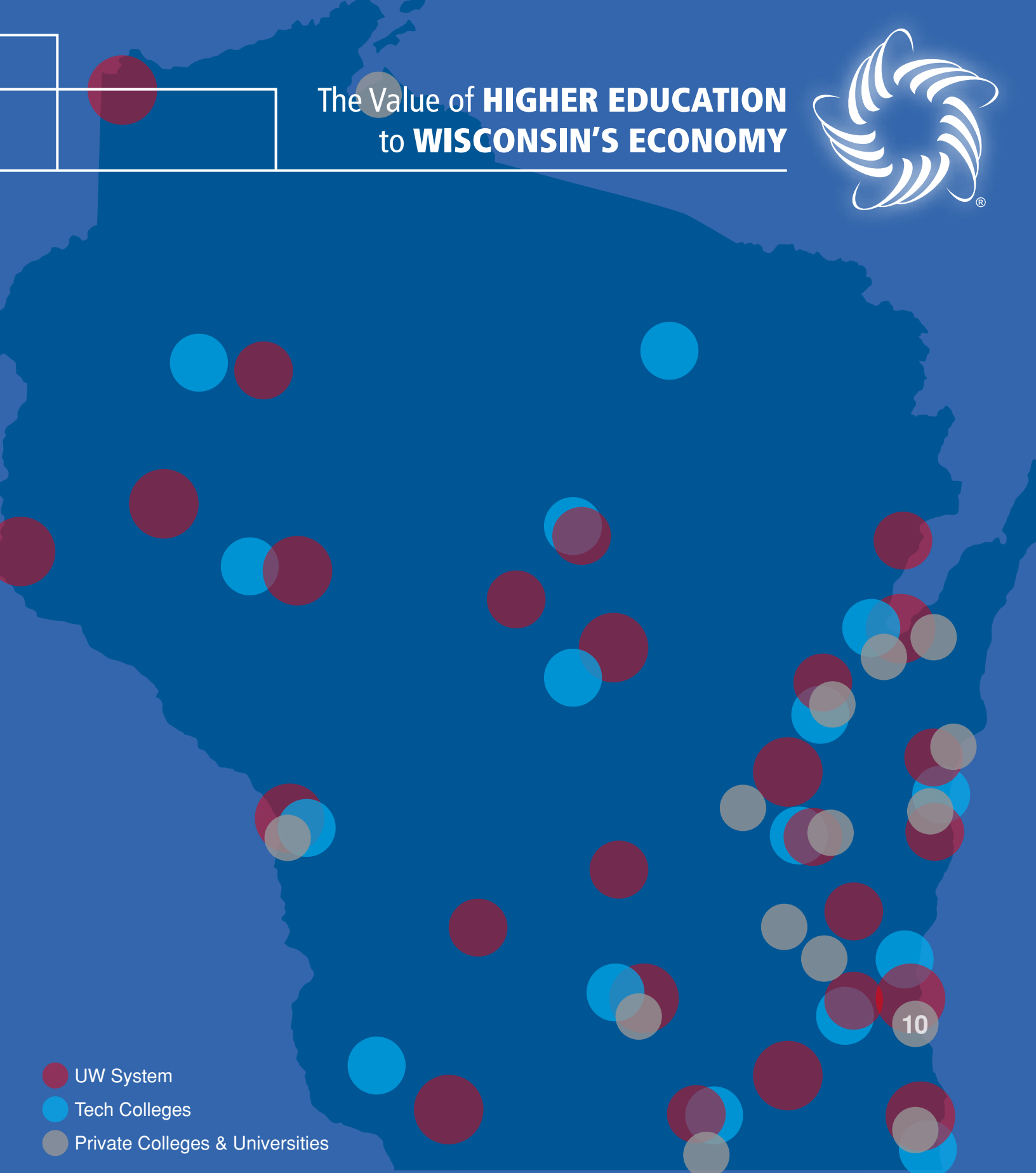


The Value of **HIGHER EDUCATION** to **WISCONSIN'S ECONOMY**



- UW System
- Tech Colleges
- Private Colleges & Universities

May 2016

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Design:
Makin' Hey! Communications

Printing:
Econoprint, Inc.

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EXECUTIVE SUMMARY

Policymakers in Wisconsin, much like their counterparts elsewhere, are coming to grips with the value of higher education in our modern “Innovation and Knowledge Economy.” In Wisconsin, this means addressing issues related to the UW System, the Wisconsin Technical College System and the private universities and colleges that make up the Wisconsin Association of Independent Colleges and Universities.

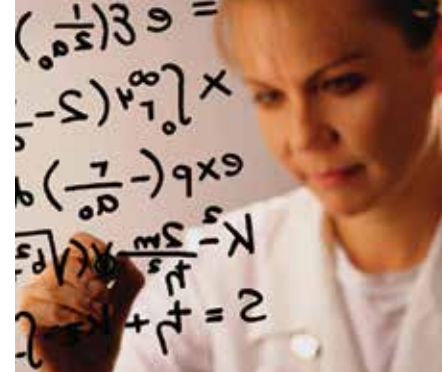
The Wisconsin Technology Council wants to assist in that debate by offering recommendations for a comprehensive look at the challenges and opportunities facing higher education.

Here are factors to be considered in fine-tuning this vital economic engine, as first identified in a resolution passed by the Tech Council’s executive committee:

- **Recognize fundamental differences between the UW’s doctoral-granting campuses** and the system’s four-year institutions. Doctoral campuses are research engines and producers of advanced degrees, with different faculty requirements, student bodies and even facilities. Comprehensive campuses are known first for undergraduate educational quality and access – but conduct an increasing amount of research. Wisconsin must maintain UW-Madison’s status as a top-five research university, elevate UW-Milwaukee’s capacity in the state’s largest city and maintain excellence and access for our four-year comprehensive campuses. Attempts to standardize missions would be stultifying and unresponsive to a changing marketplace.
- **Recognize the critical importance of talent development and attraction for the future of all sectors in Wisconsin’s economy.** When today’s kindergartners enter the workforce, 62 percent of all jobs in Wisconsin will require postsecondary education. Those same kindergartners, according to the U.S. Bureau of Labor Statistics, will change jobs/careers 11 times in their working life. The fundamental educational mission (teaching and learning) of all public and private nonprofit colleges and universities must be supported and enhanced.
- **Attract and retain the best faculty and researchers at all of our institutions.** The best teachers produce better-prepared graduates, who form the workforce of tomorrow. The best researchers excel at attracting the external grant funding that creates jobs, leads to patentable discoveries, and often is the catalyst for the formation of high-growth companies. To better compete, Wisconsin must attract and retain faculty members who feel they have the freedom to teach, research and grow within one of the nation’s premier systems.
- **Keep our universities affordable and accessible for all residents who want to get a college education in Wisconsin.** We must attract the best and brightest students from Wisconsin and around the globe, and excel at retaining the best and brightest. Wisconsin ranks 30th among 50 states in the percentage of adults with a bachelor’s degree or higher. It ranks 27th in per capita student aid. Thousands of Wisconsin students with financial need are turned away because Wisconsin Grants are underfunded.



UW-Milwaukee Innovation Accelerator



WITH THOSE PRINCIPLES IN MIND, THE TECH COUNCIL OFFERS THE FOLLOWING RECOMMENDATIONS:

