Office of Technology Policy

The Dynamics of Technology-based Economic Development

State Science and Technology Indicators

Third Edition
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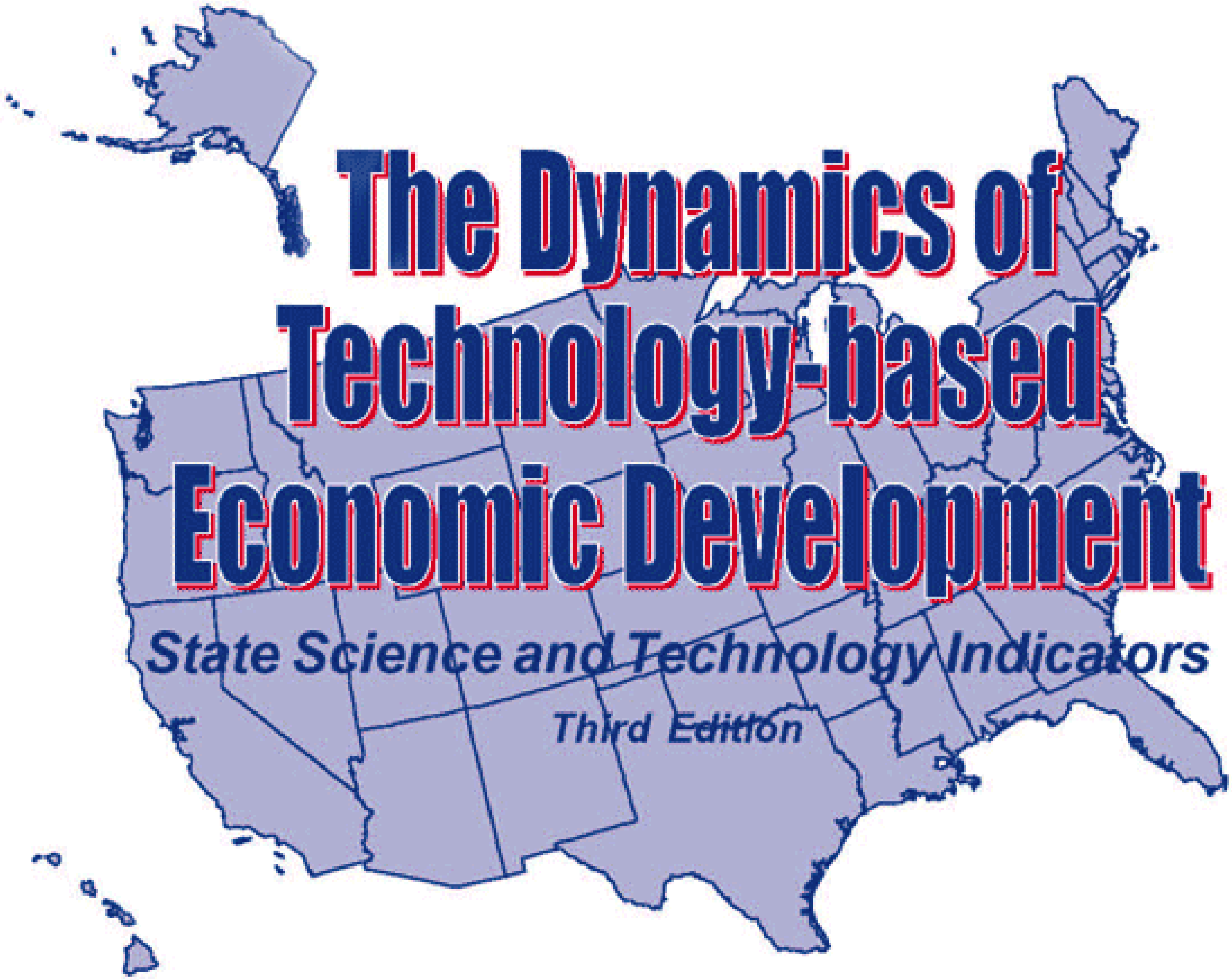

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Prepared for

Office of Technology Policy

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Foreword

Technology innovation and commercialization are the new drivers of economic growth, both in the U.S. and around the world. Our ability to create new technologies and harness their power will directly impact our national prosperity, security and global influence. Technology development is also essential to improving the quality of life, economic vitality and standard of living of communities throughout our nation.

To participate more fully in the Innovation Age, many regions, states and localities are developing specific strategies and approaches that leverage their existing strengths through focused integration of technology. Policy and planning decisions made at the state and local level play a critical role in establishing the environment necessary for innovation, job growth, and enhanced productivity and competitiveness.

As state business and government leaders attempt to fashion appropriate economic development strategies, many try first to measure and understand their existing science and technology assets and strengths. In response to state and regional requests for assistance in identifying a set of innovation factors that can be leveraged for sustainable growth, OTP has produced its third edition of the *Dynamics of Technology-based Economic Growth; Science and Technology Indicators*. This report is not only an updated collection of metrics approximating the technology infrastructure of states, but contains a more accurate definition of high technology that reflects the importance of high tech services, such as those related to systems design, data processing, software development, and telecommunications.

We hope the metrics and data in this tool will continue to help policy makers and regional leaders better understand the factors that may contribute to improvements in state competitiveness and performance, and we'd welcome feedback on ways to make it even more useful. We look forward to partnering with leaders around the nation as they seek to harness and transform their assets into economic growth and prosperity.

Bruce P. Mehlman
Assistant Secretary for Technology Policy

Preface

This report, *The Dynamics of Technology-based Economic Development*, is a third, and an improved, edition of a well-appreciated reference guide to factors that influence regional innovation and competitiveness. While there are other sources for many of the metrics contained herein, this third edition, like its predecessors, provides a consistent set of state-level data that approximates the technology infrastructure of states.

The report continues to provide the user with a reference guide. It does not attempt to take a "report card" approach or interpret the implications of the data sets for each state. OTP believes that the appropriate interpretation and application of this data remain the responsibility of those familiar with the special circumstances affecting their states. In pursuit of their respective goals and aware of their unique challenges, states will likely identify different targets for any given metric and may attempt to reach their goals by different strategies.

A change in this edition that deserves special note is the definition of high-technology industries. The previous editions relied on a definition of "high technology" that adhered to criteria based on Standard Industrial Classification (SIC) codes published by the Bureau of Labor Statistics (BLS) in 1999. This edition, consistent with new federal data acquisition procedures, uses a definition based on the North American Industry Classification System (NAICS) codes. The report's revised high tech definition represents a significant improvement in that it is based on a larger number of codes related to information technology industries, particularly those related to systems design, data processing, and software. It also incorporates more numerous and broader codes pertaining to rapidly growing industries such as communications, audio and video equipment, and computers.

OTP hopes this product continues to be a useful reference guide for those in the public and private sector who are concerned with regional innovation and competitiveness. In response to continued demand, OTP has begun work on the fourth edition that will include a new section with longitudinal data to track changes in selected state input and output metrics over an extended period of time (e.g. five years). The purpose of this new section will be to help users discern patterns or longer-term changes in state innovation capacity and achievements. The result will provide a more comprehensive view of how state performance changes in those select factors may be contributing to improvements in state competitiveness and economic performance.

As always, we welcome your comments to help us assess the value and quality of our publications and to assist us in providing improved products. If you wish to share your comments, please visit our website at http://www.ta.doc.gov/ or e-mail us at otptech@ta.doc.gov.

Acknowledgments

The contributions of the many individuals who helped to shape this project deserve to be recognized and acknowledged.

First, this project would not have been possible without the support and guidance of Mr. Jon Paugh. Jon served as Director of Technology Competitiveness, Office of Technology Policy, Technology Administration until his death in late 2001. He understood and appreciated the need for a set of tools to assist those involved in technology-based economic development at the state level. Jon constantly challenged us to provide the highest quality information in an easy-to-use format and to be flexible in terms of presenting the data more effectively. His influence, which permeated the earlier editions of this publication, persists through this third edition.

The day-to-day operational issues associated with this project were managed by the Project Technical Officer, Mr. Douglas Devereaux. Doug led the efforts to obtain data and convert it into meaningful metrics that were focused on technology-based economic development. He coordinated the Steering Committee activities and resolved the numerous issues that arose during the course of this project. Doug's tenacity, hard work, and ability to achieve consensus have contributed greatly to this work product. Doug has been designated as the contact point for any questions related to this report.

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The production of this report was facilitated by members of the Steering Committee who made many valuable contributions throughout the entire course of this project. Their suggestions, comments, and contacts greatly improved the quality and presentation of the final product. The individuals who participated in this capacity were:

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In addition to the contributions from the Steering Committee members, valuable suggestions were received from Dr. Lee Price, Deputy Under Secretary for Economic Affairs, Economics and Statistics Administration. Dr. Price reviewed many of the early drafts and helped to focus attention on the meaningful presentation of the data. We are grateful for his suggestions.

This report and its contents were developed by Taratec Corporation, 1251 Dublin Road, Columbus, OH 43215 under Contract Number SB1359-01-8-0921. Individual members of the contractor team who made significant contributions included: Dr. Paula Dunnigan, who served as the Project Manager; Mr. John Griffin, who provided strategic guidance and review; Mr. Greg Palovchik, who was responsible for data acquisition, computation, and presentation; and Ms. Jill Mullins-Cape, who designed and formatted the final report.

Introduction

1.1 Background

Science and technology (S&T) policies and programs have become an integral part of the economic development plans of most states. As businesses seek sustainable competitive advantages, S&T resources have proven to be powerful assets. All forms of economic development benefit from well-conceived and executed programs to strengthen and expand the S&T resources of a state. New business formation flows directly from research, development, and commercialization of new technologies. Business attraction of industrial clusters is advanced by creating unique competitive advantages rooted in the S&T institutions of a state. Business expansion will accelerate as companies adopt and adapt new technologies to improve the competitiveness of their products and processes. And finally, business retention is increased as companies are able to solve competitiveness problems through the application of technology and the expertise of their state's S&T community.

Perhaps more importantly, S&T can build sustainable competitive advantage, not artificial advantages associated with incentives and subsidies. Application of advanced technologies can provide a company with fundamental methods of improving its quality, its product and service functionality, and its cost competitiveness. S&T programs impact the very heart of a company — its products and production processes — not just adjust its bottom line through artificial cost savings.

S&T also builds for the future. Investments made in strengthening the research base in a state will attract further research and development (R&D) investments by both the private and public sector. This growing research capability can result in new knowledge creation, intellectual property development, human resource development and retention, and expert advisors to assist companies and entrepreneurs. The importance of S&T has been recognized for several decades as a potent tool for public policy. Pennsylvania's Ben Franklin Program and Ohio's Thomas Edison Program are now approaching 20 years of operation and are still viewed as keystone programs in their respective states. Both of these programs helped bring their states out of the "rust belt" syndrome of the early 1970s. Most other states have followed suit with programs that support state economic development through creation of specialized centers of S&T excellence.

The successful impact on economic development and the sustainable power of S&T is evident in various places in the United States. In addition to the obvious locations such as Boston, Silicon Valley, Raleigh-Durham, and Austin, we now find pockets of S&T-based economic development exploding in Minneapolis, Seattle, Boulder, and Salt Lake City. Interestingly, all these areas have strong concentrations of S&T resources including research universities and private sector research centers. Federal facilities, such as the National Institutes of Health in Bethesda, Maryland, also have served as catalysts for business growth. These communities demonstrate that S&T-based businesses exhibit the tendency to cluster in areas that have strong technology assets and infrastructure.

It is evident that not all states and communities have equally well-developed S&T infrastructures. There is wide disparity in research funding, facilities, and expertise among the states. The relationship between measures of economic prosperity and S&T capacity is intuitive. Such relationships have led to public policies to support economic development through S&T investments.

1.2 Methodology

1.2.1 Project Objectives

The goal of this project is to present a selection of indicators related to the technology-based economic development conditions in all 50 states. This publication represents the third edition resulting from this effort. It is built upon the feedback and suggestions that were received regarding the first edition that was published in June 2000, and the second edition published in October 2001.

The metrics in this benchmarking exercise were selected so as to be timely, credible, and capable of being updated through publicly available data sources. A number of metrics from the first edition have been dropped while new metrics have been added as additional data sources were identified. More specifically, the project objectives were:

- To select a series of metrics that describe the status of science and technology (S&T) assets in states
- To select a series of metrics that describe "high-technology" economic development outcomes
- To develop consistent data sets of publicly available data that quantify the metrics for each state
- To describe each metric, characterize its relevancy to S&T-based economic development, and report the data and rankings for all states
- To present the results for each state

This project is intended to present up-to-date information about the status of an individual state's S&T infrastructure in an easy-to-use format. By providing each state with comparable data for other states, areas of weakness can be identified and appropriate responses formulated by individual states in a manner that seems most appropriate to them.

It is not the intent of this project to take a report card approach and to grade individual states by an arbitrary standard. Since states choose to pursue different economic development goals and attempt to reach those goals by different routes, it is not appropriate to apply weighting factors or devise a formula for calculating overall effectiveness. Certain data and metrics in this report may be more relevant to some states than to others. The state rankings for certain metrics may be impacted by special factors, unique to only a few states, that have nothing to do with S&T infrastructure. Appropriate interpretation and application of the data in this report must be the responsibility of the citizens, elected officials, and state employees who are familiar with the special circumstances affecting their states.

