Metro Milwaukee's Academic R&D

Viewed through the lens of economic development

November 2004

Summary:

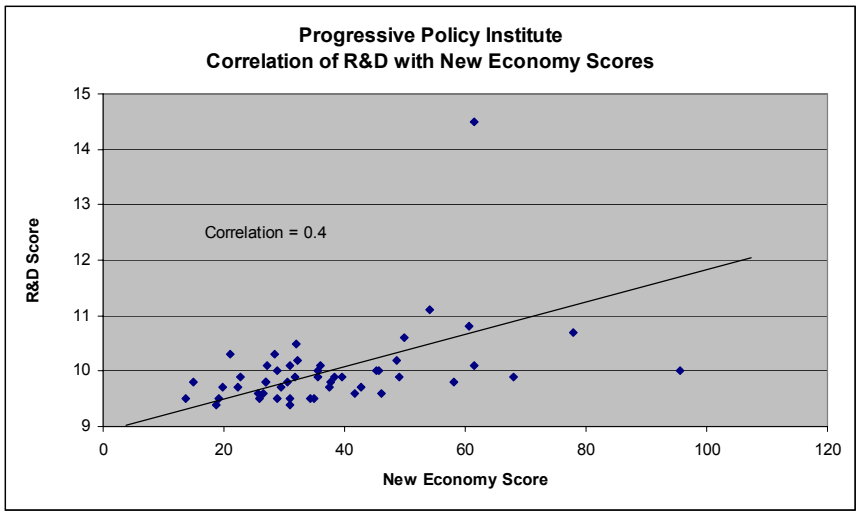
Academic R&D spending and the researchers who lead it are key catalysts for starting new technology companies in many metro areas. Metro Milwaukee is home to many islands of talented researchers who are pushing back the boundaries of their specialized academic fields. The Metro Milwaukee academic institutions are initiating collaborative programs between institutions to offer interdisciplinary perspectives that spawn innovation. TechStar is a collaborative venture between Metro Milwaukee research institutions that facilitates the transfer of technologies to startups; in the last three years Metro Milwaukee has established performance metrics that lead the country in spinouts per research dollar.

And yet, the economic problems in Wisconsin generally, and Metro Milwaukee in particular, are far from solved. Metro Milwaukee is the most significant determinant of the state's economy, which suffers from a dependence on traditional manufacturing jobs. Metro Milwaukee has especially low rankings in new economy strength. Relative to other metro area research institutions, the comparable per capita research spending is three times lower! Other states fund initiatives to build collaborative bridges between research institutions, such as the five-year, $70 million collaborative program between Mayo Clinic and the University of Minnesota. The Biomedical Technology Alliance (BTA) in Metro Milwaukee is such an initiative. Our mission: Building collaborative bridges to increase academic research capacity in Metro Milwaukee.

Written by
Lane Brostrom

R&D Impact. Academic research and development is one of the key drivers of economic growth. Metropolitan areas that have academic institutions performing large amounts of R&D are more able to attract and grow technology companies, as exemplified by MIT and Stanford, who played and continue to play critical roles in propelling the regional economies to the economies of Boston and Silicon Valley. As reported recently by the Wisconsin Technology Council, academic R&D is an integral part of the innovation economy, with contributions in the form of patents, new commercial products, skilled employees, new companies, job creation, and tax revenues.[1] The Association of American Universities concluded that there is an economic multiplier of 36 jobs per $1 million spent on academic R&D.[2]

New Economy Index. The Progressive Policy Institute has done a study of the 50 top metro areas in the US, ranking them based on their new economy strength.[3] Milwaukee, which is the 19th largest city in the US, is ranked 40th on new economy scores – see rankings table. An essential component of the new economy index is R&D spending by academic institutions. In fact, R&D spending scores have a correlation of 0.4 with new economy scores, suggesting a significant positive relationship between the two scores – see scatter plot.