- The grant maximums have been stagnant (under \$3,000) for years. Student aid empowers students to pursue the postsecondary option that is the “best fit” for them. At the same time, colleges and universities should encourage a culture of achieving cost efficiencies. Administrative functions can be consolidated to save money and improve service without touching the core enterprise. For example: Members of the Wisconsin Association of Independent Colleges and Universities have saved more than \$100 million over 10 years by collaboration on purchasing and back office functions; about \$20 million in 2015 alone.
- **Improve the transfer of knowledge and ideas into a prosperous Wisconsin economy.** We need to capture innovation, nurture its development, encourage commercialization and foster the pathway to success. This requires removing internal roadblocks and identifying and filling the gaps in the development continuum. For students in every field, Wisconsin must excel at the translation of knowledge gained in the classroom to skills that advance productive careers.
 - **Be aware of the competitive world around us.** Policies and strategies must evolve with an eye to the competitive dynamics of other states and nations. If we have advantages, others will try to emulate and surpass us. Wisconsin cannot be complacent about its strengths and it cannot close the competitive gap without understanding what those ahead of us are doing. Excellence in higher education is a Wisconsin brand to be nourished. We profit from that brand by maintaining world-class quality, which attracts and retains homegrown and outside talent. Students from well outside Wisconsin will pay a premium price for a premium education ... on campus or virtually ... if that brand is nurtured.
1. In making funding and programming choices, policymakers should compare UW-Madison with its national peers (the nation’s top 25 research universities as defined by the National Science Foundation) and UW-Milwaukee with its peers (those 20 institutions in major metropolitan areas that aren’t “flagships” but which offer doctoral level work and have an urban mission).
 2. Examine ways to speed time to graduation, which varies greatly within the UW System; consider ways to improve portability of credits within institutions; and accelerate programs that allow high-school students to get a “head start” on college through advanced placement courses and similar strategies. Wisconsin’s private colleges and universities offer a ready example. Both the UW and Wisconsin’s private nonprofit colleges and universities have instituted three-year degree programs, flexible degrees which give credit for prior learning and blend on-line and face-to-face learning, and encourage AP and Course and Youth Option programs. The real challenge is that only a few take advantage of these opportunities – again, perhaps, because funding of Wisconsin Grants is so low that students have to work so much that it lengthens their time to degree.
 3. The UW Board of Regents, working with its Tenure Policy workforce and responding to legislative initiatives, has approved policies that reflect best tenure policy practices nationally as well as within the UW System. Clear tenure policies help attract talent in a competitive industry. In a world with changing economic, social and political needs, the Regents and the UW System should monitor how tenure may continue to evolve over time while protecting core principles of academic freedom and freedom of expression.

Expenditures per Degree Granted

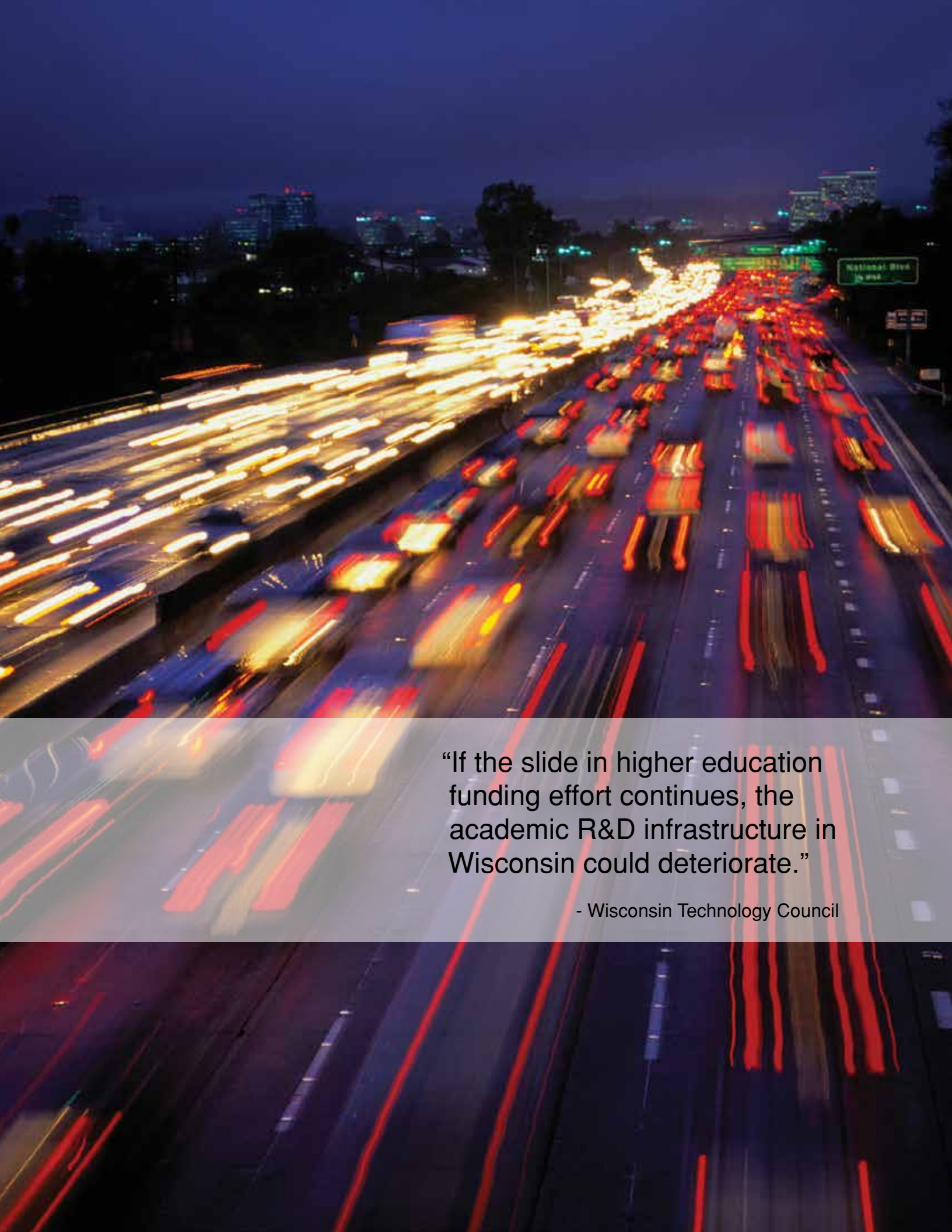
2012-13*

STATE	NUMBER OF PUBLIC FOUR-YEAR INSTITUTIONS	NUMBER OF DEGREES GRANTED	AVERAGE EXPENDITURE PER DEGREE*
Illinois	12	49,926	\$89,660
Iowa	3	16,221	86,117
Michigan	12	60,463	80,799
Indiana	11	40,828	80,107
Minnesota	11	28,752	78,613
Ohio	12	58,711	76,279
U.S. Total	481	1,460,532	75,111
Wisconsin	13	34,604	65,785

*Includes instructional, academic support, student services, and institutional support expenditures. Institutions where associate's degrees were more than 10% of all degrees granted were excluded.

Data source: Integrated Postsecondary Education Data System, National Center for Education Statistics, U.S. Department of Education.

- The UW Board of Regents and the UW System should encourage all campuses to embrace communication and management practices that support collaborative university-business interactions. Essential to these interactions are efficient decision-making processes, especially those involving campus conflict-of-interest policies that impede how faculty and staff can help to commercialize their inventions and ideas. Collaboration can take many pathways, such as joint research and development projects, training sessions and more.
- The UW Foundation and similar foundations throughout the UW System should be encouraged to investigate "Mission Investing" as a part of their portfolio management strategies.
- The UW Board of Regents and the UW System should ensure that portals such as the UW-Madison Office of Corporate Relations exist on each four-year campus and are empowered to work directly with chancellors, deans and department chairs.
- The governor and Legislature should appoint a blue-ribbon commission to consider questions related to UW System general-purpose revenue funding; administrative flexibility; campus consolidation; tuition freezes; supporting a "second" research university; supporting research and technology transfer on non-doctoral campuses, and how to get the most out of two-year campuses that make up the separate Wisconsin Technical College System and the UW System's two-year centers.



“If the slide in higher education funding effort continues, the academic R&D infrastructure in Wisconsin could deteriorate.”

- Wisconsin Technology Council

WISCONSIN ECONOMY

TRANSLATING KNOWLEDGE AND IDEAS INTO A PROSPEROUS WISCONSIN ECONOMY

The Tech Council has a unique stake in identifying ways to improve the transfer of knowledge and ideas into a prosperous Wisconsin economy.

Nations and states with a competitive advantage in knowledge and innovation – and the foresight to invest in nurturing both – are the best-positioned for long-term economic growth. Innovation and knowledge are the twin drivers of 21st century economic success. Innovation is our economy’s only sustainable source of productivity gains. Knowledge is the source of the expertise and “know-how” that spurs innovation. Increasingly, our state leaders look to our universities as a key to our economic future.

Wisconsin is blessed to have an exceptional university system by any national or international measure, a quality that extends to Wisconsin’s private universities and technical colleges, with many attributes that are the envy of most other institutions and states. The biggest impact our universities have on our economy is in training our workforce and leaders of tomorrow, and in most cases, they do an outstanding job of fulfilling this expectation.

However, by many measures we lag our peers in our measurable economic output in the form of new company formation from these exceptional assets. We have an extraordinary number of participants in this ecosystem who believe in the potential and are committed to making it happen.