1.2.2 Project Organization

This project was carried out using a team approach. Members of the team included:

- The Project Manager, Mr. Douglas Devereaux, from Technology Administration
- A Steering Committee consisting of members from various sectors of the U.S. Department of Commerce, the National Science Foundation, and the Federal Reserve Board of Governors
- The contractor, Taratec Corporation, from Columbus, Ohio

1.2.3 Project Work Plan

The initial project task was to identify appropriate data and data sources that could be used to characterize the S&T infrastructure of individual states. Working collaboratively, the team generated lists of potential candidate measures for consideration. Each of the candidate measures was investigated by the contractor, who assessed the quality, consistency, and extent of coverage of the data. Based on these factors, the team selected a total of 37 measures — 22 input measures and 15 output measures — for further refinement. There were some changes in the metrics used between the second and third editions of this publication.

The S&T-stimulating input measures fell into three main categories:

- Funding In-Flows
- Human Resources
- Capital Investment and Business Assistance

The outcome data categories were focused on:

- High-technology Intensity of the State's Business Base
- Other Outcome Measures (patents, fast-growing companies, earnings, and work force employment).

Each of the measures was converted to a metric by minimizing its scale sensitivity. The team recognized that scale differences in the data or measures between states could bias any ranking in favor of the larger states. For instance, the size of the civilian work force differs by more than 60-fold and the size of the total business establishment payroll by more than 100-fold when the states are directly compared. To account for these differences in scale, the data from each of the measures were converted to a quotient that reflected the intensity of that measure on the state's business base or its impact on the state's economy. To the extent possible, scale sensitivity has been minimized in the final set of metrics and in the state rankings.

This attempt to reduce scale sensitivity meant that some compromises were necessary in selecting the year of the data used in the numerator and denominator. The most recent data available were always used in the numerator. Whenever possible, the year of data used in the denominator of each metric was selected to be as close as possible to the year of the data used in the numerator. In some cases, this meant using the middle year in the denominator when a 3-year average was used in the numerator. In other cases, it meant using the latest data available in the denominator, even though the year of that data was prior to the year of the data used in the numerator.

A second area of metric definition deserving special note involves the definition of high-technology industries. For the second edition, the project team began with the list of high-technology SIC codes that was identified by the Bureau of Labor Statistics (BLS) in 1999[1] and is based on measures of industry employment in both R&D and technology-oriented occupations. BLS used Occupational Employment Statistics surveys from 1993, 1994,and 1995 in which employers were asked to explicitly designate workers who were actually engaged in R&D activity. The researchers identified 31 three-digit "R&D intensive" industries in which the number of R&D workers and technology-oriented occupations accounted for a proportion of employment that was at least twice the average for all industries surveyed. These industries had at least 6 R&D workers per thousand workers and 76 technology-oriented workers per thousand workers. The 31 three-digit SIC codes that comprised the BLS list of high-technology industries consisted of 27 manufacturing industries and 4 service industries. The team felt that there was value in beginning with a list that resulted from a documented selection process, was broadly known and used, and originated from a government source. Adhering to these criteria provided assurances that the list of high-technology SIC codes was not selected in a manner calculated to provide advantage to a particular state or region of the country, nor did it reflect the biases or the agenda of any particular group.

During the time interval between the research that was done to develop the BLS list and the present, federal data acquisition has completed a transition from SIC codes to North American Industry Classification System (NAICS) codes. Data from the Bureau of Census is now being reported in terms of NAICS codes. This has had a direct impact on the metrics associated with "high-technology industries" since the SIC codes from the BLS list are no longer searchable. To address this need, Mr. Carl Shepherd from the Office of Technology Policy with assistance from the Bureau of Census, converted the BLS list of SIC codes into NAICS codes using the concordance between the two classification systems. Judgement was required because this was not a simple renumbering process but involved splitting and/or combining codes. Allowances had to be made to account for partial categories. The resulting list of high-technology NAICS codes developed by Mr. Shepherd includes a total of 39 codes that range from four to six digits. Twenty-nine of these codes apply to manufacturing industries and ten represent service industries. The following table identifies the NAICS codes that have been included in the definition of "high-technology industries" that has been used in this edition.

The list of NAICS codes differs from the original BLS list of SIC codes in that it contains a larger number of codes related to information technology industries, particularly those related to systems design, data processing, and software. Also, there are more numerous and broader codes pertaining to rapidly growing industries such as communications, audio and video equipment, and computers.

After the metric definition step was completed, the data were gathered electronically and transferred to appropriate spreadsheet software. Data gathering for

[1] Hecker, Daniel, "High-technology Employment: A Broader View," *Monthly Labor Review*, June 1999, p18.

this project was completed in August 2002, and the data given in this report represent the latest data available to the best of our knowledge. During the time required for review, approval, and publication of this report, more recent data sets will likely become available for certain metrics. The rankings on individual metrics and the state profiles should be considered as snapshots taken at a particular time, with the understanding that the state indicators are dynamic and will evolve over time.

The values of individual metrics were calculated, and the states were ranked relative to each metric. The rankings were defined so that those states with highest numerical value were given the lowest numerical ranking. For instance, the state receiving the largest number of Small Business Innovation Research (SBIR) grants per 10,000 businesses located in that state received a ranking of one. Conversely, the state with the smallest number of SBIR grants per 10,000 businesses received a ranking of fifty. Rankings were done for each of the 50

NAICS Code	Industry
32411	Petroleum Refineries
3251	Basic Chemical Manufacturing
3252	Resin, Synthetic Rubber, and Artificial and Synthetic Fibers and Filaments Manufacturing
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing
3254	Pharmaceutical and Medicine Manufacturing
3255	Paint, Coating, and Adhesive Manufacturing
3256	Soap, Cleaning Compound, and Toilet Preparation Manufacturing
3259	Other Chemical Product and Preparation Manufacturing
332992	Ordnance & Accessories Manufacturing - Small Arms Ammunition Manufacturing
332993	Ordnance & Accessories Manufacturing - Ammunition (except Small Arms) Manufacturing
332994	Ordnance & Accessories Manufacturing - Small Arms Manufacturing
332995	Ordnance & Accessories Manufacturing - Other Ordnance and Accessories Manufacturing
3331	Agriculture, Construction, and Mining Machinery Manufacturing
3332	Industrial Machinery Manufacturing
3333	Commercial and Service Industry Machinery Manufacturing
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing
3339	Other General Purpose Machinery Manufacturing
3341	Computer and Peripheral Equipment Manufacturing
3342	Communications Equipment Manufacturing
3343	Audio and Video Equipment Manufacturing
3344	Semiconductor and Other Electronic Component Manufacturing
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
3346	Manufacturing and Reproducing Magnetic and Optical Media
3353	Electrical Equipment Manufacturing
33599	All Other Electrical Equipment and Component Manufacturing
3361	Motor Vehicle Manufacturing
3362	Motor Vehicle Body and Trailer Manufacturing
3363	Motor Vehicle Parts Manufacturing
3364	Aerospace Product and Parts Manufacturing
3391	Medical Equipment and Supplies Manufacturing
5112	Software Publishers
514191	On-Line Information Services
5142	Data Processing Services
5413	Architectural, Engineering, and Related Services
5415	Computer Systems Design and Related Services
5416	Management, Scientific, and Technical Consulting Services
5417	Scientific Research and Development Services
6117	Educational Support Services
811212	Computer and Office Machine Repair and Maintenance

Table 1. BLS R&D Intensive High Technology Industries Converted into NAICS Codes

states or for each state for which data were available in instances in which the data set was not complete.

The data for the District of Columbia and Puerto Rico have been included at the bottom of each data chart in the individual Metric Descriptions in Section 2 for purposes of comparison. In many cases, specific pieces of data were not available for these areas. Occasionally, the data for these areas were not taken from the same source as the data for the 50 states, or they were not available for the same year. For these reasons, the District of Columbia and Puerto Rico were not included in the rankings, nor were they included in the calculation of the national average for each metric.

The national average for each metric was calculated by independently summing the state values for both the numerator and the denominator of each metric and then dividing the two. For instance, when calculating the national average for the number of SBIR awards received per 10,000 business establishments, the average number of SBIR awards received annually by companies in each state was totaled to obtain the national average number of SBIR awards. Next, the total number of business establishments in the 50 states was calculated by adding the number of business establishments in each state. Finally, the value for the national average for the average annual number of SBIR awards per 10,000 business establishments was calculated by dividing the first total by the second total.

For metrics where data was not available for all 50 states, the national averages reflect only the values for those states that do have data reported for that metric. For instance, if data were not available for the numerator value of a particular state, the denominator value of that state would not be used in the calculation of national average, and the national average would be reported as the average of 49 states instead of 50. The symbol N/A is used in the metric table of values to indicate that data is not available for this particular state from the given data source. A dash in the metric table of values indicates that the value could not be calculated, usually because the initial data was not available.

In a change from the second edition, an indicator value index was created. The index represents the indicator value for each state divided by the indicator value for the national average and multiplied by 100. For each metric, this produced a series of dimensionless index values representing the performance of individual states. The national average, representing the states for which data was available, has been assigned a value of 100. States performing above the national average have index values greater than 100, and those performing below the national average have index values less than 100.

Another area where the committee decided to make a significant change between the second and third editions lies in the map showing state performance. This map appears on each metric page and shows each state's performance as a function of color intensity. The number of color ranges on the map has been increased from four to five to show the states that were close to the national average on a particular metric as a separate color range. The five color ranges now represent indicator index values of less than 50, 50-94, 95-105, 106-150, and greater than 150, where the indicator index value of all the states with data for that metric is defined as 100.

The source citations from which the data used to calculate each metric were extracted are provided on the appropriate Metric Description pages in Section 2 and again in the Appendix where they have been collected to facilitate reproduction. In some instances, the data were obtained on-line from databases capable of being directly queried. The actual web address (URL) from which the data were obtained is given in the source citation. However, it should be noted that the URL cited may contain a session number. Attempts to obtain the same data using the same URL (with its original session number) will not be successful. In this situation, it is best to truncate the URL at each forward slash beginning on the right side of the address until the URL is simplified sufficiently to reach an entry point into the web-site. The title of the data source should provide enough information to allow the user to access the data directly through a query of the database.

Data pertaining to individual states are presented in Section 3 as a series of State Profiles. The State Information Contacts were obtained from the U.S. Census Bureau, Statistical Abstract of the United States, "Appendix 1b, Guide to State Statistical Abstracts", <http://www.census.gov/prod/2002pubs/01statab/app1b.pdf>. Appendix 1 identifies the state sources for the most recent state statistical abstracts as of the publication date of the 2001 Edition of the Statistical Abstract of the United States. These sources are usually designated as data repositories for the state. In a few cases, the source was a commercial entity, and the state census data center designated by the U.S. Bureau of the Census was selected instead. For questions pertaining to the raw data, inquiries should be directed first to the source of the data, provided in Section 2 as well as in the Appendix, and then to the State Statistical Information Contact.

The State Profiles in Section 3 also contain a brief sketch of each state describing its population, gross state product, number of business establishments, per capita income, and percent of the population living in poverty. The first three of these measures are scale sensitive, and their rankings are intended to give the reader a picture of the state's comparative economic position. Data describing the overall state economic conditions were obtained from publications of the U.S. Census Bureau, the U.S. Department of Commerce's Bureau of Economic Analysis, and the U.S. Department of Labor's Bureau of Labor Statistics. Detailed citations of these sources are provided in the Appendix.

The third element of the State Profiles in Section 3, Science and Technology Organizations, identifies significant organizations in a state's S&T infrastructure. Included in this section are government agencies, public/private partnerships, and university partnerships. These organizations were identified through the National Governors' Association site and the National Association of State Information Resources site. Telephone contacts were made with the governor's office, the department of development, or other knowledgeable individuals to identify additional S&T organizations in a particular state. The organizations selected for inclusion are intended to represent a variety of entry portals into a state's S&T infrastructure. Some are general in scope and others are technology-specific. Each of the organizations is briefly described, and an Internet address has been provided to facilitate access to it. Questions related to the content of a state's S&T infrastructure should be directed to an appropriate organization where they will be answered or referred. Selection or omission of an organization does not imply that an assessment regarding its effectiveness, importance, or relative ranking has been done as part of this project.

The final section in each State Profile contains a bar chart depicting the state's performance on each of the 37 metrics. The chart has been divided into quartiles, and the length of the bars represent the state's performance in terms of the percent of national average for each metric. To the left of each bar the numerical rank for that metric is listed. Following the metric title for each bar, the state's value for the metric is given in parentheses. The definition of each metric can be found in Section 2, and the source of the data is given in both Section 2 and in the Appendix. Details related to the raw data and to the state's exact ranking on a particular metric can be found in the chart for that metric in Section 2.

1.3 Major Metric Groups

1.3.1 Funding In-Flows

This first set of input metrics is designed to measure the amount of science, technology, and research resources flowing into the state from governmental and private sources. These financial resources measure the opportunities to generate knowledge, intellectual property, and specialized human resources. The specific metrics included in this category are:

1. Expenditures for Total R&D Performed per $1,000 of GSP: 2000
2. Expenditures for Industry-performed R&D per $1,000 of GSP: 2000
3. Expenditures for Federally Performed R&D per $1,000 of GSP: 2000
4. Expenditures for University-performed R&D per $1,000 of GSP: 2000
5. Federal Obligations for R&D per $1,000 of GSP: 2000
6. Average Annual Number of SBIR Awards per 10,000 Business Establishments: 1999-2001
7. Average Annual SBIR Award Dollars per $1,000 of GSP: 1999-2001
8. Average Annual Number of STTR Awards per 10,000 Business Establishments: 1999-2001
9. Average Annual STTR Award Dollars per $1,000 of GSP: 1999-2001

The raw data for the numerators of seven of these metrics are expressed in terms of dollars and two in terms of the number of awards. To eliminate scale sensitivity, a normalization or scaling factor was used for each measure. In the cases where the numerator was in terms of dollars, gross state product (GSP) was selected to reflect the impact of the dollar investment on the state's economy. In the case of the number of SBIR and STTR awards, the number of businesses in the state was used since these awards are made to businesses.

