

AN EXPLAINER:

UNIVERSITIES OF CALIFORNIA AND TEXAS SYSTEMS AND MIT TOP RANKINGS FOR INNOVATION IMPACT

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The George W. Bush Institute-SMU Economic Growth Initiative [ranks the innovation impact of universities and academic medical centers by U.S. metro area.](#)

The University of California system, the University of Texas system, and the Massachusetts Institute of Technology are the best universities in America when it comes to turning research spending into innovation impact, according to a new report from the George W. Bush Institute-SMU Economic Growth Initiative.¹

That means they do better than anyone else in producing things like patents, technology licenses, licensing income, startup companies, STEM graduates, and citations in other researchers' academic papers and patents, based on George W. Bush Institute-SMU Economic Growth Initiative rankings of 177 individual institutions. The rankings use composite scores that quantify the impact of each university's research and innovation.

The report also ranks universities for innovation impact productivity, defined as their innovation impact per research spending dollar. This separate ranking acknowledges that very large universities are likely to generate more innovation output than smaller ones, but smaller institutions can be very successful in turning their available research spending budgets into transformational innovations. America has a strong interest in seeing its research universities get the best possible bang for the buck for each dollar of federal investment in research.

The nation's best-performing institutions for productivity in turning research spending into innovation impact include the California Institute of Technology (Caltech), the University of Florida, Arizona State University, Carnegie Mellon University, Brigham Young University, the University of Arkansas for Medical Sciences, and the Whitehead Institute for Biomedical Research.

WHY IT MATTERS

At a time when public trust in higher education institutions has experienced significant declines, it is vital to American prosperity that the nation's research institutions sustain and even strengthen their world-leading role in basic science and technological innovation.

¹ The University of California system, the University of Texas system, the University of Massachusetts system, the University of Maryland system, the State University of New York system, and the University of Colorado system report technology development data to the Association of University Technology Managers only at the systemwide level, so we calculate innovation impact scores at the system level for these institutions.

BEST PRACTICES

Three institution-specific factors help predict how universities score for innovation impact productivity, based on the report's quantitative analysis:

- **Technology commercialization policies:** The size of an institution's technology transfer office (TTO) and patenting budget relative to total research spending are predictive of innovation impact productivity. So is the professional background of the TTO head: Institutions with engineers as the TTO head outperform other institutions, all else equal.
- **Entrepreneurship programs:** Having a teaching entrepreneurship program predicts higher innovation impact productivity.
- **Industry funding as share of research budget:** Institutions that receive above-average industry funding as a share of research spending tend to realize lower innovation impact productivity, all else equal. Industry funding may push researchers toward firm-specific projects that lead to fewer papers, patents, licenses, and spinout companies than projects focused on transformational basic research. Also, industry funding ratios are uncorrelated with research spending, so institutions that receive large industry funding don't seem to have more resources as a result.

HOW THEY DO IT

Eds and meds institutions that outperform for innovation impact are generally ones that choose to do so. Here are some of the strategies that are helping today's high-performing institutions maximize their innovation impact productivity:

- Incentivizing blue-sky research on society's largest challenges.
- Instilling institution-wide cultures of innovation and entrepreneurship.
- Optimizing technology commercialization operations.
- Supporting local innovation and entrepreneurship ecosystems.
- Partnering with local organizations on research for social good.
- Ensuring freedom of inquiry and expression.

HOW WE COMPARE INSTITUTIONS

The report divides institutions into five groups to compare peers of similar scale and mission according to their productivity in turning research spending dollars into innovation impact.

- **Large research universities:** Institutions that operate undergraduate and graduate degree programs and spent more than \$515 million on research on average between 2016 and 2020.
- **Midsized research universities:** Operate undergraduate and graduate degree programs and spent between \$205 million and \$515 million on research on average between 2016 and 2020.
- **Smaller universities:** Operate undergraduate and graduate degree programs and spent less than \$205 million on research on average between 2016 and 2020.
- **Medical centers:** Operate patient care as well as research facilities; no undergraduate degree programs.
- **Pure research institutes:** No degree programs or patient care facilities.