At times they are frustrated by obstacles, find it difficult to get answers, encounter indifference and a shared lack of urgency, and believe we could do better. While they see opportunity to improve, they don’t know how to make change happen. We also believe we can do better and are offering ideas to be considered to improve our ability to translate knowledge and ideas into a prosperous Wisconsin economy:

- **Extend the reach to all participants in our university ecosystem.** The UW System has more than 6,500 faculty members, nearly 3,000 of whom are at doctoral-granting institutions that are engaged in significant research. There are almost 29,000 staff members, nearly 17,000 of whom are on doctoral granting campuses, and many of whom are holders of advanced degrees and engaged in research. Whether working in conjunction with faculty or independently, the greater numbers of staff researchers could provide entrepreneurial potential of similar or even greater magnitude. There are more than 180,000 students in the system, and they may offer the greatest potential based on their sheer numbers, youthful energy and capacity for taking risks. The Wisconsin Technical College System educates about 326,000 students and has 10,900 faculty and instructors. We believe that the vision for stimulating tech transfer and entrepreneurship should include these students and institutions, as well.



Fox Valley Technical College, Creative Commons license

Each institution is encouraged to develop and support integrated institution-wide programs to educate, counsel, encourage and network entrepreneurially minded members of the ecosystem, developing the skills and confidence that enables them to take risk and have a better chance for a successful outcome.

Recommendation: Improve the transfer of knowledge and ideas into a prosperous Wisconsin economy. We need to capture innovation, nurture its development, encourage commercialization and foster the pathway to success. This requires removing internal roadblocks and identifying and filling the gaps in the development continuum. For students in every field, Wisconsin must excel at the translation of knowledge gained in the classroom to skills that advance productive careers.

- **Be “best in class” among our peers in creating responsive, predictable pathways for tech transfer.** Academic research and private sector commercial development are worlds apart. Academia excels at research in an environment where they are driven to develop a deep fundamental understanding of the science, answering unanswered questions and exploring the scope of its potential. The private sector excels at development, a highly focused, pared-down process that is driven to get answers only to those questions necessary to get competitive products to market on time and on budget. For small companies, unexpected delays, unforeseen obstacles and unanticipated expenses can threaten their success. They have received a finite amount of capital from investors to reach milestones. They continue to incur their monthly expenses during unexpected delays, and once over the hurdle, they may no longer have sufficient cash to reach a milestone. This uncertainty creates risk for investors: If they see a pattern of unpredictability, it is a deterrent to further investment here. In the case of large corporations, they are more able to work with any academic institution around the globe. If we make it more difficult to collaborate than elsewhere, they will go elsewhere.

We encourage our institutions to benchmark our efficiency in the tech transfer hand-off or corporate collaboration and strive to meet or exceed the best institutional practices. The pathway needs to be transparent, complete and accessible to ensure that academic researchers and their entrepreneurial or large corporate collaborators have accurate expectations of tasks, timelines, approval requirements, costs and constraints from the very start of a commercial interaction.

Recommendation: The UW Board of Regents and the UW System should encourage all campuses to embrace communication and management practices that support collaborative university-business interactions. Essential to these interactions are efficient decision-making processes, especially those involving campus conflict-of-interest policies that impede how faculty and staff can help to commercialize their inventions and ideas. Collaboration can take many pathways, such as joint research and development projects, training sessions and more.

- **Serve as a catalyst for private sector capital formation.** Access to capital remains a challenge in Wisconsin. Academic research in this state is particularly concentrated in the life sciences where long development timelines and regulatory hurdles result in even larger requirements, far beyond what angel investors can provide alone. Our universities, their affiliated foundations, and their alumni have an opportunity to band together and be a catalyst for capital formation to help fill our capital void. The power of using “Mission Investing” and “Impact Investing” to advance an organization mission without sacrificing return has resulted in growing adoption of these concepts by leading foundations nationally. If we don’t demonstrate the ultimate measure of belief and confidence in our best and brightest entrepreneurs by being first to invest in them and their ideas, why should anybody else?

We need to do a better job of tapping into the knowledge, experience and investment capacity of our wealthy successful entrepreneurial families among the alumni, which number more than 400,000 at our flagship university alone. This requires testing the belief that an individual's philanthropic giving is segregated from their investment activity. Rather than cannibalizing philanthropy, we believe investing **Mission Investing** will engage many alumni in a new way, and engagement is the first step in philanthropy, enhancing rather than diminishing giving over time. A capital formation initiative also creates an opportunity to work across academic institutions in the state as well as other foundations interested in **Mission Investing**, leveraging the commitment to this mission. With sufficient capital and capacity to make meaningful commitments, we believe the impact could be transformative, persuading several coastal venture capital firms to establish a Midwest presence here, bringing their expertise and coastal networks, and committing to making meaningful investments in the technology and companies spinning out of our academic institutions. *Recommendation: The UW Foundation and similar foundations throughout the UW System should be encouraged to investigate "Mission Investing" as a part of their portfolio management strategies.*

- **Establish points of responsibility and authority to improve the translation of ideas into our economy.** Most academic institutions distribute the responsibilities that effect economic development across several offices and departments, and usually none are capable of covering the scope of interactions or able to effect many of the changes that could improve outcomes. We believe that those institutions with a meaningful level of research activity would benefit from greater coordination. Working largely within existing resources, this point of coordination would have responsibility to examine each institution's overall economic development; to benchmark best practices in peer institutions; to work with departments across campus to create seamless programs for training entrepreneurially minded stakeholders; to identify and eliminate choke points and gaps; and to provide "one-stop" guidance to produce transparent and predictable pathways that meet or exceed stakeholder and the private sector expectations. *Recommendation: The UW Board of Regents and the UW System should ensure that portals such as the UW-Madison Office of Corporate Relations exist on each four-year campus and are empowered to work directly with chancellors, deans and department chairs.*

Being among the best in transferring ideas to our economy would elevate our academic institutions in many ways. It helps in recruiting and retaining the best entrepreneurially minded faculty. It helps attract highly motivated students with entrepreneurial ambitions. It helps create jobs for graduates. It produces royalty income for licensing offices. It produces the next generation of benefactors and executes on the Wisconsin Idea.

WHAT OTHERS SAY: HARNESSING THE POWER OF THE UW SYSTEM FOR ECONOMIC GROWTH

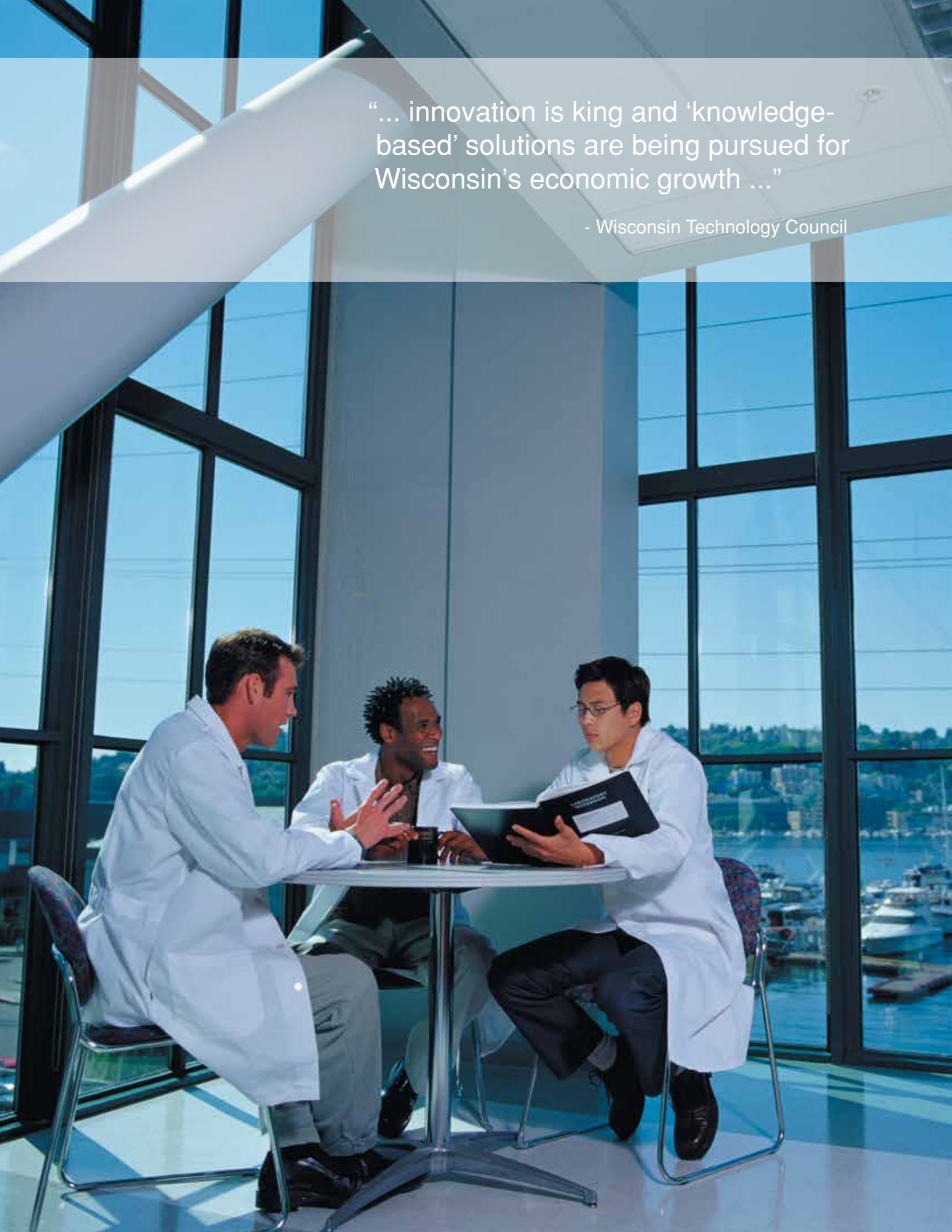
Deepening the UW System's ability to drive the Wisconsin economy was the topic of a report released in mid-2015 by the Wisconsin Policy Research Institute, a free-market think tank based in Milwaukee. The report's findings stressed the need for each of the system's campuses to become more entrepreneurial and to better align respective missions to local economies.