1.3.2 Human Resources

The second set of input metrics measures the ability of the labor market to support the science and engineering needs of technology-based businesses. It includes measures of the flow and stock of workers with advanced degrees, undergraduate degrees, and technical associates degrees. The specific metrics included in this category are:

10. National Assessment of Educational Progress (NAEP) in Science Average State Test Scores: 2000
11. Percent of the Population that has Completed High School: 2000
12. Total Associate's Degrees Granted as a Percent of the 18-24 Year Old Population: 1999-2000
13. Total Bachelor's Degrees Granted as a Percent of the 18-24 Year Old Population: 1999-2000
14. Percent of Bachelor's Degrees Granted in Science and Engineering: 1999-2000
15. Science and Engineering Graduate Students as a Percent of the 18-24 Year Old Population: 2000
16. Percent of the Civilian Work Force with a Recent Bachelor's Degree in Science or Engineering: 1999
17. Percent of the Civilian Work Force with a Recent Master's Degree in Science or Engineering: 1999
18. Percent of the Civilian Work Force with a Recent Ph.D. Degree in Science or Engineering: 1999

The NAEP scores represent the average statewide test results in science at the eighth grade level. Other metrics were expressed in terms of percentages, so state size or population was not an issue. For the number of degrees awarded, however, it was necessary to normalize the data to account for population differences. The 18-24 year age range was selected since this is the age group that is most likely to be pursuing higher education. This segment of the population most closely approximates the target market for higher education. This is not to imply that all people receiving degrees are in this age sector, but state higher educational capacity and output should show a relationship to the size of this population segment.

The data for four metrics-high school completions and the three metrics related to recent degrees in the work force-are unchanged from the second edition. The Census Bureau is in the process of reweighting the 2001 educational attainment data based upon the 2000 Census. Data on recent degrees are collected every two years, and the data for 2001 are not yet available.

1.3.3 Capital Investment and Business Assistance

The third set of input metrics measures the amount of financial and business support being provided to state businesses. Capital is one of the most critical needs for new business formation and growth. Capital is very fluid, yet there clearly are tendencies for companies in certain areas to receive disproportionate funding. In fact, the ability to attract capital often is the basis for entrepreneurs deciding where to establish their businesses. Capital takes many forms, including early stage seed and venture, loans and grants, and public offerings. In addition to capital, other forms of assistance can help to facilitate business growth and development. The metrics in this section indicate the capacity and support structure for encouraging new business formation. The specific metrics included in this category are:

19. Amount of Venture Capital Funds Invested per $1,000 of GSP: 2001
20. Average Annual Amount of SBIC Funds Disbursed per $1,000 of GSP: 1999-2001
21. Average Annual Amount of IPO Funds Raised per $1,000 of GSP: 1999-2001
22. Number of Business Incubators per 10,000 Business Establishments: 2002

Again, it was necessary to normalize or scale the data to account for the large differences in size of the state economies. Data that were obtained in the form of dollars were normalized to the GSP of the state. Support services were normalized to the number of state businesses.

1.3.4 Technology Intensity of the Business Base

The first set of output metrics measures the extent to which a state is growing the types of businesses that are classified in high-technology industries. As noted earlier, the designation of high-technology industries is based on the definition from the Bureau of Labor Statistics that was subsequently modified to incorporate NAICS codes in place of the original SIC codes. The companies in these industries are most likely to benefit from strong state S&T programs.

As might be expected, companies in these industries were found to be attractive on a national basis. Although only 5.9% of U.S. business establishments are classified in these NAICS codes, they employ 8.9% of the U.S. work force and account for 14.6% of the U.S. payroll. The following metrics were used to characterize the technology intensity of a state's business base:

23. Percent of Establishments in High-technology NAICS Codes: 1999
24. Percent of Employment in High-technology NAICS Codes: 1999
25. Percent of Payroll in High-technology NAICS Codes: 1999
26. Percent of Establishment Births in High-technology SIC Codes: 1999
27. Net Formations of High-technology Establishments per 10,000 Business Establishments: 1999

The first four metrics in this set are reported as percentages, so no scaling factor is required. Each of these metrics indicates the extent to which the state's business base is concentrated in the NAICS codes that represent high-technology industries. The final metric, net formations of technology intensive establishments, was normalized to the total number of business establishments in the state to minimize the effect of state size factors.

1.3.5 Outcome Measures

The second set of outcome metrics measures the economic development characteristics of the area. Essentially, these metrics are the variables that the S&T programs attempt to improve. The correlation between S&T assets, how effectively they are used by the states, and how much of an impact they exert on economic development is exceedingly complex and dependent upon many external factors.

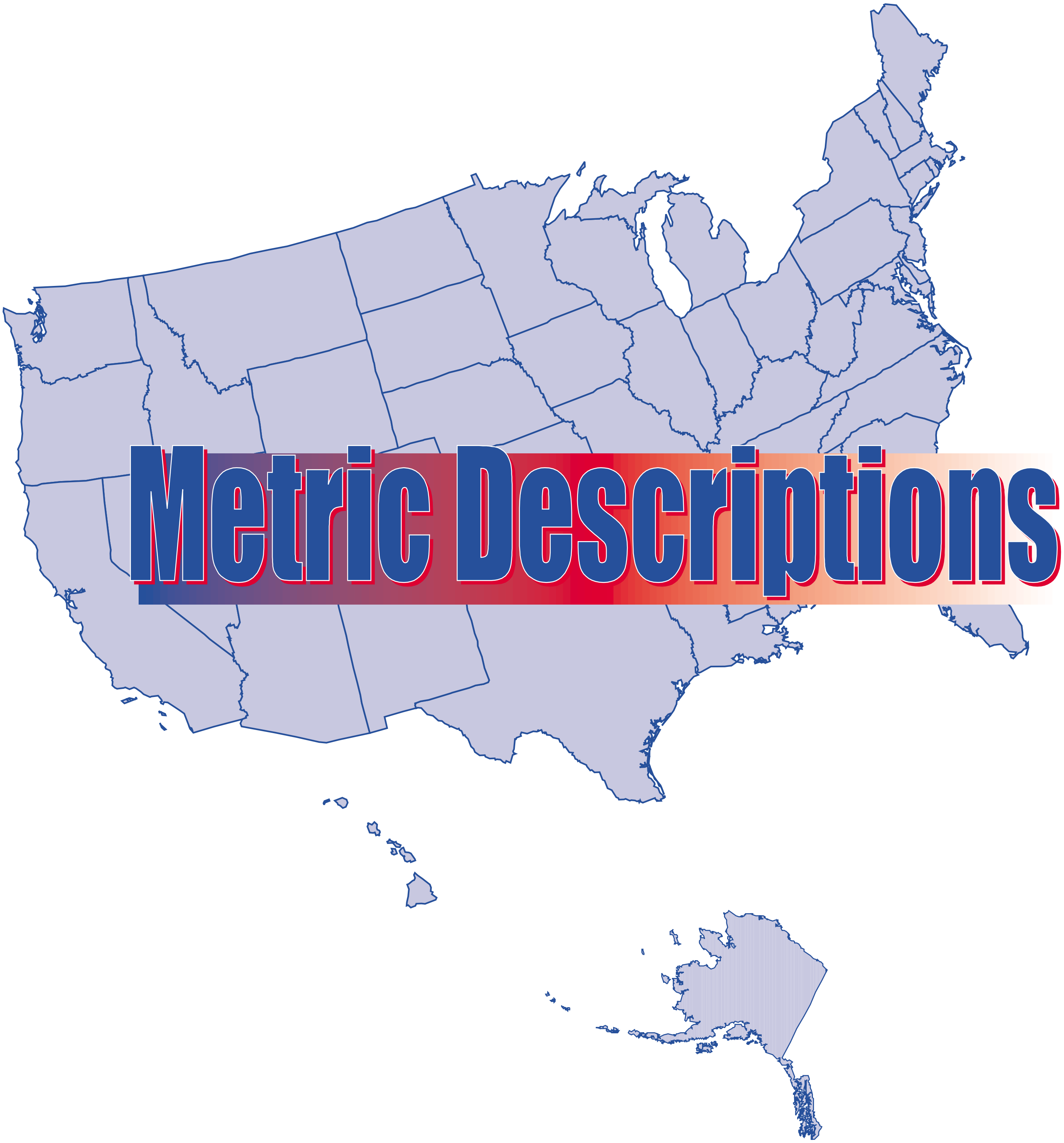
The specific measures included in this category are:

28. Average Annual Number of U.S. Patents Issued per 10,000 Business Establishments: 1999-2001
29. Number of Technology Fast 500 Companies per 10,000 Business Establishments: 2001
30. Number of Inc. 500 Companies per 10,000 Business Establishments: 2001
31. Average Annual Pay per Worker: 2000
32. Percent of the Population Living Above the Federal Poverty Threshold: 2000
33. Per Capita Personal Income: 2000
34. Labor Force Participation Rate: 2001
35. Percent of the Civilian Work Force that was Employed: 2001
36. Percent of Households with Computers: 2001
37. Percent of Households with Internet Access: 2001

The first three metrics in this set are based on the number of patents issued and the number of fast-growing companies. Obviously, they can be expected to increase as the size of a state's business base increases, making it difficult to compare states of widely differing sizes. For this reason, these measures were normalized to the number of businesses in the state. The remaining metrics are expressed in terms that are independent of the size of the state, so no normalization was required.

It should be pointed out that the percent of the population living above the federal poverty threshold was used in place of the more common poverty rate or percent of the population living at or below the federal poverty threshold. This manner of expressing the metric was selected because it represents a positive outcome.

Metric Descriptions



2. Contents

This section contains a 2-page description of each of the thirty-seven metrics developed to describe the science and technology (S&T) infrastructure of individual states. Twenty-two of these metrics are measures of inputs, and fifteen are measures of outputs.

Each metric description contains a definition of the metric, a summary of its relevance including the national performance on that metric, data considerations and limitations, and the data source references.

The actual data used to calculate the metric value for each state and for the District of Columbia and Puerto Rico are shown in chart format. Numerical rankings for each state are provided on the same chart, with one designating the highest performance and fifty designating the lowest performance on that particular metric. The indicator value index that each state's performance represents is shown in the last column of the chart. A value of 100 indicates that a state's performance on that metric is identical with the average performance of the 50 states.

The latter data also are presented graphically on an accompanying U.S. map in which the color intensity of each state represents that state's performance relative to the metric's value for the 50 states.

Total Performed R&D Expenditures

Definition

Total performed research & development (R&D) expenditures per $1,000 of gross state product (GSP) is calculated by dividing the total amount spent on R&D performance in each state by that state's GSP. R&D expenditures are the total of the basic research, applied research, and development performed by private industry, federal government, academic, and non-profit organizations located in the state. GSP is the output of goods and services produced by the labor and property located in the state.

Relevance

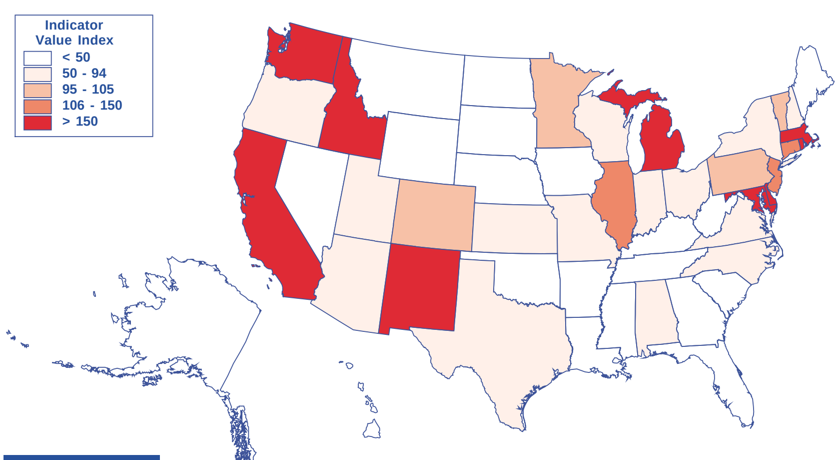
This metric describes the importance of R&D activities to a state's economy. It is directly related to the number of workers and capital employed in the conduct of research and development. The total performed R&D expenditures for the 50 states were $242.6 billion or $24.54 per $1,000 of U.S. gross domestic product. The median total performed R&D expenditure for the 50 states was $16.46 per $1,000 of GSP.

Long-term economic growth is universally deemed to be highly dependent on the R&D activities of scientists and engineers. However, the precise relationship between R&D and improvements in quality and productivity is difficult to measure. Further, that relationship is thought to vary greatly by the types of products and services being developed. In the short-run, expenditures on R&D tell little about the ultimate value of what is received for the money being spent. Significant scientific breakthroughs can result from small expenditures, or large expenditures can yield few commercial opportunities. R&D expenditures also provide insight into the perceived importance of research and, hence, how supportive the business climate is to research.

Data Considerations and Limitations

R&D expenditure estimates are based on surveys of R&D performers who are asked to indicate how much they spend, the character of the research, and where the funds originated. The use of performer reporting reduces the possibility of double-counting. The surveys are conducted by the Division of Science Resources Studies of the National Science Foundation.

The federal R&D performance expenditure data reported by universities and industry will differ from the Federal agency reported R&D funding totals because expenditures may occur in a different year than when the funds were originally authorized, obligated, or outlayed. During the last several years the differential between federal R&D expenditures and funding has increased considerably. Performers and funders of R&D may differ in what they report as R&D. Another difficulty in tracking R&D expenditures is that funds are further passed through to other performers.



Source of Data

Expenditures for Total R&D Performed:

Total R&D 2000 was compiled by the National Science Foundation, Division of Science Resources Studies <http://www.nsf.gov/sbe/srs/>. The data will be available online in the report, *National Patterns of R&D Resources 2002 Data Update*, later this year.