Metro New Economy Rankings

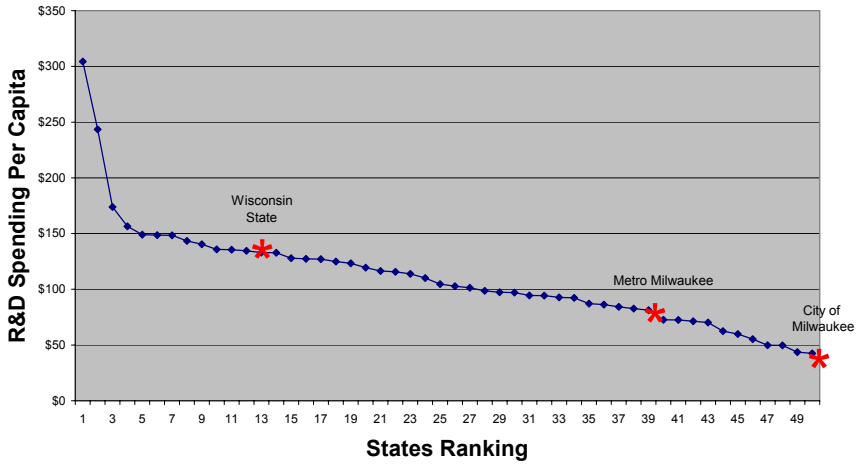
Rank	Metro Area	Score
1	San Francisco	95.6
2	Austin	77.9
3	Seattle	68
4	Raleigh-Durham	61.4
5	San Diego	61.4
6	Washington	60.6
7	Denver	58.1
8	Boston	54
9	Salt Lake City	49.8
10	Minneapolis	49
11	Atlanta	48.6
12	Dallas	46
13	Miami	45.6
14	Houston	45.3
15	Portland	42.7
16	Phoenix	41.6
17	New York	39.5
18	Philadelphia	38.3
19	Chicago	37.7
20	Los Angeles	37.4
21	Rochester	36.1
22	Hartford	35.6
23	Sacramento	35.5
24	Kansas City	35
25	Orlando	34.3
26	Richmond	32.3
27	St. Louis	31.9
28	Detroit	31.8
29	Indianapolis	31
30	Charlotte	31
31	Buffalo	30.9
32	Nashville	30.6
33	Cleveland	29.5
34	Cincinnati	28.9
35	Las Vegas	28.8
36	Columbus	28.5
37	Pittsburgh	27.1
38	New Orleans	27
39	Oklahoma City	27
40	Milwaukee	26.5
41	West Palm Beach	25.8
42	Dayton	25.7
43	Tampa	22.8
44	Norfolk	22.4
45	Greensboro	21
46	Louisville	19.8
47	Memphis	19.2
48	Jacksonville	18.7
49	San Antonio	15
50	Grand Rapids	13.6
	Top 50 Metro Average	**37.6**

R&D in SE Wisconsin and Milwaukee. Using available and comparable data for 2001, Metro Milwaukee spent roughly $117 million per year in academic R&D. Of this, the Medical College of Wisconsin had the largest portion, estimated at $85 million. This is followed by UW-Milwaukee with $24 million, Marquette with $7 million, and MSOE with $2 million.[4]

Per Capita R&D Spending. States can be compared on the basis of per capita R&D spending. The state of Wisconsin ranks in the top third of all states with a per capita spending of $133 – see plot below. Metro areas can also be compared on this basis as well. There are roughly 1.5 million people in Metro Milwaukee (including Waukesha and West Allis), giving it a per capita R&D level of $78; the city of Milwaukee counts roughly 1 million people, giving it a per capita R&D spending level of $38. When we overlay the per capita spending of our metro areas on the graph below, we see that Metro Milwaukee places in the lower third of state measures, and the city of Milwaukee would rank dead last and off the scale relative to measures of the individual 50 states.

[1] The Economic Value of Research and Development in Wisconsin, September 2004, by the Wisconsin Technology Council.
[2] www.bea.gov/regional/rims/brfdesc.cfm
[3] http://www.neweconomyindex.org/metro/introduction.html
[4] thecenter.ufl.edu/research2002.html

State R&D Per Capita Spending
As Measured by State Populations



Typically, larger metropolitan areas with several research institutions inside their urban boundaries lead their states in per capita R&D spending. The table below represents several metro areas with similar populations and their respective per capita R&D spending relative to their state levels.