While many of the report's recommendations involved specific governance changes, which may or may not be welcomed by the Legislature and the UW Board of Regents, others drilled down into direct economic activity. They included:

- Give campuses more latitude to create and expand popular programs that engage students and professors in technology transfer and "second-stage" economic development.
- Expand criteria for granting tenure to include, where appropriate, technology transfer and business missions. *Our recommendation: The UW Board of Regents, working with its Tenure Policy workforce and responding to legislative initiatives, has approved policies that reflect best tenure policy practices nationally as well as within the UW System. Clear tenure policies help attract talent in a competitive industry. In a world with changing economic, social and political needs, the Regents and the UW System should monitor how tenure may continue to evolve over time while protecting core principles of academic freedom and freedom of expression.*
- Protect basic research, which is foundational to more specific research that can be applied to solving market problems.
- Give campuses more latitude to attract private investment and to convince local businesses of the potential return on such investments.
- Set objective measurements for the economic impact of each campus and to hold chancellors accountable for those results.
- Invest in regional communications efforts to better tell the economic story to local business leaders, taxpayers and others.

“... innovation is king and ‘knowledge-based’ solutions are being pursued for Wisconsin’s economic growth ...”

- Wisconsin Technology Council



CASE STUDY

WHY STATE SUPPORT FOR BASIC RESEARCH MATTERS

There are 115 universities in the United States that can lay claim to an “R1” rating from the national organization that ranks research institutions, and Wisconsin is now home to two of them – the UW-Madison and the UW-Milwaukee, which joined the elite Research Level 1 list in February 2016.

That’s great news for Wisconsin’s two largest universities, and it doesn’t diminish the efforts of the state’s smaller colleges and universities – both public and private – that are fulfilling their respective academic missions to provide teaching, service and research.

A recent presentation in Appleton demonstrated how other four-year schools in the University of Wisconsin System are enhancing their research agendas, not only in applied work that can lead directly to company and job creation, but in basic research that is a necessary foundation.

It served as a reminder that state policymakers devalue the R&D missions of colleges and universities at the state’s economic peril.

At a meeting of the Wisconsin Innovation Network in Appleton, listeners heard about the work of Algoma Algal Biotechnology, a company that is turning wastewater into “green chemicals” through a process that involves algae and a solar reactor. Possible products are chemicals that can be used to produce synthetic rubber, medical latex, lubricants, solvents, glues, animal feed and even flavors and fragrances. High on the product list is a system for capturing isoprene gas, which is used in making tires.

The technology and the company are tied to the UW-Oshkosh, which is the third-largest research university in the UW System in terms of dollars spent on research. It is also an example of how the WiSys Technology Foundation is helping to move research ideas from the laboratory bench to the marketplace.

Created as an offshoot of the Wisconsin Alumni Research Foundation, which has handled UW-Madison invention disclosures and licenses for 90 years, WiSys performs a similar role for the rest of the UW System outside the UW-Milwaukee. It manages disclosures from professors, other faculty and students; obtains patents where possible; and generally supports inventors as they move toward licensing their ideas or building a company.

“(WiSys) is the missing ingredient from where I was before,” said Chancellor Andrew Leavitt, who took the top job at UW-Oshkosh in late 2014 after working in Georgia’s public university system.

The numbers appear to back Leavitt’s impression. Invention disclosures on UW System campuses outside the Big Two in Madison and Milwaukee have climbed steadily of late, with 56 invention disclosures in the 2014-15 fiscal year. Three patents were issued that year and others are in the pipeline; seven licensing deals were executed; about \$560,000 in grants were awarded and 12 campus-based proposals were funded. Executive director Arjun Sanga, who came to Wisconsin after working in similar technology transfer roles in Texas and Kansas, has expanded the role of WiSys through outreach on individual campuses and through regional directors that understand links to industry.



Concordia University Campus

While the pipeline is producing more inventions, disclosures and companies such as Algoma Algal Biotechnology, observers worry it could run dry in future years if state support for higher education declines.

Faculty members won't have time to conduct research if teaching loads become heavier, and the value of what they teach will be diminished if there's not a balance of research and "service," which is broadly defined but includes starting young companies.

"The number one resource is time," said Leavitt, who has led efforts in Oshkosh to make resources such as the campus Business Success Center and Small Business Development Center readily available to faculty and students alike. As a result, UW-Oshkosh students are increasingly well-represented in contests and other activities tied to undergraduate research.

While economists don't often agree on much, there's not much dissent over the notion that research universities contribute to the prosperity of cities, regions and states around them. Studies by the Federal Reserve Bank and others have cited the power of academic research and development in the economy, from direct spending tied to such research to the transfer of knowledge to companies of all sizes to the "human capital" that comes with creation of a highly skilled workforce.

Wisconsin's economy may not feel the difference next year or even the next, but continued erosion of support for higher education will prove costly over time. A strong system is emerging to pull out the best campus ideas; it is worthy of investment.

CASE STUDY

FORGING JOBS THROUGH A 'HANDS-ON' APPROACH TO TECH TRANSFER

Kyle Metzloff's "laboratory" at the UW-Platteville is more accurately a foundry, a place where students majoring in industrial technology can learn the fiery secrets of metal-casting.

It's also a crucible for molding young careers, as all of the students who graduate from Professor Metzloff's program land well-paid industrial jobs – usually with Wisconsin firms tied to the state's historic metal-casting and foundry sector.

"If I could say it's more than a 100 percent placement rate, I would," Metzloff said, "because the demand is that high."

The metal-casting program at UW-Platteville is recognized as one of the top five in the United States and is one of only 30 or so certified by the Foundry Education Foundation, which has close ties to the American Foundry Society. As the campus works to absorb cuts in its operational budget, however, its growth may be restrained despite the fact that it enjoys significant industry support.

The story is much the same across the Platteville campus, as well as other four-year campuses within the UW System, as the ripple effects of state budget cuts and a general tuition freeze take hold.

With UW-Platteville's share of overall budget cuts estimated at roughly \$3.5 million per year, plans are in the works to make ends meet. Chancellor Dennis Shields has said the campus will balance its budget while providing "the same affordable, accessible and high-quality education that has been the standard of this university for the past 150 years."

But how to get there? Options include looking for new sources of revenue, such as private gifts, and a mix of spending cuts, some of which involve reductions in faculty or staff. A recent budget paper estimated 70 jobs could be lost at UW-Platteville, mostly by attrition and incentives to retire, but not entirely so.

That's no small loss of faculty and staff on a growing, regional campus with about 7,500 students. It's also a loss to the state economy, especially if hands-on programs that contribute to productivity in basic fields can't grow to meet demand for skilled workers.

Manufacturing remains a core sector of Wisconsin's economy, with about 470,000 workers – about 18 percent of the private workforce overall. Workers employed in the cast metals industry represent a sub-sector of manufacturing, with at least 21,000 employees statewide.