Gross State Product:

U.S. Department of Commerce, Bureau of Economic Analysis. (2002, June). *Gross State Product: 2000*. <http://www.bea.doc.gov/bea/regional/gsp> (2002, June 10).

Expenditures for Total R&D Performed per $1,000 of GSP: 2000

STATE	Total R&D, millions	GSP, millions	INDICATOR VALUE *	Rank	Indicator Value Index **
Alabama	$1,730	$119,921	$14.43	30	59
Alaska	$196	$27,747	$7.06	44	29
Arizona	$3,107	$156,303	$19.88	18	81
Arkansas	$454	$67,724	$6.70	46	27
California	$55,093	$1,344,623	$40.97	8	167
Colorado	$4,230	$167,918	$25.19	14	103
Connecticut	$4,888	$159,288	$30.69	11	125
Delaware	$1,532	$36,336	$42.16	6	172
Florida	$4,663	$472,105	$9.88	35	40
Georgia	$2,796	$296,142	$9.44	36	38
Hawaii	$291	$42,364	$6.87	45	28
Idaho	$1,434	$37,031	$38.72	9	158
Illinois	$12,767	$467,284	$27.32	12	111
Indiana	$3,252	$192,195	$16.92	24	69
Iowa	$1,017	$89,600	$11.35	32	46
Kansas	$1,420	$85,063	$16.69	25	68
Kentucky	$866	$118,508	$7.31	42	30
Louisiana	$627	$137,700	$4.55	48	19
Maine	$319	$35,981	$8.87	37	36
Maryland	$8,634	$186,108	$46.39	4	189
Massachusetts	$13,004	$284,934	$45.64	5	186
Michigan	$18,892	$325,384	$58.06	1	237
Minnesota	$4,299	$184,766	$23.27	16	95
Mississippi	$513	$67,315	$7.62	41	31
Missouri	$2,583	$178,845	$14.44	29	59
Montana	$170	$21,777	$7.81	40	32
Nebraska	$439	$56,072	$7.83	39	32
Nevada	$377	$74,745	$5.04	47	21
New Hampshire	$775	$47,708	$16.24	26	66
New Jersey	$13,133	$363,089	$36.17	10	147
New Mexico	$3,085	$54,364	$56.75	2	231
New York	$13,556	$799,202	$16.96	23	69
North Carolina	$5,045	$281,741	$17.91	21	73
North Dakota	$146	$18,283	$7.99	38	33
Ohio	$7,662	$372,640	$20.56	17	84
Oklahoma	$660	$91,773	$7.19	43	29
Oregon	$2,116	$118,637	$17.84	22	73
Pennsylvania	$9,842	$403,985	$24.36	15	99
Rhode Island	$1,501	$36,453	$41.18	7	168
South Carolina	$1,126	$113,377	$9.93	34	40
South Dakota	$85	$23,192	$3.67	49	15
Tennessee	$2,057	$178,362	$11.53	31	47
Texas	$11,552	$742,274	$15.56	27	63
Utah	$1,361	$68,549	$19.85	19	81
Vermont	$465	$18,411	$25.26	13	103
Virginia	$5,069	$261,355	$19.40	20	79
Washington	$10,516	$219,937	$47.81	3	195
West Virginia	$457	$42,271	$10.81	33	44
Wisconsin	$2,693	$173,478	$15.52	28	63
Wyoming	$61	$19,294	$3.16	50	13
50 States	**$242,556**	**$9,882,154**	**$24.54**	—	**100**
Dist of Columbia	$2,296	$59,397	$38.66	—	157
Puerto Rico	N/A	—	—	—	—

* (Total R&D / GSP) x $1,000
** 100 equals 50-state indicator value

Industry-performed R&D Expenditures

Definition

This metric measures the amount of research & development (R&D) expenditures that are actually performed by all non-farm industries in a state divided by the gross state product (GSP) of that state. R&D expenditures are the total of basic research, applied research, and development performed by the industrial sector, including industry-administered, federally funded research and development centers. The sources for that funding can be from government, academia, non-profits, or industry. GSP is the output of goods and services produced by the labor and property located in the state.

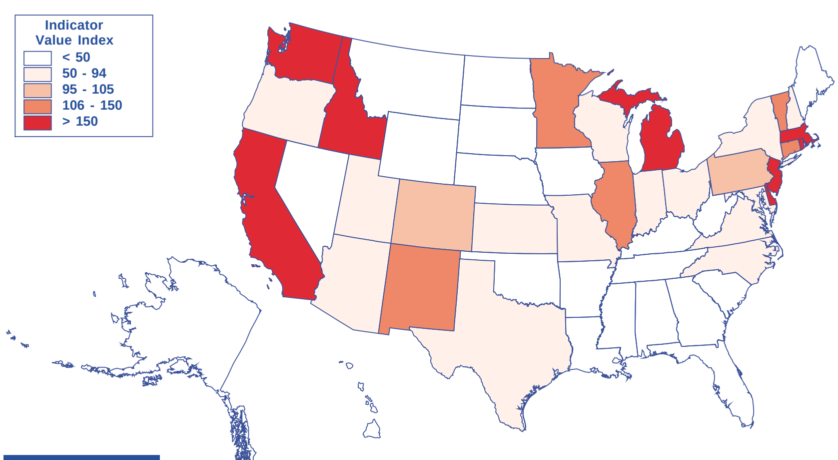
Relevance

This metric describes the importance of R&D activities to the industry sector of a state's economy. The total industry-performed R&D expenditures for the 50 states was $187.4 billion or $18.97 per $1,000 of U.S. gross domestic product. Industry performed 77.2% of all the R&D performed in the 50 states. The median expenditure for industry-performed R&D for the 50 states was $11.75 per $1,000 of GSP.

The value of industry performed R&D is often hidden in the ultimate value of the innovation and product improvements of industrial goods and services. Further, value from the R&D may become evident years after the R&D actually takes place. However, without the continuous flow of industrial R&D, companies will lose competitiveness. The level and intensity of industrial R&D in the states indicate where industry decides to locate its scientists. These location decisions are influenced by availability of a talented workforce, outstanding supporting research services, and overall quality of life in the states.

Data Considerations and Limitations

R&D performance estimates are based on surveys of R&D performers conducted by the Division of Science Resources Studies of the National Science Foundation. Performers are asked to report how much they spend on R&D, the nature of the R&D, and where the funds originated. A survey questionnaire is sent to all companies that spend more than $5 million annually on R&D in the U.S. and to a sample of all other firms. The level of R&D performance is determined by using information from previous surveys or other sources. Remaining firms are subjected to probability sampling and may not receive a questionnaire for a given survey year. Therefore, in states dominated by small companies, the R&D performance estimates could be subject to significantly higher sampling variability. Data for the following states have imputation of more than 50%: Alaska, Connecticut, Delaware, Illinois, Iowa, Michigan, Minnesota, Montana, New Mexico, North Dakota, Rhode Island, Tennessee, and Washington. The data includes performance at industry Federally Funded Research and Development Centers.



Source of Data

Expenditures for Industry-performed R&D:

Industry R&D was collected and compiled by the National Science Foundation, Division of Science Resources Studies <http://www.nsf.gov/sbe/srs/>, Survey of Industrial Research and Development: 2000. The data will be available online in the report, *Research and Development in Industry: 2000*, when it is released later this year.

Gross State Product:

U.S. Department of Commerce, Bureau of Economic Analysis. (2002, June). *Gross State Product: 2000*. <http://www.bea.doc.gov/bea/regional/gsp> (2002, June 10).

Expenditures for Industry-performed R&D per $1,000 of GSP: 2000

STATE	Industry R&D, millions	GSP, millions	INDICATOR VALUE *	Rank	Indicator Value Index **
Alabama	$607	$119,921	$5.06	37	27
Alaska	$9	$27,747	$0.32	50	2
Arizona	$2,445	$156,303	$15.64	17	82
Arkansas	$273	$67,724	$4.03	39	21
California	$45,769	$1,344,623	$34.04	6	179
Colorado	$3,140	$167,918	$18.70	15	99
Connecticut	$4,371	$159,288	$27.44	9	145
Delaware	$1,444	$36,336	$39.74	3	210
Florida	$3,212	$472,105	$6.80	32	36
Georgia	$1,579	$296,142	$5.33	36	28
Hawaii	$44	$42,364	$1.04	47	5
Idaho	$1,338	$37,031	$36.13	4	191
Illinois	$10,661	$467,284	$22.81	10	120
Indiana	$2,668	$192,195	$13.88	20	73
Iowa	$538	$89,600	$6.00	33	32
Kansas	$1,140	$85,063	$13.40	21	71
Kentucky	$582	$118,508	$4.91	38	26
Louisiana	$126	$137,700	$0.92	48	5
Maine	$201	$35,981	$5.59	34	29
Maryland	$2,032	$186,108	$10.92	27	58
Massachusetts	$9,863	$284,934	$34.62	5	183
Michigan	$17,640	$325,384	$54.21	1	286
Minnesota	$3,722	$184,766	$20.14	13	106
Mississippi	$101	$67,315	$1.50	45	8
Missouri	$1,893	$178,845	$10.58	28	56
Montana	$28	$21,777	$1.29	46	7
Nebraska	$199	$56,072	$3.55	41	19
Nevada	$248	$74,745	$3.32	42	17
New Hampshire	$586	$47,708	$12.28	24	65
New Jersey	$12,062	$363,089	$33.22	7	175
New Mexico	$1,158	$54,364	$21.30	12	112
New York	$10,539	$799,202	$13.19	22	70
North Carolina	$3,672	$281,741	$13.03	23	69
North Dakota	$51	$18,283	$2.79	43	15
Ohio	$5,962	$372,640	$16.00	16	84
Oklahoma	$333	$91,773	$3.63	40	19
Oregon	$1,651	$118,637	$13.92	19	73
Pennsylvania	$7,873	$403,985	$19.49	14	103
Rhode Island	$1,090	$36,453	$29.90	8	158
South Carolina	$781	$113,377	$6.89	30	36
South Dakota	$44	$23,192	$1.90	44	10
Tennessee	$1,215	$178,362	$6.81	31	36
Texas	$8,961	$742,274	$12.07	25	64
Utah	$979	$68,549	$14.28	18	75
Vermont	$396	$18,411	$21.51	11	113
Virginia	$2,718	$261,355	$10.40	29	55
Washington	$9,265	$219,937	$42.13	2	222
West Virginia	$235	$42,271	$5.56	35	29
Wisconsin	$1,981	$173,478	$11.42	26	60
Wyoming	$7	$19,294	$0.36	49	2
50 States	**$187,432**	**$9,882,154**	**$18.97**	**—**	**100**
Dist of Columbia	$112	$59,397	$1.89	—	10
Puerto Rico	N/A	—	—	—	—

* (Industry R&D / GSP) x $1,000
** 100 equals 50-state indicator value

Federally Performed R&D Expenditures

Definition

Federally performed research & development (R&D) per $1,000 of gross state product (GSP) is computed by dividing the amount of federally performed R&D in each state by the state's GSP. Federally performed R&D is the sum of all basic research, applied research, and development performed by federal agencies located in a state. Federally funded R&D centers that are administered by private industry are excluded from this category, as are those administered by colleges, universities, or non-profits. GSP is the output of goods and services produced by the labor and property located in the state.

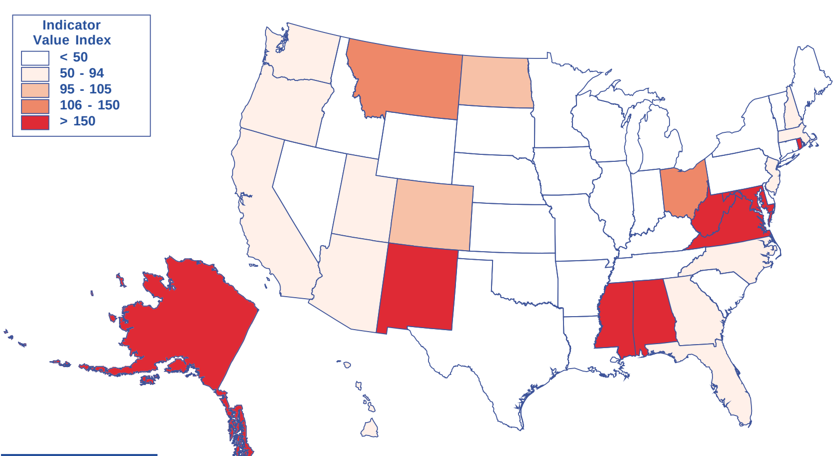
Relevance

This metric describes the importance of federal R&D performance to the economies of the states. In 2000, the federal government performed $14.8 billion in R&D in the 50 states. Federal agencies performed about 6.1% of the total R&D. The percentage of total R&D performed by federal agencies has steadily declined since the mid-1970s. The total federally performed R&D expenditures for the 50 states amounted to $1.49 per $1,000 of U.S. gross domestic product. The median expenditure for federally performed R&D in the 50 states was $0.73 per $1,000 of GSP.

Federal performance of R&D is indicative of where the federal government has R&D facilities. Examples of these R&D facilities include national laboratories, state agricultural research stations, defense institutes and laboratories, observatories, and atmospheric research centers. These facilities were often located for strategic, national security, and political reasons. However, they also reflect on the labor force and research support of the state and local area in which they are located.

Data Considerations and Limitations

R&D expenditure estimates are based on surveys of Federal R&D agencies. Federal R&D data includes costs associated with the administration of intramural and extramural programs by Federal personnel as well as actual intramural performance.



