | 3,777 | 418 | 274 | 11 | 26 | 67 | 40 | 0 | 16 | 0 |
| 2000 | 4,888 | 19 | 4,371 | 127 | 4,244 | 468 | 304 | 16 | 28 | 75 | 46 | 0 | 30 | 0 |
| 2003 | 6,548 | 96 | 5,834 | 852 | 4,982 | 595 | 418 | 9 | 28 | 71 | 68 | 0 | 24 | 0 |
| 2004 | 7,881 | 30 | 7,177 | 1,717 | 5,460 | 650 | 469 | 7 | 25 | 82 | 67 | 0 | 25 | 0 |
| 2005 | 8,987 | 393 | 7,885 | 1,443 | 6,442 | 669 | 477 | 8 | 29 | 85 | 71 | 0 | 40 | 0 |

Federally funded R&D performed by the federal government has been low relative to the other performers in Connecticut since 1987. However, in 2005 the funding increased by

[5] The *Benchmarking Connecticut* data provides detail on the performing sectors.
[6] http://www.nsf.gov/statistics/natlpatterns/

10 times the 2004 level. Please note, the federally funded R&D performed by industry decreased by about the same amount as the increase in the federally funded R&D performed by the federal government. The total amount of federally funded R&D in the state has stayed about the same, but the performer has changed.

What federal units are performing R&D in Connecticut? The Connecticut Center for Advanced Technology in East Hartford receives federal funding for research, in addition to the services they provide to entrepreneurs.[7] East Hartford houses the Department of Interior's Connecticut District Office of Water Resources, which conducts research on surface and groundwater resources. Groton is the location of the Department of Defense Naval Submarine Medical Research Laboratory and the Department of Transportation U.S. Coast Guard R&D Center. Hamden has the U.S. Department of Agriculture's Northeastern Center for Forest Health Research, which performs research on the impact of insects. A Department of Commerce (DOC) Laboratory is located in Milford, which is a unit of the Northeast Fisheries Science Center, part of the DOC National Oceanic and Atmospheric Administration. West Haven houses a Department of Veterans Affairs R&D unit. In addition to administering medical care to veterans, this unit performs R&D related to psychiatry, alcoholism, drug abuse, posttraumatic stress disorders and emission-computed tomography.[8]

Turning to the largest performing sector in Connecticut, more than $7.8 billion of Industry R&D was performed in Connecticut in 2005, with most being funded by industry. Universities and colleges have seen some increases, with most of their funding coming from the federal government. Connecticut does not have any Federally Funded R&D Centers (FFRDC), which is why zero dollars were spent.

The next table shows funding for industry R&D in Connecticut in 2005. Of the $7.8 billion in funding, more than $3.8 billion, or just about half of the total, was spent in the Pharmaceuticals and Medicines industry.

[7] Connecticut Center for Advanced Technology
[8] RAND Corporation, 2000, http://rand.org/pubs/monograph_reports/MR1194/MR1194.chap7.pdf

**Funds for Industrial R&D performed in Connecticut, by Industry: 2005**[9]

| Industry - 2005 | CT Industry R&D^ |
|---|---|
| All industries | 7,885 |
| **Manufacturing industries** | 7,166 |
| Food | 184 |
| Beverage & tobacco products | D |
| Textiles, apparel & leather | 4 |
| Wood products | * |
| Paper, printing & support activities | D |
| Petroleum & coal products | * |
| Chemicals | 3,967 |
| Basic chemicals | D |
| Resin, synthetic rubber, fibers & filament | D |
| Pharmaceuticals & medicines | 3,824 |
| Other chemicals | 68 |
| Plastics & rubber products | 29 |
| Nonmetallic mineral products | 3 |
| Primary metals | 8 |
| Fabricated metal products | D |
| Machinery | 262 |
| Computer & electronic products | 278 |
| Computers & peripheral equipment | 5 |
| Communications equipment | 57 |
| Semiconductor & electronic components | 116 |
| Navigational, measuring, control instruments | 98 |
| Other computer & electronic products | 2 |
| Electrical equip, appliances & components | D |
| Transportation equipment | D |
| Motor vehicles, trailers & parts | 9 |
| Aerospace products & parts | D |
| Other transportation equipment | D |
| Furniture & related products | 1 |
| Miscellaneous manufacturing | 31 |
| Medical equipment & supplies | 21 |
| Other miscellaneous manufacturing | 9 |