The foundry program is one example with UW-Platteville's College of Business, Industry, Life Sciences and Agriculture. The college produces students who work in animal science, soils and crops, environmental horticulture, biotechnology, health care, supply chain management, finance, manufacturing technology, building construction and occupational safety management.

In short, it supplies workers in some of the state's bread-and-butter business sectors. However, the numbers show the college has been producing fewer students in recent years, in part because of constraints on its growth. The same is largely true in the College of Liberal Arts and Education, which produces graduates in fields such as criminal justice, humanities and the arts.

State budget cuts have forced efficiencies in some areas at UW-Platteville, as they have on other campuses, as well as stronger partnerships with business and industry. Once the low-hanging fruit is harvested from the tree, will it become harder to make cuts without sawing off a few limbs?

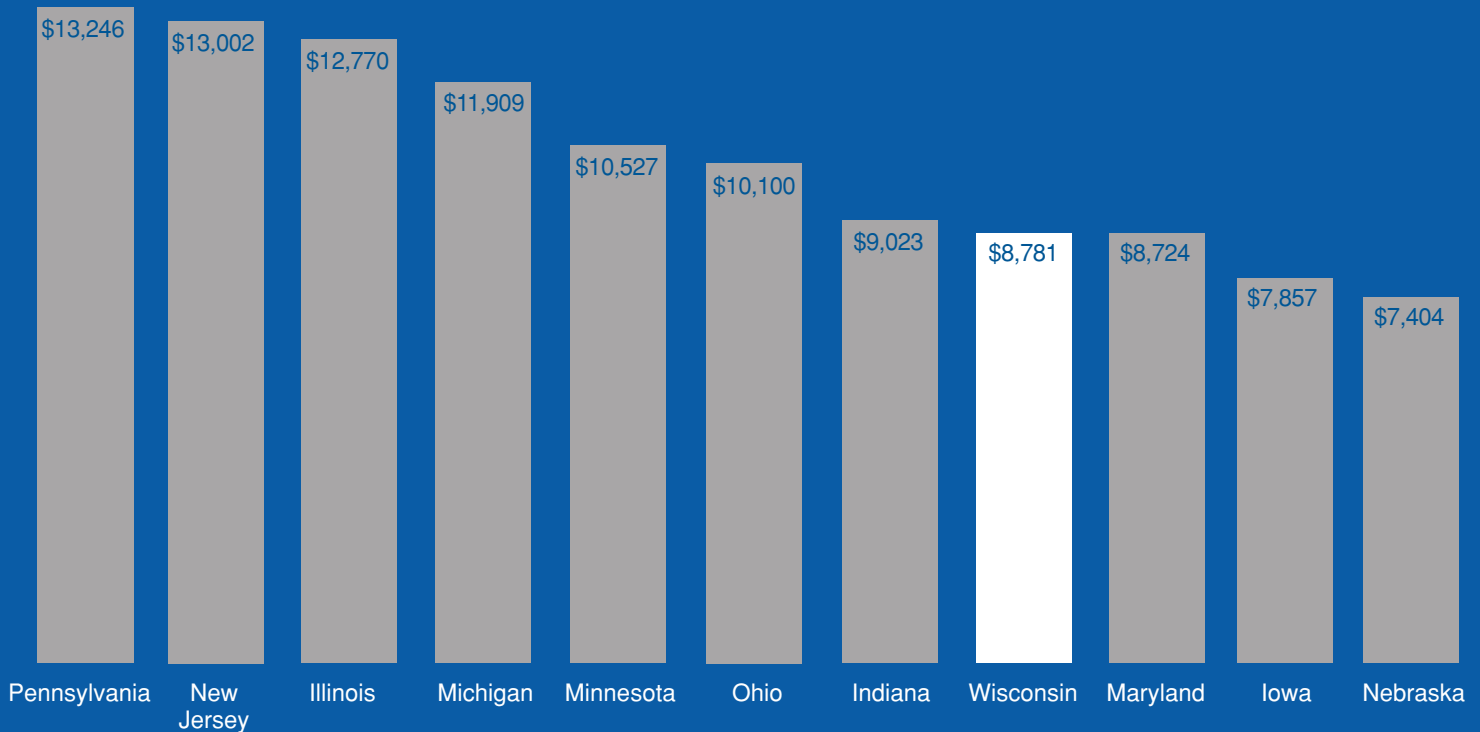
That question must be confronted in the next state budget cycle, when the governor and members of the Wisconsin Legislature revisit support for higher education. While the latest budget figures show a modest \$135 million surplus for the fiscal year that ended June 30, the state will likely grapple with the same mega-issues – Medicaid, corrections, transportation, K-12 education and higher education – the next time around. (See related section on attraction/retention/access/competition.)

The UW System budget is roughly \$6 billion per year overall for 26 campuses and central administration, with about \$1.2 billion of that amount coming from state tax dollars. The rest comes from program revenues (largely tuition), federal grants and contracts and other sources, such as private donors and foundations. In other words, about one-fifth of the UW System budget comes from state government.

Another over-arching issue to be addressed in the next state budget is demographics. Mounds of data demonstrate an urgent need for Wisconsin to attract and retain as many skilled workers as possible. With an aging workforce and limited in-migration, the state cannot afford to lose homegrown workers or turn away young people from elsewhere who want to get an education here. Wisconsin's economy cannot grow if it consistently loses more workers than it gains. In the foundry of human talent, more raw material will be needed in the years to come.

Average Resident Undergraduate Tuition and Fees at Public Four-Year Institutions in Selected States

2014-15



U.S. Average (Weighted) \$9,139

Source: The College Board; Legislative Fiscal Bureau



“The driving force of economic growth is investment in human capital – skills and ideas – rather than investment in machines and buildings.”

- Researcher Steve Dorwick

CASE STUDY

COMPUTER SCIENCES AT UW-MADISON EXPANDS REACH INTO STATE ECONOMY

On a campus famed for its breakthroughs in biotechnology, engineering and agriculture, a much smaller department is exerting an outsized effect on the Wisconsin economy – and well beyond.

The UW-Madison Department of Computer Science, which has been at the forefront of computational innovation since the earliest days of the Internet, is poised to build upon its quiet national reputation while expanding its ties to companies close to home.

In a world that views the Silicon Valley as one of the few places where people build solutions for software, computer architecture, mobile data and even artificial intelligence, the relatively small “Comp Sci” department on the Madison campus is changing that perception.

Recent events demonstrate the department’s rising profile – and challenge the long-held perception that its researchers think first about placing graduates at mega-companies elsewhere and second about emerging companies in Wisconsin.

- Milwaukee philanthropists Sheldon and Marianne Lubar, who made their mark in business and investing in Wisconsin, announced a \$7-million gift to the department this fall to help attract and retain top faculty. The money will endow two chairs and two professorships, plus establish an endowed discretionary fund.
- Verona-based Epic Systems announced in December it will endow three faculty positions within the department. Epic was founded by Judith Faulkner, one of the department’s renowned graduates. The size of the gift wasn’t disclosed, but it is likely comparable to the Lubar gift because the faculty seats are endowed in perpetuity.

- The Wisconsin Alumni Research Foundation recently won a \$234-million judgment in a lawsuit against Apple Inc. that accused the California giant of infringing on the microprocessor work of Guri Sohi, a computer sciences professor. The judgment was significant for its size alone, but it also underscored how long UW-Madison researchers have been at the forefront of digital innovation. Perhaps the best example is emeritus professor Larry Landweber, one of the first people to be inducted in the Internet Hall of Fame for his 1970s work on TheoryNet and CSNet.

How does the department’s teaching and research mission translate to strengthening Wisconsin’s economy? While it’s true that many UW-Madison computer science graduates wind up working for Google, Microsoft, Oracle and other industry leaders, the department has increasingly focused on emerging companies – and jobs – much closer to home.

In fact, Google, Microsoft and Zendesk offices in Madison wouldn’t have Wisconsin addresses if not for the department’s ability to lend talent and expertise. Within the past year, two Wisconsin companies founded by Madison researchers were sold, thus bringing dollars and connections home.

Perhaps the biggest advantage over time may come from how the department works with Wisconsin-based companies such as Epic, the U.S. market leader in software-based electronic health records, and major companies in sectors that increasingly rely on computer science.

It's not just about the next "smartphone" application but putting computer science to work through robotics, autonomous vehicles, drones, financial services, insurance and even behavioral fields that help solve other human and environmental problems.