Source of Data

Expenditures for Federally Performed R&D:

Federal R&D was collected and compiled by the National Science Foundation, Division of Science Resources Studies <http://www.nsf.gov/sbe/srs/>, Survey of Federal Funds for Research and Development: Fiscal Years 2000, 2001, and 2002. The data will be available online in the report, *Federal Funds for Research and Development: Fiscal Years 2000, 2001, and 2002*, when it is released later this year.

Gross State Product:

U.S. Department of Commerce, Bureau of Economic Analysis. (2002, June). *Gross State Product: 2000.* <http://www.bea.doc.gov/bea/regional/gsp> (2002, June 10); Government of Puerto Rico, Office of the Governor. *Appendix Statistics: Table 1 - Selected Series of Income and Product, Total and Per Capita.* <http://www.jp.gobierno.pr>. (2002, May 10).

Expenditures for Federally Performed R&D per $1,000 of GSP: 2000

STATE	Federal R&D, thousands	GSP, millions	INDICATOR VALUE *	Rank	Indicator Value Index **
Alabama	$664,981	$119,921	$5.55	4	371
Alaska	$75,446	$27,747	$2.72	7	182
Arizona	$145,601	$156,303	$0.93	19	62
Arkansas	$45,489	$67,724	$0.67	27	45
California	$1,655,628	$1,344,623	$1.23	14	82
Colorado	$241,771	$167,918	$1.44	11	96
Connecticut	$19,373	$159,288	$0.12	49	8
Delaware	$7,598	$36,336	$0.21	44	14
Florida	$573,140	$472,105	$1.21	15	81
Georgia	$273,713	$296,142	$0.92	21	62
Hawaii	$58,658	$42,364	$1.38	13	93
Idaho	$21,722	$37,031	$0.59	30	39
Illinois	$85,344	$467,284	$0.18	46	12
Indiana	$71,630	$192,195	$0.37	38	25
Iowa	$34,586	$89,600	$0.39	35	26
Kansas	$20,162	$85,063	$0.24	41	16
Kentucky	$7,500	$118,508	$0.06	50	4
Louisiana	$99,196	$137,700	$0.72	26	48
Maine	$4,755	$35,981	$0.13	48	9
Maryland	$4,869,668	$186,108	$26.17	1	1,753
Massachusetts	$259,172	$284,934	$0.91	22	61
Michigan	$239,543	$325,384	$0.74	25	49
Minnesota	$32,014	$184,766	$0.17	47	12
Mississippi	$186,799	$67,315	$2.77	6	186
Missouri	$43,851	$178,845	$0.25	40	16
Montana	$35,344	$21,777	$1.62	10	109
Nebraska	$25,082	$56,072	$0.45	33	30
Nevada	$20,696	$74,745	$0.28	39	19
New Hampshire	$35,717	$47,708	$0.75	23	50
New Jersey	$417,685	$363,089	$1.15	17	77
New Mexico	$320,838	$54,364	$5.90	3	395
New York	$176,034	$799,202	$0.22	42	15
North Carolina	$262,003	$281,741	$0.93	20	62
North Dakota	$25,842	$18,283	$1.41	12	95
Ohio	$615,458	$372,640	$1.65	9	111
Oklahoma	$58,619	$91,773	$0.64	28	43
Oregon	$88,618	$118,637	$0.75	24	50
Pennsylvania	$151,955	$403,985	$0.38	37	25
Rhode Island	$240,862	$36,453	$6.61	2	443
South Carolina	$45,754	$113,377	$0.40	34	27
South Dakota	$13,232	$23,192	$0.57	31	38
Tennessee	$88,947	$178,362	$0.50	32	33
Texas	$464,699	$742,274	$0.63	29	42
Utah	$69,871	$68,549	$1.02	18	68
Vermont	$3,599	$18,411	$0.20	45	13
Virginia	$1,449,209	$261,355	$5.54	5	371
Washington	$258,718	$219,937	$1.18	16	79
West Virginia	$102,958	$42,271	$2.44	8	163
Wisconsin	$37,816	$173,478	$0.22	43	15
Wyoming	$7,298	$19,294	$0.38	36	25
50 States	**$14,754,194**	**$9,882,154**	**$1.49**	**—**	**100**
Dist of Columbia	$1,722,640	$59,397	$29.00	—	1,943
Puerto Rico	$9,125	$41,366	$0.22	—	15

* (Federal R&D / GSP) x $1,000
** 100 equals 50-state indicator value

University-performed R&D Expenditures

Definition

Expenditures for university-performed research & development (R&D) per $1,000 of gross state product (GSP) are calculated by dividing the amount of research performed by universities and colleges in a state by that state's GSP. R&D performance includes the total of basic research, applied research, and development. The research performed by universities may be funded by the federal government, non-federal governments, industry, non-profits, or the universities themselves. GSP is the output of goods and services produced by the labor and property located in the state.

Relevance

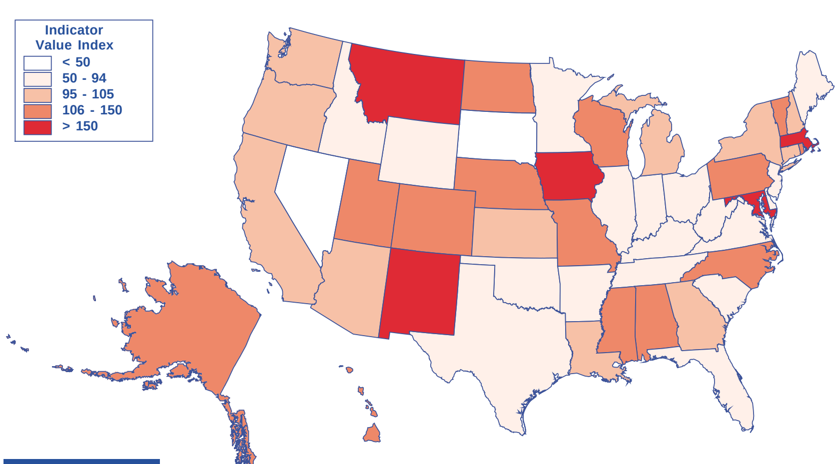
This metric describes the importance of university research to a state's economy. Universities tend to be oriented toward basic research that focuses on long-term, fundamental knowledge and discoveries of new underlying principles. In 2000, universities performed $29.7 billion in research or 12.2% of the total R&D performed in the 50 states. The total university-performed R&D expenditures for the 50 states amounted to $3.01 per $1,000 of U.S. gross domestic product. The median expenditure for university-performed R&D in the 50 states was $2.96 per $1,000 of GSP.

Because universities specialize in basic research, the economic impact of their R&D accrues over many years. Further, universities have historically advocated publishing their research findings and thus disseminated their research findings well beyond their state boundaries. Nonetheless, universities' faculty, facilities, and knowledge contribute substantially to the resource base that attracts new businesses to a state.

World class research institutions are frequently cited as reasons for new businesses to locate in an area. In recent times, universities have become more likely to conduct applied R&D for the benefit of particular sponsors. This type of research impacts the competitiveness of local businesses more directly and in a shorter time frame than does basic research. Finally, some research universities have begun to support the process of new business formation based on intellectual property developed at the university by its faculty, staff, and students.

Data Considerations and Limitations

The federal R&D performance expenditure data reported by universities and industry will differ from the Federal agency reported R&D funding totals because expenditures may occur in a different year than when the funds were originally authorized, obligated, or outlayed. During the last several years, the differential between federal R&D expenditures and funding has increased considerably. Performers and funders of R&D may differ in what they report as R&D. Another difficulty in tracking R&D expenditures is that funds are further passed through to other performers.



Source of Data

Expenditures for University-performed R&D:

National Science Foundation, Division of Science Resources Studies. *Academic Research and Development Expenditures: Fiscal Year 2000 [Early Release Tables]*. Arlington, VA. (2001, December).

Gross State Product:

U.S. Department of Commerce, Bureau of Economic Analysis. (2002, June). *Gross State Product: 2000.* <http://www.bea.doc.gov/bea/regional/gsp> (2002, June 10); Government of Puerto Rico, Office of the Governor. *Appendix Statistics: Table 1 - Selected Series of Income and Product, Total and Per Capita*. <http://www.jp.gobierno.pr>. (2002, May 10).

Technology Administration

Expenditures for University-performed R&D per $1,000 of GSP: 2000

STATE	University R&D, thousands	GSP, millions	INDICATOR VALUE *	Rank	Indicator Value Index **
Alabama	$428,122	$119,921	$3.57	14	119
Alaska	$107,417	$27,747	$3.87	7	129
Arizona	$465,777	$156,303	$2.98	25	99
Arkansas	$130,894	$67,724	$1.93	44	64
California	$4,053,042	$1,344,623	$3.01	24	100
Colorado	$544,204	$167,918	$3.24	18	108
Connecticut	$468,435	$159,288	$2.94	26	98
Delaware	$78,126	$36,336	$2.15	42	71
Florida	$851,932	$472,105	$1.80	45	60
Georgia	$926,749	$296,142	$3.13	21	104
Hawaii	$161,300	$42,364	$3.81	10	127
Idaho	$73,726	$37,031	$1.99	43	66
Illinois	$1,170,625	$467,284	$2.51	35	83
Indiana	$509,141	$192,195	$2.65	33	88
Iowa	$418,263	$89,600	$4.67	3	155
Kansas	$258,336	$85,063	$3.04	23	101
Kentucky	$274,238	$118,508	$2.31	37	77
Louisiana	$399,411	$137,700	$2.90	29	96
Maine	$57,753	$35,981	$1.61	47	53
Maryland	$1,507,549	$186,108	$8.10	1	269
Massachusetts	$1,485,792	$284,934	$5.21	2	173
Michigan	$995,756	$325,384	$3.06	22	102
Minnesota	$416,411	$184,766	$2.25	39	75
Mississippi	$217,064	$67,315	$3.22	19	107
Missouri	$614,101	$178,845	$3.43	17	114
Montana	$99,069	$21,777	$4.55	4	151
Nebraska	$208,480	$56,072	$3.72	11	124
Nevada	$106,340	$74,745	$1.42	49	47
New Hampshire	$150,982	$47,708	$3.16	20	105
New Jersey	$567,666	$363,089	$1.56	48	52
New Mexico	$246,258	$54,364	$4.53	5	151
New York	$2,290,812	$799,202	$2.87	30	95
North Carolina	$1,040,017	$281,741	$3.69	12	123
North Dakota	$67,406	$18,283	$3.69	13	123
Ohio	$918,500	$372,640	$2.46	36	82
Oklahoma	$252,419	$91,773	$2.75	31	91
Oregon	$346,149	$118,637	$2.92	28	97
Pennsylvania	$1,549,050	$403,985	$3.83	8	127
Rhode Island	$129,697	$36,453	$3.56	15	118
South Carolina	$294,184	$113,377	$2.59	34	86
South Dakota	$27,269	$23,192	$1.18	50	39
Tennessee	$405,013	$178,362	$2.27	38	75
Texas	$2,039,642	$742,274	$2.75	32	91
Utah	$308,059	$68,549	$4.49	6	149
Vermont	$64,762	$18,411	$3.52	16	117
Virginia	$587,718	$261,355	$2.25	40	75
Washington	$642,934	$219,937	$2.92	27	97
West Virginia	$73,420	$42,271	$1.74	46	58
Wisconsin	$661,470	$173,478	$3.81	9	127
Wyoming	$43,094	$19,294	$2.23	41	74
50 States	**$29,734,574**	**$9,882,154**	**$3.01**	**—**	**100**
Dist of Columbia	$245,828	$59,397	$4.14	—	138
Puerto Rico	$74,529	$41,366	$1.80	—	60

* (University R&D / GSP) x $1,000
** 100 equals 50-state indicator value

Federal R&D Obligations

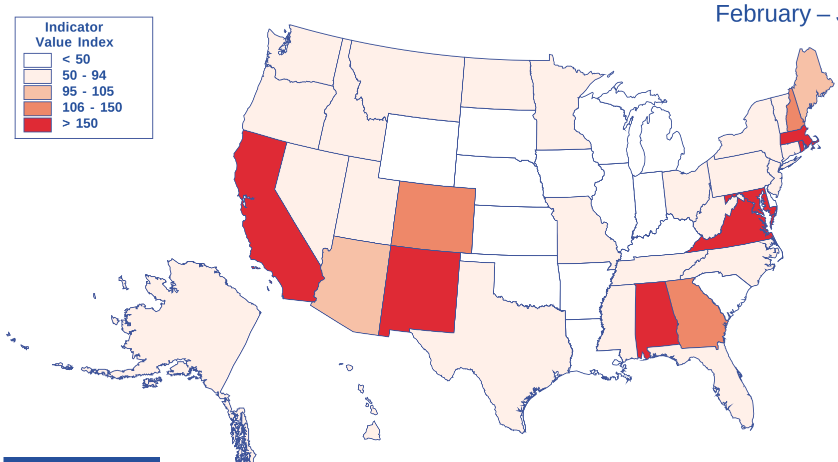
Definition

Federal obligations for research & development (R&D) per $1,000 of gross state product (GSP) are calculated by dividing federal R&D obligations committed to a state by that state's GSP. Federal obligations are the amounts of money for orders placed, contracts awarded, services received, and similar transactions directed to a state during a given period of time regardless of when the funds were appropriated and when future payment of money is required. The R&D obligations include the costs of specific R&D projects as well as the applicable overhead costs such as planning, laboratory overhead, pay of military personnel, and departmental administration. R&D obligations may be given to federal agencies, industrial firms, universities and colleges, non-profits, state and local governments, and federally funded R&D centers. GSP is the output of goods and services produced by the labor and property located in the state.

The geographic distribution of Department of Defense development funding to industry reflects only the location of prime contractors, not the numerous subcontractors who perform much of the research and development.