Per Capital R&D Spending for Selected Metro Areas Compared to State Levels

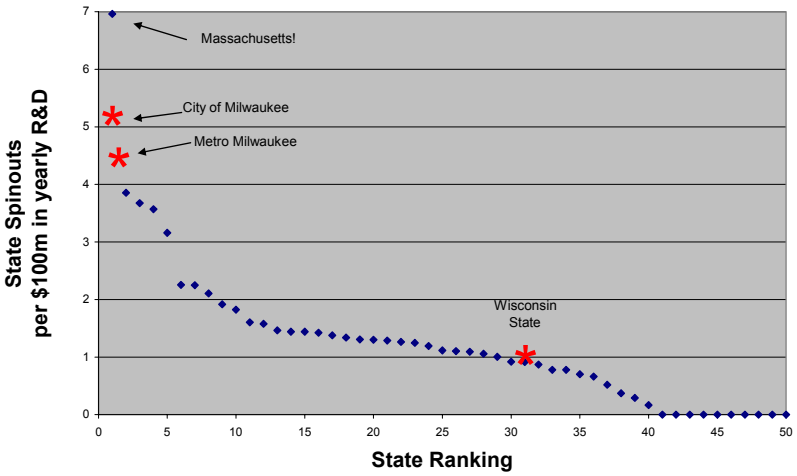
MSA (Metro Statistic Area)	MSA Population	MSA Institutions	MSA 2001 R&D Dollars	MSA Per Capita R&D	State Per Capita R&D	Delta	Delta %
Pittsburgh	2,400,000	3	$496,000,000	$207	$136	$71	52%
St. Louis	2,700,000	4	$450,000,000	$167	$120	$47	39%
Minneapolis	3,000,000	5	$465,000,000	$155	$93	$62	67%
Cincinnati	2,000,000	3	$207,000,000	$104	$87	$17	19%
Cleveland	2,100,000	4	$212,000,000	$101	$87	$14	16%
Metro Milwaukee	1,500,000	4	$117,000,000	$78	$132	**($54)**	**-41%**

Emerging Strength. There is great diversity among the individual Metro Milwaukee research institutions: a medical school, a dental school, a rich spectrum of engineering disciplines, technical colleges, clinical programs, biotech programs, three business schools, a law school, and collaborative programs with regional hospitals and state businesses. Metro Milwaukee is home to some of the most advanced basic research accomplishments, particularly in the areas of: functional MRI, systems biology, molecular genetics, bioinformatics, intelligent maintenance, functional genomics and proteomics, rehabilitation engineering, therapeutics, medical diagnostics, water science, and cardio vascular science.[5] Between 1998 and 2001, Metro Milwaukee research institutions have shown significant growth in research spending: MCW – 50%, UWM – 13%, Marquette – 7%, and MSOE – 24%.

With economic development built into mission statements, Metro Milwaukee research institutions have established the kind of technology transfer programs that contribute new technology companies to the local economy. In the last three years, Metro Milwaukee research institutions licensed technologies into 15 local start-up companies.[6] The effectiveness of regional spinout activity can be compared to other states in ratio to R&D spending – see below.[7]

[5] A recent, more comprehensive report of areas of excellence in Metro Milwaukee academic R&D has been developed by Bill Hendee at the Medical College of Wisconsin; whendee@mcw.edu.
[6] MCW – Medical Advances, PointOne, Prodesse, PhysioGenix, ArgiNOx, Cytometix, Bioinnovation, Neurognostics, OncoDetect; UW Milwaukee – NovaScan, PackageScan, Intelligent Maintenance Systems, JunTech; Marquette – Parident Therapeutics; MSOE – 3D Molecular Designs.
[7] http://drc.cfed.org/measures/univ_spin.html

State Spinouts Per $100m in R&D Spending
As Measured by Individual States



Whereas the state of Wisconsin has marginal performance in these metrics, with 0.9 spinouts per $100 million in R&D spending, the spinout metrics of Metro Milwaukee (4.3) and the city of Milwaukee (5.1) are only behind the state of Massachusetts in leading the country.[8]

Metro Milwaukee is home to numerous health, technology and service companies that collaborate with research institutions. GE Medical Systems, one of the largest employers building a large research facility next to MCW, is collaborating extensively with MCW, UWM, Marquette and MSOE in the research and development of new technologies, applications and products.

Metro Milwaukee research institutions are active collaborators with one another. The institutions collaborate in TechStar, a technology transfer and business venturing organization. There are numerous joint research and education programs and many research faculty members that are shared between institutions. Such programs include the Functional Imaging and Biomedical Engineering Programs shared between MCW and MU; the Medical Informatics programs between MCW, MU, UWP and MSOE; and the Medical Informatics Program between MCW and UWM.