That's why the department is broadening its mission to include students from other disciplines – statistics, economics, finance, even the social sciences – who will benefit from learning more about computational theory and practice.

It has launched an "Introduction to Data Programming" class for students who are majoring in related fields; those students will write basic programs by the end of the class. The department also offers an undergraduate computer science certificate program – the equivalent to a degree "minor" – for students in physical, biological or social science.

"Who in the 21st century economy shouldn't be able to do some programming... to make some data inquiries... or have some basic exposure to computational thinking," said Mark Hill, chairman of the computer sciences department and a researcher who specializes in computer architecture.

To meet the demand for students and industry, the UW-Madison computer sciences department may have to increase sharply in size. Such a move would likely pay for itself. In fact, the department's 34 faculty brought in \$21 million in grants and industry contracts to the campus in 2014-15, which is many times more than what those faculty cost in salaries.

Of course, the UW-Madison isn't the only place teaching computer science. Other four-year public and private campuses, as well as the state's technical colleges and some accredited private companies, are engaged in producing more talent. The state's flagship campus plays a major role, however, in projecting a national reputation that puts Wisconsin on the computer science map.



Photo credit: UW-Madison University Communications, Photo by: Bryce Richter

CASE STUDY

UW-MILWAUKEE'S COMMITMENT TO FACULTY, STUDENT ENTREPRENEURSHIP

Atop a hill that overlooks the core of Milwaukee's largest health-care hub sits a gleaming symbol of investment by the UW-Milwaukee and its partners in a different kind of university.

It's the Innovation Accelerator, part of the surrounding Innovation Campus and a piece in the larger research and development puzzle at UW-Milwaukee, which is building stronger industry connections, incubating startup companies and training young entrepreneurs.

The UW-Milwaukee is emerging as Wisconsin's second research university, a status bolstered by its recent R1 ranking from the accreditation group that periodically revises such rankings. Other states claim multiple R&D centers that contribute to their economies, and it's not just the mega-states such as California, New York and Texas. The success of the Research Triangle in North Carolina is tied to the combined horsepower of Duke, North Carolina and North Carolina State universities, to cite one familiar example.

Closer to home, Illinois has R&D hubs at the University of Illinois, Northwestern and the University of Chicago; Indiana is home to Indiana University and Purdue; Michigan has Michigan and Michigan State; Pennsylvania boasts Penn State and Pittsburgh; Iowa has the University of Iowa and Iowa State; and Minnesota has the University of Minnesota and the Mayo Clinic, which functions like an academic institution in some ways.

The effort to build a second research university does not come without risk – financial and otherwise – but it is consistent with a larger nationwide trend that has expanded the notion of campus entrepreneurship from a relative handful of enterprising faculty to thousands of students.

"We have put the pedal down even further ... when it comes to R&D and entrepreneurship," UW-Milwaukee Chancellor Mark Mone told a recent forum hosted by the Wisconsin Innovation Network, part of the Wisconsin Technology Council.

Mone's "no-turning-back" commitment to research, industry ties and educating future company founders comes at a time when UW-Milwaukee, like many campuses in the UW System, is absorbing state budget cuts. He's persuaded that commitment – which began in the late 1990s during the tenure of then-Chancellor Nancy Zimpher – will pay dividends to the campus and the region over time.

Mone is not alone in Wisconsin or elsewhere. The UW-Madison remains one of the nation's research powerhouses and was ahead of the curve in offering pathways for entrepreneurs. But even that campus has experienced a post-2000 explosion in programs for students and faculty who want to convert ideas into businesses or other ventures.

Across the rest of the UW System, most four-year campuses have committed to undergraduate research, industry connections and entrepreneurship training and built support systems to match. The same goes for many of Wisconsin's private colleges and universities, notably many in the Milwaukee region, as well as the state technical college system.

The story is much the same across the United States. In 1985, U.S. college campuses collectively offered about 250 courses in entrepreneurship, according to recent report by the Ewing Marion Kauffman Foundation. By 2013, about 400,000 students were taking such courses – and the number has likely grown since then.

What's driving student interest in entrepreneurship? Images of launching the next Facebook, Snapchat or Instagram is certainly part of the appeal, but for most students it's less about the home-run startup than acquiring skills that keep them nimble in a fickle job market.

In a world where company lifespans are shortening, economic downturns often lead to major company layoffs and job migration is more commonplace, knowing how to "think like a 'trep" builds transferable self-employment skills.

That notion is being imbedded in UW-Milwaukee's educational mission, said Mone, who believes campus entrepreneurship programs are not just for business students but "absolutely integrative" and applicable to a full array of physical and social sciences as well as the arts.

That concept is reflected in the Innovation Campus off Highway 45 in Wauwatosa, where the accelerator is already full, as well as other new or planned buildings on UW-Milwaukee's main campus.



UW-Milwaukee Chancellor Mark Mone

Average Resident Undergraduate Tuition and Fees and Median Household Income for Big Ten States

2013-14

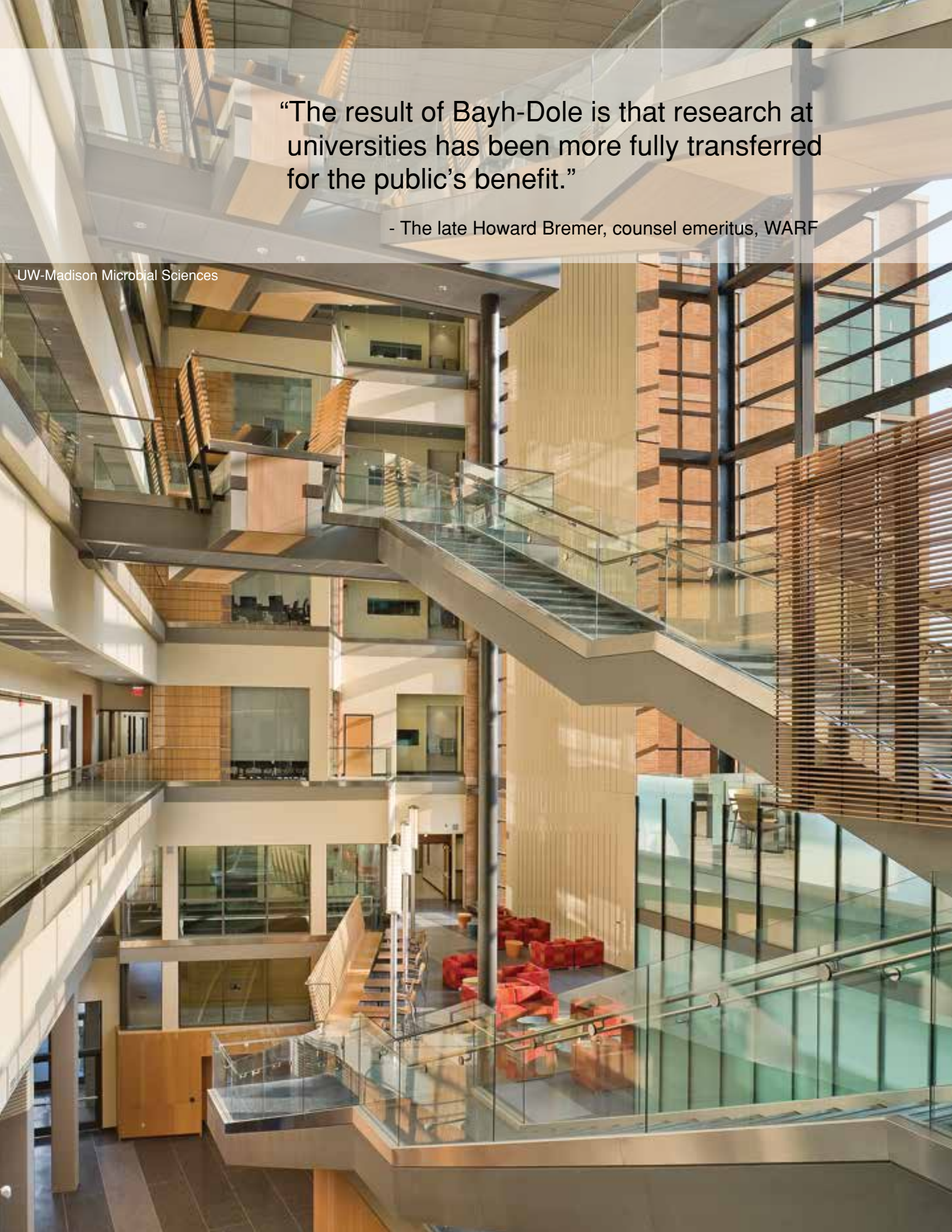
STATE	RESIDENT UNDERGRADUATE TUITION AND FEES (\$)	MEDIAN HOUSEHOLD INCOME (\$)	TUITION AND FEES AS % OF MEDIAN HOUSEHOLD INCOME
Michigan	11,600	48,801	23.8
Pennsylvania	12,802	53,952	23.7
Illinois	12,580	57,196	22.0
Ohio	9,942	46,398	21.4
New Jersey	12,723	61,782	20.6
Indiana	8,926	50,553	17.7
Minnesota	10,464	60,907	17.2
Wisconsin	8,741	55,258	15.8
Iowa	7,837	54,855	14.3
Nebraska	7,315	53,774	13.6
Maryland	8,480	65,262	13.0
U.S. Average*	\$8,598	\$51,939	16.6%

Source: The College Board and the U.S. Census Bureau.