RANKINGS

America's top-performing universities for innovation impact comprise a mix of public and private institutions, as the following table shows. The highest-impact institutions are a relatively concentrated group: Just 30 eds and meds institutions account for 46% of all university research spending in the United States and 44% of the sector's total innovation impact as we measure it.

Table 1

Best Performing Eds and Meds Institutions for Overall Innovation Impact
(Top 15 of 177 ranked institutions)

	Institution	Innovation Impact	Research Spending (\$m)	Innovation Impact Productivity
1	University of California System	100.0	\$ 5,611	1.78
2	University of Texas System	56.4	\$ 3,010	1.88
3	Massachusetts Institute of Technology	33.8	\$ 1,782	1.89
4	University of Michigan	27.8	\$ 1,546	1.80
5	University of Washington	27.5	\$ 1,300	2.11
6	Harvard University	25.6	\$ 882	2.91
7	University of Pennsylvania	25.4	\$ 986	2.58
8	University of Minnesota	24.4	\$ 997	2.45
9	University of Florida	22.8	\$ 668	3.41
10	Stanford University	21.9	\$ 1,388	1.58
11	Purdue University	21.1	\$ 659	3.20
12	Arizona State University	20.3	\$ 599	3.39
13	Johns Hopkins University	20.2	\$ 1,778	1.14
14	University of Massachusetts System	20.2	\$ 685	2.95
15	Northwestern University	19.6	\$ 601	3.27
	Average for All Institutions	7.7	\$405	2.86

The best-performing institutions dramatically outperform peer institutions for innovation impact productivity, as the next table shows. Caltech, for instance, generates more than 2.5 times as much innovation output from each research dollar than the average large university. Also, university size doesn't predict productivity: High-performing smaller institutions like Brigham Young, the University of Arkansas for Medical Sciences, the Whitehead Institute, and the Cold Spring Harbor Laboratory achieve far greater innovation impact productivity than most large universities.

Table 2

Best Performing Eds and Meds Institutions for Innovation Impact Productivity
(Top 5 in each of five groups)

	Institution	Innovation Impact Productivity	Innovation Impact	Research Spending (\$m)
Large Universities:				
1	California Inst of Technology	4.91	19.1	\$ 389
2	University of Florida	3.41	22.8	\$ 668
3	Arizona State University	3.39	20.3	\$ 599
4	Northwestern University	3.27	19.6	\$ 601
5	Purdue University	3.20	21.1	\$ 659
Average of Group		1.93	18.0	\$ 971
Midsized Universities:				
1	Carnegie Mellon University	5.48	14.6	\$ 266
2	University of New Mexico	5.43	13.3	\$ 244
3	Princeton University	4.53	13.3	\$ 293
4	Washington State University	3.57	7.2	\$ 201
5	University of Chicago	3.51	12.4	\$ 355
Average of Group		2.29	5.4	\$ 233
Smaller Universities:				
1	Brigham Young University	30.75	10.6	\$ 35
2	WiSys Technol Foundation	18.82	3.4	\$ 18
3	Worcester Polytechnic Inst	11.62	3.7	\$ 32
4	University of Akron	11.56	4.3	\$ 37
5	U of North Carolina Charlotte	7.94	3.3	\$ 41
Average of Group		5.13	2.2	52
Medical Centers:				
1	Univ of Arkansas for Med Sci	4.17	2.3	\$ 56
2	U of North Texas Health Sci Ctr	3.02	1.4	\$ 45
3	Massachusetts General Hospital	2.02	19.0	\$ 941
4	Cedars-Sinai Medical Center	1.91	3.4	\$ 176
5	Dana-Farber Cancer Institute	1.82	5.7	\$ 314
Average of Group				
Pure Research Institutes:				
1	Whitehead Inst for Biomed Res	5.70	2.5	\$ 44
2	Cold Spring Harbor Laboratory	4.82	6.7	\$ 139
3	Wistar Institute	2.86	1.9	\$ 68
4	Zucker Inst for Innov Comm	1.72	4.5	\$ 264
5	Salk Inst for Biological Studies	1.02	1.1	\$ 109
Average of Group		2.72	3.4	\$ 358