Relevance

This metric measures the magnitude of federal R&D dollars flowing into a state. These dollars will be used by R&D performers within the state to execute research, development, and demonstration projects. States benefit in two ways from federal R&D obligations. First, the obligations go to support employees, facilities, administrators, and purchases of materials within the state, thus, contributing to the state's overall level of economic activity. Second, the obligations go to support research that may lead to wealth creation from new technology, new products, and new businesses in the state. The total federal R&D obligations for the 50 states was $68.7 billion or $6.95 per $1,000 of U.S. gross domestic product.



The median federal R&D obligation for the 50 states was $4.30 per $1,000 of GSP.

Federal R&D obligations also reflect on the capabilities and capacities of the research institutions within a state. Many of the federal obligations are awarded on a competitive basis so the level of R&D funding is one indicator of the state's research competitiveness.

Data Considerations and Limitations

Data for this metric were derived from the *Survey of Federal Funds for Research and Development* conducted for the National Science Foundation by QRC Division of Macro International, Inc.

Web-based data collection (FEDWEB) has been used for this survey since 1999. A total of 32 agencies reported R&D data. Since multiple subdivisions of an agency were requested to complete the survey, there were a total of 92 respondents. The survey had a response rate of 100%, so no weighting of responses or imputation was used.

Some measurement problems are known to exist in the data. These are related to the fact that some agencies are not able to report the full costs of research and development. Usually this involves a break-out of the headquarters costs associated with administering R&D programs. R&D plant data are also underreported to some extent, because of the difficulty that some agencies, particularly the Department of Defense and the National Aeronautics and Space Administration, have in reporting this data.

Data for this survey are collected for three fiscal years — the year preceding data collection, the year of data collection, and the year subsequent to data collection. Although data collection starts in February and ends in May, a few agencies request extensions to June. The data for FY 2000 were collected during the period of February – June of 2000.

Source of Data

Federal Obligations for R&D:

Federal R&D was collected and compiled by the National Science Foundation, Division of Science Resources Studies <http://www.nsf.gov/sbe/srs/>, Survey of Federal Funds for Research and Development: Fiscal Years 2000, 2001, and 2002. The data will be available online in the report, *Federal Funds for Research and Development: Fiscal Years 2000, 2001, and 2002*, when it is released later this year.

Gross State Product:

U.S. Department of Commerce, Bureau of Economic Analysis. (2002, June). *Gross State Product: 2000.* <http://www.bea.doc.gov/bea/regional/gsp> (2002, June 10); Government of Puerto Rico, Office of the Governor. *Appendix Statistics: Table 1 - Selected Series of Income and Product, Total and Per Capita*. <http://www.jp.gobierno.pr>. (2002, May 10).

Technology Administration

Federal Obligations for R&D per $1,000 of GSP: 2000

STATE	Federal Obligations for R&D, thousands	GSP, millions	INDICATOR VALUE *	Rank	Indicator Value Index **
Alabama	$1,614,901	$119,921	$13.47	5	194
Alaska	$146,777	$27,747	$5.29	19	76
Arizona	$1,121,701	$156,303	$7.18	11	103
Arkansas	$116,333	$67,724	$1.72	49	25
California	$14,082,960	$1,344,623	$10.47	7	151
Colorado	$1,369,733	$167,918	$8.16	9	117
Connecticut	$806,228	$159,288	$5.06	20	73
Delaware	$69,867	$36,336	$1.92	44	28
Florida	$2,216,206	$472,105	$4.69	24	68
Georgia	$2,632,186	$296,142	$8.89	8	128
Hawaii	$209,737	$42,364	$4.95	22	71
Idaho	$216,928	$37,031	$5.86	15	84
Illinois	$1,404,613	$467,284	$3.01	36	43
Indiana	$506,326	$192,195	$2.63	39	38
Iowa	$267,038	$89,600	$2.98	38	43
Kansas	$223,493	$85,063	$2.63	40	38
Kentucky	$203,851	$118,508	$1.72	48	25
Louisiana	$249,045	$137,700	$1.81	46	26
Maine	$249,812	$35,981	$6.94	12	100
Maryland	$8,684,796	$186,108	$46.67	1	672
Massachusetts	$4,145,472	$284,934	$14.55	4	209
Michigan	$975,052	$325,384	$3.00	37	43
Minnesota	$781,132	$184,766	$4.23	26	61
Mississippi	$394,585	$67,315	$5.86	14	84
Missouri	$890,597	$178,845	$4.98	21	72
Montana	$95,025	$21,777	$4.36	25	63
Nebraska	$98,491	$56,072	$1.76	47	25
Nevada	$263,897	$74,745	$3.53	34	51
New Hampshire	$356,873	$47,708	$7.48	10	108
New Jersey	$1,937,769	$363,089	$5.34	18	77
New Mexico	$2,130,504	$54,364	$39.19	2	564
New York	$2,927,523	$799,202	$3.66	32	53
North Carolina	$1,062,536	$281,741	$3.77	31	54
North Dakota	$64,051	$18,283	$3.50	35	50
Ohio	$1,799,136	$372,640	$4.83	23	69
Oklahoma	$185,121	$91,773	$2.02	43	29
Oregon	$468,167	$118,637	$3.95	29	57
Pennsylvania	$2,357,552	$403,985	$5.84	16	84
Rhode Island	$418,037	$36,453	$11.47	6	165
South Carolina	$248,988	$113,377	$2.20	42	32
South Dakota	$38,803	$23,192	$1.67	50	24
Tennessee	$734,406	$178,362	$4.12	28	59
Texas	$2,671,790	$742,274	$3.60	33	52
Utah	$285,968	$68,549	$4.17	27	60
Vermont	$72,030	$18,411	$3.91	30	56
Virginia	$4,842,811	$261,355	$18.53	3	267
Washington	$1,329,466	$219,937	$6.04	13	87
West Virginia	$235,677	$42,271	$5.58	17	80
Wisconsin	$420,839	$173,478	$2.43	41	35
Wyoming	$35,059	$19,294	$1.82	45	26
50 States	**$68,659,888**	**$9,882,154**	**$6.95**	**—**	**100**
Dist of Columbia	$2,374,647	$59,397	$39.98	—	575
Puerto Rico	$81,016	$41,366	$1.96	—	28

* (Federal Obligations for R&D / GSP) x $1,000
** 100 equals 50-state indicator value

Technology Administration

SBIR Awards

Definition

The number of Small Business Innovation Research Program (SBIR) awards per 10,000 business establishments was calculated by averaging the number of SBIR awards made to businesses in each state for the years 1999, 2000, and 2001 and dividing this by the number of business establishments in each state in 2000. Phase 1 and Phase 2 awards were combined for this metric. Total business establishments are the total number of businesses located at discrete addresses as reported in the 2000 County Business Patterns. SBIR awards go also to small businesses in the District of Columbia and Puerto Rico.

Relevance

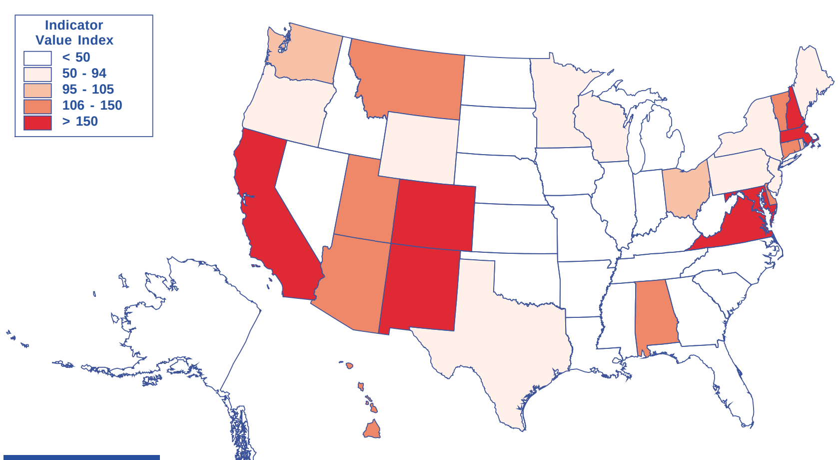
This metric indicates the degree to which small companies in each state are participating in federally funded research and development (R&D) and adding to the United States' base for technical achievement. The SBIR program was started in 1982 and was re-authorized in 1992. The program is widely recognized as a way to encourage technological innovation within small businesses. The SBIR program funds research to evaluate the feasibility and scientific merit of new technology and to develop the technology so it can be commercialized. Requirements for participation in the program include American ownership of the company, for-profit enterprise, employment of the principal researcher by the company, and fewer than 500 employees.

The total average annual number of SBIR awards granted from 1999-2001 for all 50 states was 4,530 or 6.4 SBIR awards granted per 10,000 business establishments. The median number of SBIR awards granted in the 50 states was 3.6 per 10,000 business establishments.

The potential benefits from the SBIR awards are many. First, the federal government may find new suppliers for technologically advanced products thus stimulating the growth of small businesses. Second, small businesses are provided capital with which to invest in new technology that can improve their market position. Third, the technology developed and commercialized as a result of the SBIR awards may lead to the formation of new businesses.

Data Considerations and Limitations

The total SBIR budget dictates how many awards will be given in any year. The SBIR budget fluctuates depending on the agency budgets, making year-to-year comparisons of state award receipt more difficult. Also, because of the relatively small number of awards each year, the actual number of awards going to any one state can vary widely on a yearly basis. Using a three-year average helps to smooth out the yearly fluctuations.



Source of Data

SBIR Awards Granted:

Small Business Administration. *Technology - 1999 SBIR State Chart*. <http://www.sba.gov/SBIR/sbir1999state.html> (2001, May 1); Small Business Administration. *Technology - 2000 SBIR State Chart*. <http://www.sba.gov/SBIR/sbir2000state.html> (2001, May 1); The 2001 SBIR data was provided by the Small Business Adminstration, Office of Technology per a special request from Taratec Corporation, Columbus, Ohio. The data will be available online later this year at http://www.sba.gov/SBIR/indexsbir-sttr.html.

Establishments:

U.S. Census Bureau. *County Business Patterns - United States: 2000*. (2002, May). <http://www.census.gov/prod/2002pubs/00cbp/cbp00-1.pdf> (2002, June 12).

Average Annual Number of SBIR Awards per 10,000 Business Establishments: 1999-2001

STATE	Average Annual SBIR Awards	2000 Establishments	INDICATOR VALUE *	Rank	Indicator Value Index **
Alabama	83	99,817	8.3	11	129
Alaska	3	18,501	1.6	42	25
Arizona	96	114,804	8.3	10	130
Arkansas	8	63,185	1.3	48	21
California	909	799,863	11.4	7	177
Colorado	230	137,528	16.7	4	260
Connecticut	82	92,436	8.8	9	137
Delaware	22	23,771	9.1	8	142
Florida	103	428,438	2.4	34	38
Georgia	48	200,442	2.4	35	37
Hawaii	21	29,853	6.9	14	108
Idaho	10	37,429	2.7	32	42
Illinois	74	308,067	2.4	33	38
Indiana	26	146,321	1.8	40	28
Iowa	9	80,890	1.2	50	18
Kansas	17	74,939	2.3	36	36
Kentucky	13	89,921	1.5	46	23
Louisiana	12	101,016	1.2	49	18
Maine	15	39,466	3.8	24	59
Maryland	228	128,467	17.7	3	276
Massachusetts	664	176,222	37.7	1	587
Michigan	74	236,912	3.1	29	48
Minnesota	63	139,080	4.5	23	70
Mississippi	10	59,788	1.6	43	25
Missouri	20	144,755	1.4	47	21
Montana	24	31,849	7.4	13	116
Nebraska	8	49,623	1.7	41	26
Nevada	11	48,178	2.2	38	34
New Hampshire	57	37,414	15.1	5	236
New Jersey	134	233,559	5.8	20	90
New Mexico	87	42,782	20.4	2	318
New York	176	492,073	3.6	27	56
North Carolina	57	203,903	2.8	31	43
North Dakota	6	20,139	3.1	28	49
Ohio	171	270,509	6.3	17	98
Oklahoma	13	85,094	1.6	45	24
Oregon	60	100,645	6.0	19	93
Pennsylvania	153	294,741	5.2	22	81
Rhode Island	17	28,534	6.1	18	95
South Carolina	16	97,146	1.6	44	25
South Dakota	5	23,783	2.2	37	35
Tennessee	39	130,876	3.0	30	47
Texas	173	471,509	3.7	25	57
Utah	45	55,379	8.1	12	126
Vermont	15	21,564	6.8	15	106
Virginia	248	175,582	14.1	6	220
Washington	109	164,018	6.6	16	103
West Virginia	8	41,047	1.9	39	29
Wisconsin	50	140,415	3.6	26	56
Wyoming	10	18,120	5.5	21	86
50 States	**4,530**	**7,050,393**	**6.4**	**—**	**100**
Dist of Columbia	19	19,655	9.7	—	150
Puerto Rico	1	N/A	—	—	—

* (Average Annual SBIR Awards / 2000 Establishments) x 10,000
** 100 equals 50-state indicator value

Technology Administration

SBIR Award Dollars

Definition

The average annual dollar award of Small Business Innovation Research Program (SBIR) grants per $1,000 of gross state product (GSP) was calculated by averaging the dollar awards given to companies in each state for the years 1999, 2000 and 2001 and dividing this average by the state's GSP in 2000. Phase 1 and Phase 2 awards dollars were combined to compute this metric. SBIR awards go also to small businesses in the District of Columbia and Puerto Rico. GSP is the output of goods and services produced by the labor and property located in the state.