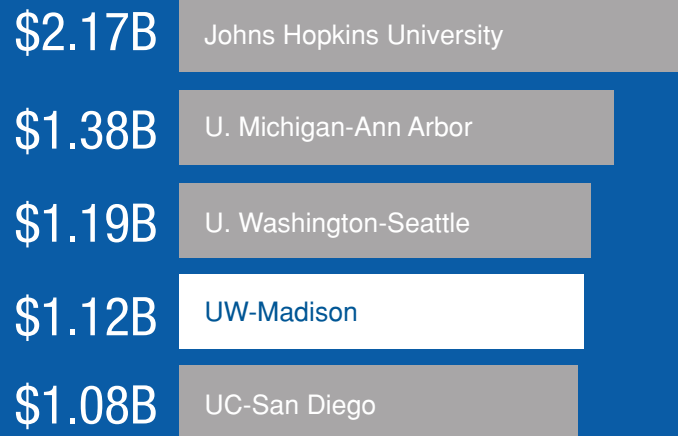
“The result of Bayh-Dole is that research at universities has been more fully transferred for the public’s benefit.”

- The late Howard Bremer, counsel emeritus, WARF

UW-Madison Microbial Sciences



4th in research expenditures



Source: 2014 figures/National Science Foundation and Northstar Economics

The Lubar Center for Entrepreneurship will serve as the “gateway to our campus” when completed in 2018, Mone said, as it will include a welcome center in addition to space for entrepreneurial classes and workshops. A \$10-million Lubar family gift made in mid-2015 is well on its way to being matched this year and next, Mone said.

The Kenwood Interdisciplinary Research Complex opened last fall. The \$80-million facility will house a laboratory for applied and analytical chemistry, a high-resolution transmission electron microscopy center, a high-performance data computing hub and a small business collaboration backed by the National Science Foundation. It is also home to the North American Nanohertz Observatory for Gravitational Waves, backed by a \$14.5 million, five-year NSF grant to study certain sets of waves and pulsars throughout the Milky Way. This center was part of the worldwide effort that recently proved Albert Einstein’s 1916 theory that gravitational waves exist and directly affect the state-time dimension.

Part of the “grease” that makes the engine run is the UWM Research Foundation. It was formed 10 years ago to help the campus expand its research program and to help connect that work with industry. The UWM Research Foundation is a core part of the infrastructure that supports an R1 research institution.

In addition to the traditional patenting and licensing role – which has led to a growing portfolio of more than 40 patents, half of which are the subject of active licenses or option agreements – the UWM Research Foundation helps support the development of key industry partnerships in water, energy, healthcare and advanced embedded systems.

The UWM Research Foundation is also coupled with efforts to grow entrepreneurship at the faculty and student level – helping manage the UWM Student Startup Challenge and the National Science Foundation Innovation Corps (I-Corps) program.

For UW-Milwaukee and other schools, the risk is financial in the sense that many more campuses are chasing entrepreneurial students and faculty – and federal R&D spending has leveled off. That means there’s a chance of a market bubble. Some observers also worry that entrepreneurial programs must move beyond startup tactics to include critical thinking skills that are part of a traditional liberal arts education.

For Mone and his team, the risk is worth it because the payoff appears so large: Better research programs, more productive industry relationships, a stronger community and students who are prepared to deal with an ever-changing world. After all, one way to reduce “brain drain” is to help students find – or make – jobs close to home.

CASE STUDY

PRIVATE UNIVERSITIES SERVE AS VITAL CATALYST IN THE MILWAUKEE REGION



Marquette University President Mike Lovell

Milwaukee has nearly two-dozen colleges and universities that collectively educate about 180,000 students across a spectrum of disciplines, including virtually all of the “STEM” fields – science, technology, engineering and math – needed in today’s innovation economy.

Harnessing the collective power of those colleges and universities is a goal for Marquette University President Michael Lovell, who a little more than a year

into the job appears to be picking up where he left off in his previous role as chancellor of UW-Milwaukee.

Lovell spoke recently at a meeting of the Tech Council’s Wisconsin Innovation Network in Wauwatosa, where part of his talk summarized specific projects at Marquette. He spoke just as much, however, about what others are doing to move the region ahead.

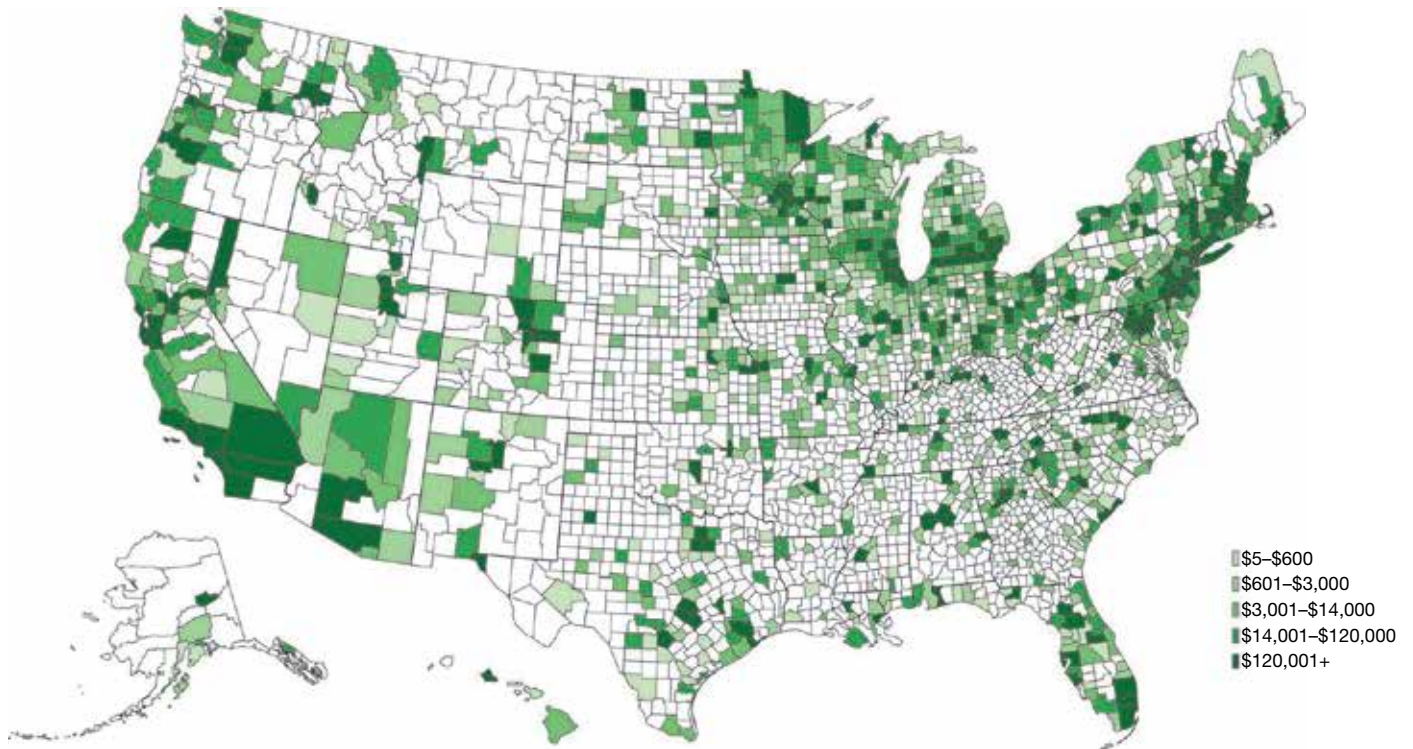
“Universities today are really being called upon to help lead research and the growth of regions,” Lovell said. “There’s not a region in the country that is doing well that doesn’t have a major research university.”