RECOMMENDATIONS

State and local policymakers should do the following to amplify the innovation impact of eds and meds institutions:

- Redirect state funding streams to promote innovative eds and meds research, support technology commercialization initiatives, and foster the growth of innovation districts and other innovation ecosystems.
- Require consistent reporting of innovation impact outcomes by public universities and academic medical centers.
- Mandate commitment to free inquiry and objective research as condition for funding.
- Work with eds and meds institutions on research for social good.
- Act as a convener on local or statewide innovation initiatives.

The federal government also has a vital role to play, primarily as a funder, in supporting transformational research by eds and meds institutions and fostering local innovation ecosystems.

- Congress should raise federal investment in R&D by at least 50% to 1% of U.S. GDP, the report argues.
- Congress should also shift funding streams to incentivize more blue-sky, transformational research; fund the true cost of medical research and reduce cross-subsidization by patient care revenues at academic medical centers; and support local innovation ecosystems with evergreen, peer-reviewed funding programs.

CONCLUSION

Innovative research conducted at America's eds and meds institutions is more important than it's ever been to state and local economies, as well as to the nation's future. But university and academic medical centers need to pursue significant reforms, engage more effectively in surrounding communities, and rebuild public trust. States and localities have a vital interest in ensuring they succeed.

SOURCES AND METHODS

Our composite innovation impact scores are based on institutions' performance on nine "output" metrics from 2016 to 2020:

- Patents issued per year.
- Intellectual property (IP) licenses signed per year.
- IP license income earned per year.
- Spinout companies formed around university IP per year.
- IP licenses signed with spinout companies per year.
- Citations of papers by university researchers in other academic papers over the period.
- Citations of papers by university researchers in issued patents over the period.
- Number of bachelor's and master's degree graduates in STEM fields over the period.
- Number of Ph.D. graduates in STEM fields over the period.

Data for the first five metrics, plus total research spending for each institution, come from the Association of University Technology Managers dataset. Paper and patent citations come from Google Scholar and Google Patent searches, respectively. STEM graduate numbers come from U.S. Department of Education data on postsecondary institutions.

We standardize scores on each metric by dividing by the standard deviation of the distribution of scores across universities, use weightings from principal component analysis to combine each institution's nine scores into a raw composite score, then recalibrate so that the top-ranking institution (the University of California System) has a score of 100. Our analysis replicates the method we and partners from Opus Faveo Innovation Development employed in a 2020 [report](#) with data from 2013 to 2017.

We calculate total innovation impact scores for whole metropolitan areas – our "BushEds" scores – by summing the output scores for all institutions in a metro area. We calculate BushEds per Capita scores by dividing each metro's aggregate BushEds score by total 2020 population. We calculate innovation impact productivity scores for individual institutions by dividing each institution's innovation impact score by its average annual research spending between 2016 and 2020.

See our [full report](#), Appendix 1, for a full explanation of sources and methods used in these rankings.

Our [main report](#) offers extensive examples of how individual institutions are pursuing each of these strategies.

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GEORGE W. BUSH INSTITUTE-SMU ECONOMIC GROWTH INITIATIVE

The Bush Institute-SMU Economic Growth Initiative combines the public policy expertise of the George W. Bush Institute and the academic expertise of SMU. The joint initiative draws from economic policy-making experience at the highest levels and from cutting edge academic research to identify ideas for promoting innovation, entrepreneurship, and faster, more inclusive growth through global competitiveness and sound immigration policy.



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