Relevance

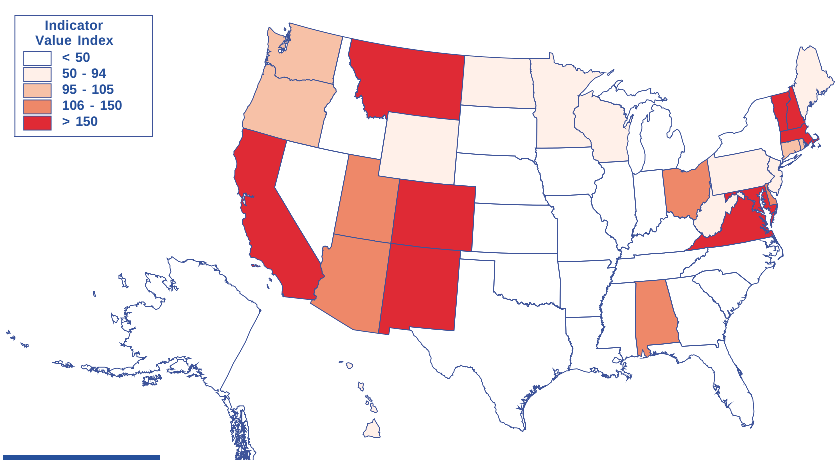
This metric is useful in understanding the magnitude of the federal government's investment in innovative small businesses in each state. The SBIR program was started in 1982 and was reauthorized in 1992. The program is widely recognized as a way to encourage technological innovation within small businesses. The SBIR program funds research to evaluate the feasibility and scientific merit of new technology and to develop the technology to a point where it can be commercialized. Phase I awards can be made up to $100,000 for a six-month effort. Phase II awards are for $750,000 or less and normally do not exceed a duration of two years.

The total average annual SBIR award dollars granted from 1999-2001 for all 50 states was $1.08 billion or $0.11 per $1,000 of U.S. gross domestic product (GDP). The median SBIR award dollars granted in the 50 states was $0.07 per $1,000 of GSP.

While the absolute dollars are a small part of GDP, the potential long-term benefits to small businesses and their local economy are much greater. First, small businesses are provided capital which is leveraged with their own investment dollars to develop new technology and products that can improve their market position. Second, the technology developed and commercialized as a result of the SBIR awards may lead to the formation of new businesses or the accelerated growth of existing small businesses. Third, the federal government may find new suppliers for technologically advanced products thus stimulating the growth of small businesses.

Data Considerations and Limitations

The total SBIR budget depends on the extramural R&D budgets of federal agencies. The SBIR budget fluctuates depending on the agency budgets making year-to-year comparisons of state award receipt more difficult. Also, because of the relatively small number of awards each year, the dollar value of SBIR awards going to any one state can vary widely on a yearly basis. Using a three-year average helps to smooth out the yearly fluctuations.



Source of Data

SBIR Award Dollars Granted:

Small Business Administration. *Technology - 1999 SBIR State Chart*. <http://www.sba.gov/SBIR/sbir1999state.html> (2001, May 1); Small Business Administration. *Technology - 2000 SBIR State Chart.* <http://www.sba.gov/SBIR/sbir2000state.html> (2001, May 1); The 2001 SBIR data was provided by the Small Business Adminstration, Office of Technology per a special request from Taratec Corporation, Columbus, Ohio. The data will be available online later this year at http://www.sba.gov/SBIR/indexsbir-sttr.html.

Gross State Product:

U.S. Department of Commerce, Bureau of Economic Analysis. (2002, June). *Gross State Product: 2000.* <http://www.bea.doc.gov/bea/regional/gsp> (2002, June 10); Government of Puerto Rico, Office of the Governor. *Appendix Statistics: Table 1 - Selected Series of Income and Product, Total and Per Capita.* <http://www.jp.gobierno.pr>. (2002, May 10).

Average Annual SBIR Award Dollars per $1,000 of GSP: 1999-2001

STATE	Average Annual SBIR Dollars, thousands	2000 GSP, millions	INDICATOR VALUE *	Rank	Indicator Value Index **
Alabama	$18,081	$119,921	$0.15	10	138
Alaska	$589	$27,747	$0.02	48	19
Arizona	$20,981	$156,303	$0.13	12	123
Arkansas	$1,459	$67,724	$0.02	47	20
California	$224,699	$1,344,623	$0.17	9	153
Colorado	$57,727	$167,918	$0.34	3	314
Connecticut	$18,208	$159,288	$0.11	16	104
Delaware	$4,785	$36,336	$0.13	13	120
Florida	$24,095	$472,105	$0.05	30	47
Georgia	$11,933	$296,142	$0.04	35	37
Hawaii	$3,800	$42,364	$0.09	20	82
Idaho	$1,320	$37,031	$0.04	38	33
Illinois	$17,018	$467,284	$0.04	37	33
Indiana	$5,537	$192,195	$0.03	43	26
Iowa	$1,704	$89,600	$0.02	49	17
Kansas	$2,984	$85,063	$0.04	40	32
Kentucky	$2,629	$118,508	$0.02	45	20
Louisiana	$1,988	$137,700	$0.01	50	13
Maine	$2,770	$35,981	$0.08	23	70
Maryland	$53,590	$186,108	$0.29	4	263
Massachusetts	$164,626	$284,934	$0.58	1	527
Michigan	$17,629	$325,384	$0.05	28	49
Minnesota	$14,500	$184,766	$0.08	22	72
Mississippi	$1,739	$67,315	$0.03	44	24
Missouri	$3,963	$178,845	$0.02	46	20
Montana	$5,630	$21,777	$0.26	6	236
Nebraska	$1,969	$56,072	$0.04	39	32
Nevada	$2,751	$74,745	$0.04	36	34
New Hampshire	$12,825	$47,708	$0.27	5	245
New Jersey	$32,380	$363,089	$0.09	21	81
New Mexico	$21,530	$54,364	$0.40	2	361
New York	$40,693	$799,202	$0.05	31	46
North Carolina	$12,646	$281,741	$0.04	33	41
North Dakota	$1,391	$18,283	$0.08	24	69
Ohio	$43,771	$372,640	$0.12	14	107
Oklahoma	$2,943	$91,773	$0.03	41	29
Oregon	$13,359	$118,637	$0.11	17	103
Pennsylvania	$37,231	$403,985	$0.09	19	84
Rhode Island	$3,791	$36,453	$0.10	18	95
South Carolina	$3,439	$113,377	$0.03	42	28
South Dakota	$1,011	$23,192	$0.04	34	40
Tennessee	$9,078	$178,362	$0.05	32	46
Texas	$40,169	$742,274	$0.05	29	49
Utah	$9,285	$68,549	$0.14	11	124
Vermont	$3,477	$18,411	$0.19	8	172
Virginia	$64,819	$261,355	$0.25	7	226
Washington	$25,187	$219,937	$0.11	15	105
West Virginia	$2,516	$42,271	$0.06	27	54
Wisconsin	$11,030	$173,478	$0.06	26	58
Wyoming	$1,462	$19,294	$0.08	25	69
50 States	**$1,082,736**	**$9,882,154**	**$0.11**	**—**	**100**
Dist of Columbia	$4,650	$59,397	$0.08	—	71
Puerto Rico	$207	$41,366	$0.01	—	5

* (Average Annual SBIR Dollars / 2000 GSP) x $1,000
** 100 equals 50-state indicator value

Technology Administration

STTR Awards

Definition

The number of Small Business Technology Transfer Program (STTR) awards per 10,000 business establishments was calculated by averaging the number of STTR awards in each state for the years 1999, 2000, and 2001 and dividing this by the number of business establishments in each state in 2000, the middle year of the three-year period. STTR awards are given to partnerships of small businesses and non-profit research institutions. Phase 1 and Phase 2 awards were combined to compute this metric. STTR awards are also granted to small businesses in the District of Columbia. Total business establishments are the total number of businesses as reported in the *2000 County Business Patterns*.

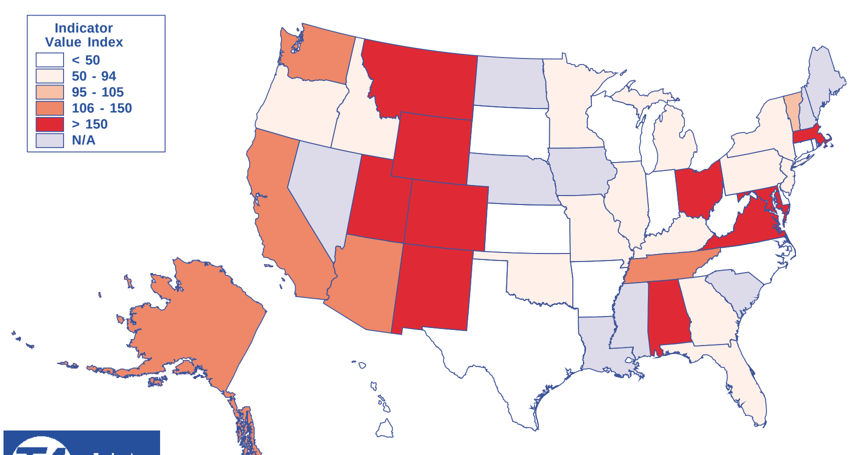
The total average annual number of STTR awards granted from 1999-2001 for 41 states was 317 or 0.5 STTR awards granted per 10,000 business establishments. The median number of STTR awards granted in the 41 states was about 0.3 per 10,000 business establishments. The potential benefits from the STTR awards are many. First, the STTR program helps form strong technical relationships between small businesses and research institutions that can last beyond the performance of the specific grant. Second, small businesses receive capital to invest in new technology that can improve their market position. Third, the federal government may find new suppliers for technologically advanced products thus stimulating the growth of small businesses.

Relevance

This metric indicates the degree to which partnerships of small companies and non-profit research institutions in each state are participating in federally funded research and development and adding to the United States' base for creating technical innovation. The STTR program was started in 1992 for U.S. companies that have fewer than 500 employees and are operated on a for-profit basis. The program is widely recognized as a way to encourage technological innovation within small businesses and for building strategic linkages between businesses and research institutions. The STTR program funds research to evaluate the feasibility and scientific merit of new technology and to develop the technology to a point where it can be commercialized. It shares the philosophy of the Small Business Innovation Research (SBIR) Program but differs because it requires a partnership between small business and selected federal and non-profit research institutions.

Data Considerations and Limitations

The total STTR budget dictates how many awards will be given in any year. The STTR budget fluctuates depending on the level of the R&D budgets of participating federal agencies thus making year-to-year comparisons of state awards more difficult. Also, because of the relatively small number of awards each year, the actual number of awards going to any one state can vary widely on an annual basis. Using a three-year average helps to smooth out the yearly fluctuations.



Source of Data

STTR Awards Granted:

Small Business Administration. *Technology - 1999 STTR State Chart*. <http://www.sba.gov/SBIR/indexsbir-sttr-sttr99chart.html> (2002, August 1); Small Business Administration. *Technology - 2000 STTR State Chart*. <http://www.sba.gov/SBIR/indexsbir-sttr-sttr00chart.html> (2002, June 12); The 2001 STTR data was provided by the Small Business Adminstration, Office of Technology per a special request from Taratec Corporation, Columbus, Ohio. The data will be available online later this year at http://www.sba.gov/SBIR/indexsbir-sttr.html.

Establishments:

U.S. Census Bureau. *County Business Patterns - United States: 2000*. (2002, May). <http://www.census.gov/prod/2002pubs/00cbp/cbp00-1.pdf> (2002, June 12).

Average Annual Number of STTR Awards per 10,000 Business Establishments: 1999-2001

STATE	Average Annual STTR Awards	2000 Establishments	INDICATOR VALUE *	Rank	Indicator Value Index **
Alabama	8	99,817	0.8	7	172
Alaska	1	18,501	0.5	15	111
Arizona	7	114,804	0.6	13	119
Arkansas	1	63,185	0.2	37	33
California	48	799,863	0.6	11	123
Colorado	11	137,528	0.8	8	159
Connecticut	1	92,436	0.1	38	30
Delaware	0	23,771	0.1	39	29
Florida	12	428,438	0.3	22	59
Georgia	6	200,442	0.3	24	58
Hawaii	1	29,853	0.2	31	46
Idaho	1	37,429	0.3	27	55
Illinois	8	308,067	0.3	26	56
Indiana	3	146,321	0.2	34	42
Iowa	N/A	—	—	—	—
Kansas	1	74,939	0.2	36	37
Kentucky	2	89,921	0.3	28	53
Louisiana	N/A	—	—	—	—
Maine	N/A	—	—	—	—
Maryland	13	128,467	1.0	5	203
Massachusetts	39	176,222	2.2	1	459
Michigan	7	236,912	0.3	20	64
Minnesota	4	139,080	0.3	23	59
Mississippi	N/A	—	—	—	—
Missouri	4	144,755	0.3	29	52
Montana	2	31,849	0.7	10	151
Nebraska	N/A	—	—	—	—
Nevada	N/A	—	—	—	—
New Hampshire	N/A	—	—	—	—
New Jersey	10	233,559	0.4	17	88
New Mexico	6	42,782	1.4	4	288
New York	16	492,073	0.3	19	65
North Carolina	4	203,903	0.2	33	44
North Dakota	N/A	—	—	—	—
Ohio	20	270,509	0.7	9	152
Oklahoma	2	85,094	0.3	25	56
Oregon	3	100,645	0.3	21	61
Pennsylvania	10	294,741	0.3	18	67
Rhode Island	1	28,534	0.2	30	48
South Carolina	N/A	—	—	—	—
South Dakota	0	23,783	0.1	40	29
Tennessee	8	130,876	0.6	12	120
Texas	9	471,509	0.2	35	41
Utah	5	55,379	0.9	6	186
Vermont	1	21,564	0.5	16	95
Virginia	25	175,582	1.4	3	297
Washington	9	164,018	0.5	14	113
West Virginia	0	41,047	0.1	41	17
Wisconsin	3	140,415	0.2	32	44
Wyoming	3	18,120	1.8	2	378
41 States	**317**	**6,516,733**	**0.5**	**—**	**100**
Dist of Columbia	N/A	—	—	—	—
Puerto Rico	N/A	N/A	—	—	—

* (Average Annual STTR Awards / 2000 Establishments) x 10,000
** 100 equals 41-state indicator value

Technology Administration

STTR Award Dollars

Definition

The average annual dollar award of Small Business Technology Transfer Program (STTR) grants per $1,000 of gross state product (GSP) was calculated by averaging the dollar awards over the three-year period of 1999-2001 and dividing this average by the state's GSP in 2000. STTR awards are given to partnerships of small businesses and non-profit research institutions. Phase 1 and Phase 2 awards dollars were combined to compute this metric. STTR awards go also to small businesses in the District of Columbia. GSP is the output of goods and services produced by the labor and property located in the state.

