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Overview of Report Findings

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http://www.csg.org/KnowledgeEconomy/
Key Motivating Ideas

• Research is a key drive of economic prosperity – both short-term economic activity and long-term growth.

• This report focuses on long-term growth – it’s not about easy fixes, but sustainable success.
Largest information technology company that you do not know.

Each year
• 1 million article manuscripts received by ~2,000 journals (all with Open Access options)
• 350,000 new articles published, in addition to 11M existing articles
• 2,000 new books published
• ScienceDirect: 750M digital article downloads

• Scopus: 57M records, 22,000 titles, 5,000 publishers, 700M citations, 80K books

• SciVal: 75 trillion metrics values
• Grants: 7,000 sponsors, 20,000+ active opportunities, ~5M awarded grants
• Patents: >93m records, 100 patent offices
• Compounds: 22M compounds, 35M reactions; 3.3M molecular facts
• Drug information: 16k branded drugs; 12k generic drugs
Content and data assets that are Deep and Broad

1.4bn US business contacts
Global business news
Over 30k sources
57 languages
Global patents
100 patent offices
>93m records
Secondary law
(regulations, directives, cases)
>60% of world’s primary laws published each year
Global air fleet specifications
Global commodities prices
US medical providers
6.5m entries
1.5bn US bankruptcy records
Global watch lists
1.2m+ entries
240 countries
Global disease pathways
3.3m molecular facts
8.4bn US names, addresses etc.
Global chemical compound & reaction databases
22m compounds; 35m reactions
2,500 journals; 1,800 books
US drugs database
16k branded drugs; 12k generic drugs
Events
500 in 40 countries
Event Participants
6m+
17% of global research
1.2m article submissions per year
12.5m articles on Science Direct

 Approximately 3 petabytes of unique and high quality content and leading open sourced Big Data technology HPCC
What content does Scopus include?

57M records from 22,000 serial titles and 80,000 books
21.4M pre 1996 records | 35.6 M post 1995 records

- Content from > 5,000 publishers
- “Articles in Press” from > 3,750 titles
- Titles from 105 different countries in all geographical regions
- 40 “local” languages covered
- More than 2,800 Open Access journals indexed

Physical Sciences
6,600
- Chemistry
- Physics
- Engineering
- etc.,

Health Sciences 6,300
- (100% Medline)
- Nursing
- Dentistry
- etc.,

Social Sciences
6,350
- Psychology
- Economics
- Business
- A&H
- etc.,

Life Sciences
4,050
- Neuroscience
- Pharmacology
- Biology
- etc.,

More than 20,400 titles in Scopus, titles can be in more than one subject area
Data sources to identify a state’s unique strengths

- Research output
- Identifying Key Research Strengths
- Patent citations
- Research Publication Downloads
- Research collaboration
- Relative article share
- Research impact
The development of MP3 technologies illustrates the unexpected benefits of basic research. In 1985, a hand-sized storage and playback device that would hold 15,000 recorded songs was the stuff of science fiction. Even simple hand-held calculators were rare and expensive at that time. Research funded by the Department of Defense, the National Science Foundation, the National Institutes of Health, the Department of Energy, and the National Institute of Standards and Technology contributed to the breakthrough technologies of magnetic storage drives, lithium-ion batteries, and the liquid crystal display, which came together in the development of MP3 devices. The device itself is innovative, but it built upon a broad platform of component technologies, each derived from fundamental studies in physical science, mathematics, and engineering.
Who Funds Basic Research?

Starts with new knowledge discovery and follows with Dissemination and Use to drive Innovations.
International **Comparative Performance** of the UK Research Base – **2013**

A report prepared by Elsevier for the UK's Department of Business, Innovation and Skills (BIS)
The Illinois science and technology roadmap

Full report

In partnership with:
Elsevier
Ocean Tomo

In collaboration with:
Dr. G. Scott Drexler,
University of Maryland
Mapping Research and Innovation
Understanding Amsterdam’s Competitive Advantage

CITY COMPETITIVENESS  RESEARCH STRENGTHS  RESEARCH TO COMMERCIALIZATION  MUNICIPAL TO GLOBAL

11 Comparator Cities
AMSTERDAM  BARCELONA  BERLIN  BRUSSELS  COPENHAGEN  DUBLIN  HAMBURG  MADRID  MANCHESTER  STOCKHOLM  VIENNA

September 2014

The Innovation and the Roadmap
Key Motivating Ideas

• Research is a key drive of economic prosperity – both short-term economic activity and long-term growth.