| Industry - 2005 | CT Industry R&D^ |
|---|---|
| | |
| **Non-manufacturing industries** | 719 |
| Mining, extraction & support activities | D |
| Utilities | 1 |
| Construction | D |
| Wholesale trade | 32 |
| Retail trade | 3 |
| Transportation & warehousing | * |
| Information | 81 |
| Publishing | 54 |
| Newspaper, periodical, book & directory | 1 |
| Software | 53 |
| Telecommunications | 1 |
| Wired & wireless telecom carriers | * |
| Satellite telecommunications | * |
| Other telecommunications | * |
| ISPs, web search portals, data processing | 26 |
| ISPs & web search portals | 3 |
| Data processing, hosting & related svcs | 24 |
| Other information | * |
| Finance, insurance, & real estate | 76 |
| Professional, scientific & technical services | 471 |
| Architectural, engineering & related services | 41 |
| Computer systems design & related services | 134 |
| Scientific R&D services | 272 |
| Other professional, scientific & tech svcs | 24 |
| Health care services | 1 |
| Other non-manufacturing | 14 |

* : amount < $500,000
D : suppressed to avoid disclosure of confidential information
^ : millions of dollars

Next, let's turn to federal R&D funds. The next table shows the amount of federal R&D funding in Connecticut by the 11 agencies required to report information. The Department of Defense funds most of the federal R&D in Connecticut, and the R&D is primarily performed by the industry sector. Most of the universities and colleges in the state are receiving federal funds from the Department of Health and Human Services.

[9] NSF/Division of Science Resources Statistics, Survey of Industrial Research and Development: 2005

**Federal Obligations for R&D in Connecticut by Selected Agency and Performer: FY 2005**[10]

| State and agency | Total R&D | Intra-mural[a] | Extramural | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Industry | Industry FFRDC | Universities and colleges | University FFRDC | Other nonprofits | Nonprofit FFRDC | State, local govts |
| Connecticut | 2,153,517 | 392,637 | 1,221,870 | 0 | 491,628 | 0 | 40,196 | 0 | 7,186 |
| Department of Agriculture | 9,741 | 3,559 | 15 | 0 | 5,197 | 0 | 0 | 0 | 970 |
| Department of Commerce | 7,285 | 423 | 1,610 | 0 | 4,467 | 0 | 20 | 0 | 765 |
| Department of Defense, research | 62,021 | 164 | 25,707 | 0 | 13,567 | 0 | 22,583 | 0 | 0 |
| Department of Defense, total devel. | 1,517,033 | 375,185 | 1,128,849 | 0 | 11,826 | 0 | 1,173 | 0 | 0 |
| Department of Energy | 37,737 | 0 | 25,769 | 0 | 11,004 | 0 | 964 | 0 | 0 |
| Department of Health and Human Svcs | 440,163 | 119 | 20,575 | 0 | 399,016 | 0 | 15,288 | 0 | 5,165 |
| Department of Homeland Security | 15,892 | 12,054 | 3,838 | 0 | 0 | 0 | 0 | 0 | 0 |
| Department of the Interior | 1,444 | 1,133 | 0 | 0 | 158 | 0 | 0 | 0 | 153 |
| Department of Transportation | 16 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 |
| Environmental Protection Agency | 2,755 | 0 | 70 | 0 | 2,605 | 0 | 0 | 0 | 80 |
| National Aeronautics and Space Admin | 19,714 | 0 | 14,615 | 0 | 5,046 | 0 | 0 | 0 | 53 |
| National Science Foundation | 39,716 | 0 | 806 | 0 | 38,742 | 0 | 168 | 0 | 0 |

[a] Includes costs of administration of intramural and extramural programs by federal personnel

## Conclusion

Industry R&D is a strength in Connecticut and has been for some time, particularly in the Pharmaceuticals industry. Without federal laboratories in the state, Connecticut does not perform as much federal R&D as other states, but many states do not have federal laboratories and continue to grow in this area. However, some federal R&D is taking place in the state. And in terms of federal funding, Connecticut is above-average relative to the other states.[11] Connecticut's federal funding is primarily performed by the industry sector instead of the federal sector. Growth in R&D performed by universities and colleges is not very strong either. Policies that focus on strengthening R&D performed by higher education institutions would benefit the state, because an area that is rich in research and applying knowledge to new processes and products eventually leads to new businesses and jobs.

[10] NSF/Division of Science Resources Statistics, Survey of Federal Funds for Research and Development: FY 2005, 2006, and 2007.
[11] http://masstech.org/institute/the_index.htm