Relevance

This metric is useful in understanding the magnitude of federal investment in research partnerships between small businesses and non-profit research institutions. The STTR program was authorized in 1992 for U.S. companies that have fewer than 500 employees and are operated on a for-profit basis. The program is widely recognized as a way to encourage technological innovation within small businesses and to build strategic linkages between businesses and research institutions.

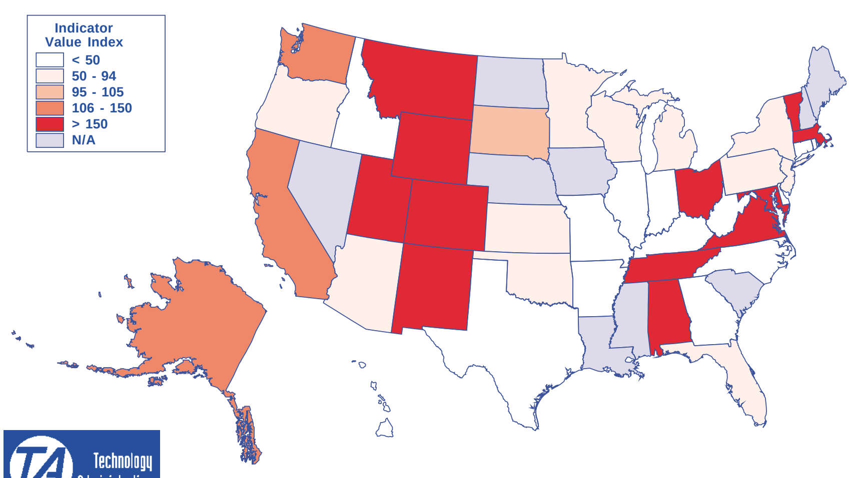
Each year, five federal departments are required to reserve a portion of their research and development (R&D) funds to award to small business/non-profit research institution partnerships. They include the Department of Defense, the Department of Energy, the Department of Health and Human Services, the National Aeronautics and Space Administration, and the National Science Foundation. Phase I awards of up to $100,000 cover approximately one year's exploration of the scientific, technical, and commercial feasibility of an idea or technology. Phase II awards can range up to $500,000 for two years to expand the Phase I results.

The U.S. Small Business Administration is the coordinating agency for the STTR program.

The total average annual STTR award dollars granted from 1999-2000 for 41 states was $60 million or $0.007 per $1,000 of U.S. gross domestic product (GDP). The median STTR award dollars granted in the 41 states was $0.005 per $1,000 of GSP. While the absolute dollars are a small part of GDP, the potential long-term benefits to small businesses and their local economy are much greater. First, small businesses are required to develop a strategic partnership with a federal research facility or non-profit research center. Second, small businesses are provided capital which is leveraged with their own investment dollars to develop new technology and products that can improve their market position. Third, the technology developed and commercialized as a result of the STTR awards may lead to the formation of new businesses or the accelerated growth of existing small businesses. Fourth, the federal government may find new suppliers for technologically advanced products thus stimulating the growth of small businesses.

Data Considerations and Limitations

The total STTR budget depends on the extramural R&D budgets of selected federal agencies. The STTR budget fluctuates depending on the agency budgets making year-to-year comparisons of state award receipt more difficult. Also, because of the relatively small number of awards each year, the dollar value of STTR awards going to any one state can vary widely on an annual basis. Using a three-year average helps to smooth out the yearly fluctuations.



Source of Data

STTR Award Dollars Granted:

Small Business Administration. *Technology - 1999 STTR State Chart*. <http://www.sba.gov/SBIR/indexsbir-sttr-sttr99chart.html> (2002, August 1); Small Business Administration. *Technology - 2000 STTR State Chart*. <http://www.sba.gov/SBIR/indexsbir-sttr-sttr00chart.html> (2002, June 12); The 2001 STTR data was provided by the Small Business Adminstration, Office of Technology per a special request from Taratec Corporation, Columbus, Ohio. The data will be available online later this year at http://www.sba.gov/SBIR/indexsbir-sttr.html.

Gross State Product:

U.S. Department of Commerce, Bureau of Economic Analysis. (2002, June). *Gross State Product: 2000.* <http://www.bea.doc.gov/bea/regional/gsp> (2002, June 10).

Average Annual STTR Award Dollars per $1,000 of GSP: 1999-2001

STATE	Average Annual STTR Dollars, thousands	2000 GSP, millions	INDICATOR VALUE *	Rank	Indicator Value Index **
Alabama	$1,924	$119,921	$0.016	6	249
Alaska	$233	$27,747	$0.008	13	130
Arizona	$876	$156,303	$0.006	17	87
Arkansas	$171	$67,724	$0.003	35	39
California	$9,294	$1,344,623	$0.007	15	107
Colorado	$2,050	$167,918	$0.012	9	189
Connecticut	$134	$159,288	$0.001	39	13
Delaware	$23	$36,336	$0.001	41	10
Florida	$2,363	$472,105	$0.005	18	78
Georgia	$863	$296,142	$0.003	31	45
Hawaii	$67	$42,364	$0.002	38	24
Idaho	$107	$37,031	$0.003	32	45
Illinois	$1,482	$467,284	$0.003	28	49
Indiana	$526	$192,195	$0.003	33	42
Iowa	N/A	—	—	—	—
Kansas	$334	$85,063	$0.004	24	61
Kentucky	$322	$118,508	$0.003	34	42
Louisiana	N/A	—	—	—	—
Maine	N/A	—	—	—	—
Maryland	$2,328	$186,108	$0.013	8	194
Massachusetts	$7,603	$284,934	$0.027	1	413
Michigan	$1,395	$325,384	$0.004	23	66
Minnesota	$682	$184,766	$0.004	25	57
Mississippi	N/A	—	—	—	—
Missouri	$557	$178,845	$0.003	30	48
Montana	$395	$21,777	$0.018	4	281
Nebraska	N/A	—	—	—	—
Nevada	N/A	—	—	—	—
New Hampshire	N/A	—	—	—	—
New Jersey	$1,735	$363,089	$0.005	20	74
New Mexico	$835	$54,364	$0.015	7	238
New York	$2,592	$799,202	$0.003	27	50
North Carolina	$665	$281,741	$0.002	37	37
North Dakota	N/A	—	—	—	—
Ohio	$4,051	$372,640	$0.011	11	168
Oklahoma	$456	$91,773	$0.005	19	77
Oregon	$563	$118,637	$0.005	22	74
Pennsylvania	$1,926	$403,985	$0.005	21	74
Rhode Island	$115	$36,453	$0.003	29	49
South Carolina	N/A	—	—	—	—
South Dakota	$150	$23,192	$0.006	16	100
Tennessee	$1,772	$178,362	$0.010	12	154
Texas	$1,837	$742,274	$0.002	36	38
Utah	$1,139	$68,549	$0.017	5	257
Vermont	$206	$18,411	$0.011	10	173
Virginia	$5,029	$261,355	$0.019	3	298
Washington	$1,796	$219,937	$0.008	14	127
West Virginia	$33	$42,271	$0.001	40	12
Wisconsin	$573	$173,478	$0.003	26	51
Wyoming	$437	$19,294	$0.023	2	351
41 States	**$59,639**	**$9,241,373**	**$0.007**	**—**	**100**
Dist of Columbia	N/A	—	—	—	—
Puerto Rico	N/A	—	—	—	—

* (Average Annual STTR Dollars / 2000 GSP) x $1,000
** 100 equals 41-state indicator value

Science Test Scores

Definition

The National Assessment of Educational Progress (NAEP) is the only nationally representative and continuing assessment of what students know in the areas of reading, mathematics, science, writing, history/geography, and other fields. The assessment represents the consensus of groups of curriculum experts, educators, and the general public on what should be covered in such a test. The scores reported in this metric refer to the results from eighth grade students in the area of science.

Relevance

NAEP is a congressionally mandated project of the National Center for Education Statistics, the U.S. Department of Education. This metric reports the average overall scale score for the field of science by eighth grade students by state from the 2000 NAEP assessment. It is an indicator of how effectively students in a particular state are learning science at the elementary and middle school levels.

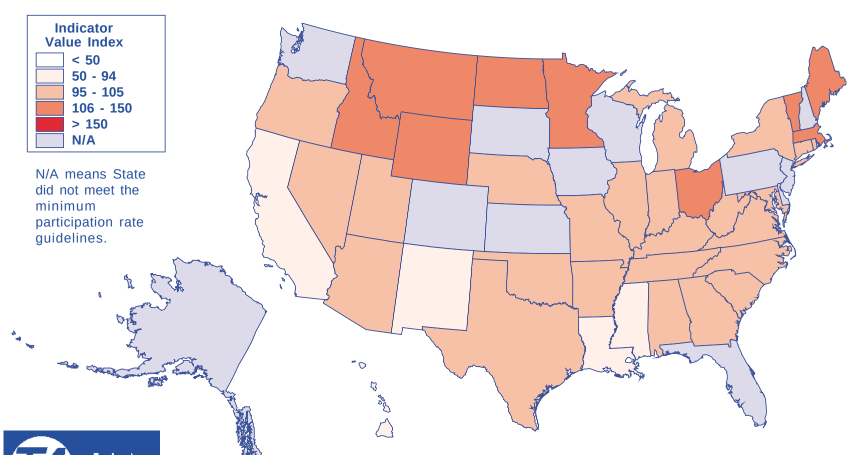
The scale for this test ranges from 0-300 points. The average national science score in grade eight rose from 150 in the 1996 assessment to 151 in the 2000 assessment. This increase was not statistically significant. The median state test score for the 38 participating states reporting results was 150 and the average state test score was 149.

The test is organized according to two dimensions: Fields of Science, and Ways of Knowing and Doing Science. Within this framework, three fields of science are addressed: earth, physical, and life sciences. The ways of knowing and doing science include: conceptual understanding, scientific investigation, and practical reasoning.

Data Considerations and Limitations

The 2000 science assessment for grade eight was conducted both nationally and on a state-by-state basis. National results are based on the national sample of 47,000 students from 2,100 schools that are representative samples of public and nonpublic schools. The state-by-state assessments included 180,000 students from 7,500 public schools in the state samples.

In 2000, a total of 39 states and 5 other jurisdictions participated in the grade eight assessment. States for which scores are reported but which did not meet one or more of the guidelines for school participation in 2000 include: Arizona, California, Idaho, Illinois, Indiana, Maine, Michigan, Minnesota, Montana, New York, Oregon, and Vermont. States that did not participate or failed to meet the minimum guidelines for participation include: Alaska, Colorado, Delaware, Florida, Iowa, Kansas, New Hampshire, New Jersey, Pennsylvania, South Dakota, Washington, and Wisconsin. No state scores have been included for these states.



Source of Data

The findings from the National Assessment of Educational Progress in science are found in the National Center for Education Statistics report titled, *The Nation's Report Card: Science Highlights 2000*. It is available electronically on the World Wide Web at <http://nces.ed.gov/nationsreportcard>.

NAEP Science Test Scores:

U.S. Department of Education, National Center for Education Statistics. *The Nation's Report Card: Science Highlights 2000*. <http://nces.ed.gov/nationsreportcard>. (2001, November 6).

National Assessment of Educational Progress (NAEP) in Science Average State Test Scores: 2000

STATE	INDICATOR VALUE	Rank	Indicator Value Index *
Alabama	141	33	95
Alaska	N/A	—	—
Arizona	146	26	98
Arkansas	143	30	96
California	132	37	89
Colorado	N/A	—	—
Connecticut	154	15	103
Delaware	N/A	—	—
Florida	N/A	—	—
Georgia	144	28	97
Hawaii	132	37	89
Idaho	159	8	107
Illinois	150	19	101
Indiana	156	11	105
Iowa	N/A	—	—
Kansas	N/A	—	—
Kentucky	152	17	102
Louisiana	136	35	91
Maine	160	6	107
Maryland	149	22	100
Massachusetts	161	2	108
Michigan	156	11	105
Minnesota	160	6	107
Mississippi	134	36	90
Missouri	156	11	105
Montana	165	1	111
Nebraska	157	10	105
Nevada	143	30	96
New Hampshire	N/A	—	—
New Jersey	N/A	—	—
New Mexico	140	34	94
New York	149	22	100
North Carolina	147	25	99
North Dakota	161	2	108
Ohio	161	2	108
Oklahoma	149	22	100
Oregon	154	15	103
Pennsylvania	N/A	—	—
Rhode Island	150	19	101
South Carolina	142	32	95
South Dakota	N/A	—	—
Tennessee	146	26	98
Texas	144	28	97
Utah	155	14	104
Vermont	161	2	108
Virginia	152	17	102
Washington	N/A	—	—
West Virginia	150	19	101
Wisconsin	N/A	—	—
Wyoming	158	9	106
38 States	**149**	—	**100**
Dist of Columbia	N/A	—	—
Puerto Rico	N/A	—	—

* 100 equals 38-state indicator value