• This report focuses on long-term growth – it’s not about easy fixes, but sustainable success.

• States with strong research ecosystems are able to attract, grow, and retain innovative companies and high-wage jobs.

• This report outlines a process that states can take to identify and showcase their research strengths:
  - Research output and impact
  - Research focus
  - Inputs and research efficiency
  - Knowledge transfer and collaboration
George Lan
Analytical product manager
Elsevier
Production of research is not balanced in the US

- The combined absolute number of research publications of the top five states (California, New York, Massachusetts, Texas and Maryland) comprised more than 50% of the total U.S. output.
Many states produce highly cited research

- As a whole, the US produces highly impactful research, cited 49% more than the world average.
# Key Findings

## National

<table>
<thead>
<tr>
<th>Publication Rate</th>
<th>Per 1,000 Residents</th>
<th>Per million $USD R&amp;D expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.7</strong></td>
<td><strong>6.5</strong></td>
<td></td>
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</table>

## Top State

<table>
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<tr>
<th>Massachusetts</th>
<th>Minnesota</th>
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<tr>
<td><strong>7.5</strong></td>
<td><strong>10.5</strong></td>
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</table>

Publications produced per 1,000 residents, the highest of any state.

Publications produced per million $USD of R&D expenditures, the third highest among all states after Massachusetts and Delaware.

## Top Research Fields

<table>
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<th>Field 1</th>
<th>Field 2</th>
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<tbody>
<tr>
<td>Medicine</td>
<td>Engineering</td>
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</table>

## Collaboration Partners

**New York & Massachusetts**

From 2004–2013, researchers from these states collaborated on 37,972 publications, of which 43% were in medicine.

## Tennessee Growth in Research Impact

The field-weighted citation impact of Tennessee’s research grew from 1.54 in 2004 to 1.76 in 2013, or 1.5% per year over the past decade. This was the top growth rate among states that already achieved an impact above the U.S. average (1.49).

## North Carolina Research Strength in Medicine

Ranked in the top five among all states in both the relative volume of its research in medicine and the relative citation impact of its research in medicine.
### America's Knowledge Economy: A State-by-State Review

#### Texas

**Overview:** Research and development is a critical contributor to innovation and long-term economic growth, and the United States has a long history of being a global leader. According to a new collaborative report from The Council of State Governments and Elsevier—America’s Knowledge Economy: A State-by-State Review—the United States published more than 530,000 publications in 2013. Predictably, states with larger populations also tended to publish more. For example, California and New York were the top two producers from 2004 to 2013. From 2004 to 2013, a big chunk of United States publications—more than onethird—was focused on the field of medicine. Over the same period, Massachusetts and California produced the most impactful research—also called field-weighted citation impact—among all states. This brief offers a state-specific snapshot of data pulled from the report. To read the full report, visit [www.csg.org/knowledgeeconomy](http://www.csg.org/knowledgeeconomy).

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<th>Publications</th>
<th>Field-Weighted Citation Impact, 2004–2013</th>
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<td><strong>1.69</strong></td>
<td>1.58 Cited 58% more than global average</td>
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**1.69 Publications per 1,000 Residents, 2013**

U.S. Average: 1.70 publications per 1,000 residents

#### Comparative Advantage in Research

**Materials Science**

Ranked 7th among all states in terms of research impact and cited 9% more than the U.S. average.

- **California: Top Collaborating State, 2004–2013**
  - 36,577 collaborations from 2004–2013 (9.5% of all of Texas's publications)

**Research and Development Funding, 2004–2013**

3rd among all states | $43.1 billion

### Critical Mass of Research and Innovation, 2004–2013

Texas researchers and inventors account for 7.8% of all U.S. research publications (4th among all states) and 7.1% of all U.S. patents granted (2nd among all states).