Conclusion. Metropolitan Milwaukee is home to 28% of Wisconsin's population, 28% of its companies, and 30% of its jobs – giving credence to statement: as goes Milwaukee's economy, so goes Wisconsin's. Wisconsin's economy suffers from low average wages, low venture capital investment levels, and high taxes. Moreover, Metropolitan Milwaukee suffers from a reduced strength in its traditional manufacturing sector and a relative weakness in its new economy measures. In Metro Milwaukee, MCW is a clear early leader in academic R&D, but MCW's spending levels are far short of the level needed to bring Metro Milwaukee to comparable metro areas. To achieve mediocre per capita R&D spending levels among the other three research institutions in the city of Milwaukee, and to give a breadth and depth in unique areas that support both MCW and a developing metro economy, R&D spending levels should be above $100 million per year – roughly triple current levels. Given the importance of academic R&D in the tech-led economic development continuum, improving R&D capabilities should be a clear imperative for Metropolitan Milwaukee and the state of Wisconsin.

Limiting Factors. There are a few limiting factors that should be addressed in growing Metro Milwaukee's academic R&D. In all, Metro Milwaukee research institutions count full-time student populations of approximately 36,300 – almost identical to UW-Madison. However, these students are divided among five individual public and private institutions with unique governance, charters and missions. Within any one institution, there are islands of specialized research talent that do not have the opportunity to engage in

[8] Remember: this metric is a ratio – Metro Milwaukee is skilled in the numerator, but deficient in the denominator.

interdisciplinary developments because of a lack of inter-institutional visibility and a lack of incentives to reach outside of their existing institution. In most cases, interdisciplinary research becomes fundable only after preliminary research has already been performed showing promising preliminary results with established collaborators.

Over the last three years, there are significant disparities between Madison and Milwaukee in the allocation of state financial resources to support the development of interdisciplinary R&D infrastructure in each region – see table below.[9]

Metro Madison	**Amount**	**Metro Milwaukee**	**Amount**
BioStar Buildings	$320,000,000	TechStar	$2,700,000
WARF (~$30m/yr)	$90,000,000	MCW Biomedical Building	$88,000,000
HealthStar Building	$134,000,000		
Total:	$544,000,000	Total:	$90,700,000

Additionally, within the UW System, there are wide disparities in the distribution of operating funds. Though both Madison and Milwaukee schools are research oriented, operating funds for Madison are $28,659 per student, but for Milwaukee funds are $17,719.[10] If Milwaukee were allocated the same per student operating funds as Madison, operating funds to Milwaukee would be increased by over $200 million per year.

Recommendations. Academic R&D is an important contributor to the economic development continuum in any region. The most commercializable innovations result from interdisciplinary collaborations with talented researchers. However, the talented interdisciplinary programs in Metro Milwaukee are divided among different research institutions. Other states fund initiatives to build collaborative bridges between research institutions as a means for economic development. One such example is the collaborative program between Mayo Clinic and the University of Minnesota, which received a 5-year, $70 million commitment from the state of Minnesota to support collaborative R&D. Conservative projections show that the economic activity generated by the collaboration could result in 4,000 net new direct and indirect jobs, and $290 million in overall new impact annually to the state of Minnesota by 2010.[11]

With the goal of increasing the academic R&D capacity in Metro Milwaukee to levels commensurate with similar metro areas and with the needs of Milwaukee's economy, we recommend the following:

1. Leading researchers and research institutions in Metro Milwaukee must continue to encourage and foster collaborative efforts between institutions and be unified in promoting the funding of collaborative R&D infrastructure.
2. Elected officials should remedy the disparities in funding interdisciplinary research programs between the metro areas of Madison and Milwaukee; UW officials should remedy the funding disparities between UW-Madison and UW-Milwaukee.
3. Elected officials, researchers, and research institutions should consider the BTA as a collaborative program for increasing the academic R&D capacity for Metro Milwaukee; the BTA will be developed similarly to the collaboration between the Mayo Clinic and University of Minnesota.

[9] Funding references: Biostar - The Economic Value of Research and Development in Wisconsin, September 2004, by the Wisconsin Technology Council; WARF - http://www.warf.ws/aboutus/; Healthstar - http://www.news.wisc.edu/releases/10391.html; TechStar - internal; MCW - http://www.doa.state.wi.us

[10] http://www.legis.state.wi.us/lab/reports/04-10full.pdf

[11] http://www.mayoclinic.org/news2004-rst/2130.html