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#### Virginia

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<th>Field-Weighted Citation Impact, 2004–2013</th>
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<tr>
<td><strong>2.34</strong></td>
<td>1.48 Cited 48% more than global average</td>
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**2.34 Publications per 1,000 Residents, 2013**

U.S. Average: 1.70 publications per 1,000 residents

#### Comparative Advantage in Research

**Medicine**

Cited 11% more than the U.S. average.

- **Maryland: Top Collaborating State, 2004–2013**
  - 15,246 collaborations from 2004–2013 (8.7% of all of Virginia's publications)

**Research from Medical Sector, 2004–2013**

16.7% of Virginia's total research output is from its government sector, the 5th highest rate among all states.

**Research from Corporate Sector, 2004–2013**

6.3% of Virginia's total research output is from its corporate sector, the 10th highest rate among all states.
A few examples ---

- California has a national patent share more than three times that of the next closest state, which is Texas. New York, Massachusetts and Washington round out the top five.

- Minnesota, Rhode Island and North Carolina are the top three states for medical research intensity.

- New Mexico, Idaho and Virginia are the top three states in engineering.

- Maryland, North Carolina and Nebraska lead in biochemistry, genetics and molecular biology.

- Alabama’s agricultural and biological sciences output is 18 percent higher than the national average.

- Arkansas’ relative output in business, management and accounting is second among all states, trailing only Oklahoma.
Relative volume: North Carolina specializes in the health sciences

- 28.7% of all US output was in the field of medicine, but an even higher percentage (38.6%) of North Carolina’s output was.
Relative volume and impact: North Carolina has a comparative advantage in medicine

• 3rd among all states in relative volume, 4th in relative impact
Relative volume and impact: New York has a growing advantage in computer science

- 4th among all states in relative volume, 10th among all states in relative impact
Research requires substantial investment

• US universities produced 12.7 publications per million $ USD of research and development expenditures.

• Map below shows range of states’ academic research outputs per million $ USD
But, the payoffs – driving innovation – are worth it

- Knowledge and basic research produced help drive innovation
- One proxy is how much academic research is cited in industry patents. For example, New York’s research in computer science from 2004-2012 has been cited in 1,026 patents so far.
- States with highest relative patent citation-to-publication shares shown below
Main Takeaways

• US produces a large amount of highly impactful research.

• Although the level of output and funding varies, quality research is distributed across the entire country.

• Through a variety of metrics, each state can identify its relative comparative research strengths.

• Research requires substantial focused investment, but the payoffs – driving innovation and future economic growth at the state level – are worth it.
How can you use this information?

• Identify what research areas your state is good at and leverage that expertise (to attract businesses, workers, students, etc.)
  - Ex) Major aerospace company relocating its R&D and production facilities to a state/region
    o Looking for an areas where high impact new knowledge is being produced + highly skilled graduates that can put it to work quickly

• Inform strategy and decisions about investments supporting higher education and research
  - Ex 1) Your state is applying for a multi-million dollar federal grant to open/renew a major energy research center
    o the application calls for evidence about the quality of the state’s past energy research.
  - Ex 2) Your state wants to stimulate small-business growth by connecting companies with academic researchers.
    o In what research areas should you focus talent and infrastructure investments?
Where can you get more detailed information about your state’s research output?

• Tip of the iceberg in terms of data and analysis

• [http://www.csg.org/knowledgeeconomy](http://www.csg.org/knowledgeeconomy) for full report and highlights about your individual state

• Our products and tools can help you dig deeper and identify your state’s clusters of expertise and the individual researchers/departments that drive research excellence.

• Online, ready-to-use tools ([SciVal](http://www.csg.org/knowledgeeconomy)) and custom analytic reporting available, depending on your needs

• For more information, see [http://www.elsevier.com/research-intelligence](http://www.elsevier.com/research-intelligence) and directly contact Daniel Calto ([d.calto@elsevier.com](mailto:d.calto@elsevier.com)) or George Lan ([g.lan@elsevier.com](mailto:g.lan@elsevier.com))
Overview of Report Findings

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Questions?

Please submit them in the question box of the GoToWebinar taskbar.