Or, in the case, of Milwaukee, multiple research universities that find ways to work together.

One such project in Milwaukee is The Commons, a collaboration of area colleges that provides students with chances to work with area businesses in real-world settings. Last year, more than 140 students from 19 colleges or universities spent time working on specific projects and business challenges. Another class has formed for this academic year.

One illustrative example within The Commons is Concordia University in Mequon. It has space in the UW-Milwaukee Innovation Accelerator, works with private accelerators such as gener8tor, and turns to groups ranging from SCORE to the Small Business Development Centers for mentoring. Its business plan contest is modeled after the Governor’s Business Plan Contest, which is produced by the Tech Council.

At the UW-Milwaukee, where Lovell spent time as engineering dean, interim chancellor and chancellor, projects tied to economic opportunity range from the Student Start-Up Challenge and the App Brewery to nationally recognized partnerships with Johnson Controls Inc., GE Healthcare and Rockwell Automation. Current UW-Milwaukee Chancellor Mark Mone has accelerated progress on those projects and more, especially those tied to the water cluster.



This map shows the geographic distribution of vendor and sub-award spending by nine members of the Committee on Institutional Cooperation, which works predominantly with Big Ten Conference universities, including the UW-Madison. "One of the things that makes Wisconsin attractive to researchers elsewhere is its infrastructure of research-oriented firms in the private sector," said Jason Owen-Smith, executive director of the Institute for Research on Innovation & Science at the University of Michigan.

Lovell's appreciation of academic and industry partnerships dates to his time at the University of Pittsburgh, where the Swanson Center for Product Innovation was an eye-opener for him. Launched in 2001, it led to 500 projects involving 100 existing companies, 226 products, 260 jobs, eight startups and \$13.2 million in new company revenues within a few years.

The UW-Milwaukee project with Johnson Controls is a targeted extension of that concept, Lovell said, and continues to benefit the company and the university today with shared labs, appointments, interns and more. "Co-location: That's where the magic happens," he said. At Marquette, Lovell pushed for creation of a Strategic Innovation Fund shortly after arriving there in the summer of 2014. About \$5.7 million was raised, and more than 275 proposals came from faculty members with ideas. Those ideas involved 480 faculty out of Marquette's 600, which Lovell counts as just as important as the 38 ideas initially selected for funding.

"With one simple thing, we energized the campus," he said.

According to National Science Foundation figures from 2012, Marquette raised and spent about \$18.6 million on research. Lovell said he would like to double that figure over the next five years.

In the same NSF data for 2012, the Medical College of Wisconsin stood at \$209 million, UW-Milwaukee at \$61 million and the Milwaukee School of Engineering at \$5 million, with other area colleges at amounts of \$1 million or less. That's a total approaching \$300 million – still a far cry from the UW-Madison's \$1.2 billion, but enough to leverage industry support and economic activity.

It's tempting to look at the success of UW-Madison and the Madison area and conclude that Milwaukee has somehow missed the R&D boat that carries metropolitan regions to warmer economic ports. That's only true if the region fails to work together in the years ahead.

Look for academic leaders such as Lovell to continue their drive for greater cooperation among themselves and industry, Milwaukee's historic strength, to help the region become more competitive.

CASE STUDY

BEST WAY TO CONTROL COLLEGE DEBT COSTS IS TO SPEED TIME TO GRADUATE

Wisconsin lawmakers are concerned about curbing how much debt college students shoulder once they graduate, a worthy bipartisan cause.

The best fix, however, may also be the simplest in concept: Reduce the time needed to graduate.

The true cost of attending a four-year college or university is measured by how many years students pay for tuition, fees, books, supplies, housing, meals, transportation and other expenses that come with the experience. In fact, tuition is less than half of the total cost on most public campuses and usually less than 40 percent of the total.

The problem for many students is that attending a four-year college or university is often not a four-year deal. It's more like five or six, according to statistics nationally and in Wisconsin, especially for public universities.

It only stands to reason that if you're attending college for five or six years, you're more likely to run short on money and high on debt. That's why strategizing to shorten the time to graduate must become a part of the equation.

According to a 2013 report from the Chronicle of Higher Education, only 28.7 percent of the students in Wisconsin's public universities (the University of Wisconsin System) graduated in four years and 59.3 percent in six years. The rest dropped out altogether or took time off, perhaps to resume their studies later or pursue a job.

The UW-Madison led the way with a 55 percent graduation rate in four years and 82.8 percent in six years, with UW-La Crosse and UW-Eau Claire placing second and third, respectively.

Wisconsin ranked 17th best among the 50 states in public university graduation rates, which compared to neighboring Iowa (4th), Michigan (12th), Illinois (13th), Minnesota (19th) and Indiana (25th).

What's striking is how much better private colleges and universities rank in speed to graduate, in Wisconsin as well as nationally.

In Wisconsin, the leaders in the four-year graduation rate are Beloit College, St. Norbert College, Marquette University, Lawrence University and Ripon College, according to a 2013 report by The College Board. Most are 60 percent or higher. The trend is much the same nationally, based on reports by The College Board and U.S. News & World Report.

"The four-year graduation rate for first-time, full-time students who began and stayed at a private, non-profit college or university is 68 percent higher than the rate for students on public campuses," reports the Wisconsin Association of Independent Colleges and Universities. "This enables graduates to pay less tuition and to start earning sooner."

It also enables them to rack up less debt and pay it off sooner. Learning how private universities and colleges churn out quality graduates faster should be a priority for lawmakers and the UW System, which could embrace some private school practices.

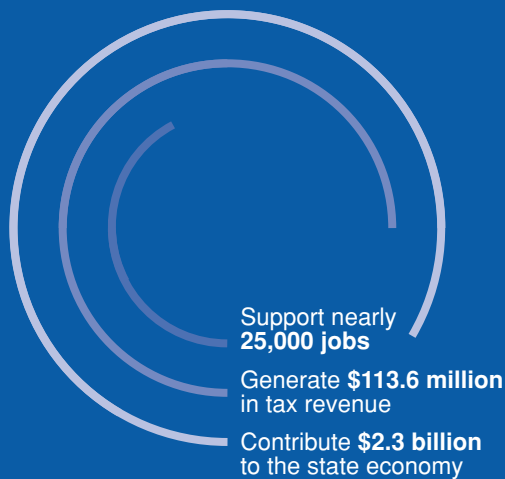
Other strategies should begin before students ever step foot on a college campus. Wisconsin is among the top dozen states nationally in offering Advanced Placement courses and examinations to high school students, who may earn college credit, advanced standing or both if they score well on the tests.

The number of AP exams taken in 2015 was the highest ever in Wisconsin, which may help speed college graduations in coming years.

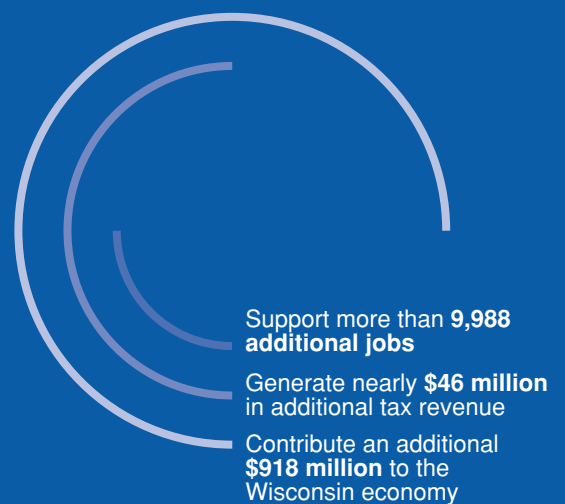
And yet, Wisconsin has room for improvement. Seamless transitions between secondary and post-secondary institutions cut the time needed to earn a degree and enhance student learning. The state has enacted two programs – Youth Options and Course Options – which enable students to earn college credits while still in high school. The intention of the Legislature in enacting these programs was to exempt the student from the burden of paying.

However, the programs were structured in a way that created a financial disincentive for school districts to participate, so the full promise of these programs has yet to be met. Parallel programs in Minnesota, which are funded by the state rather than the local districts, are producing results far outstripping those in Wisconsin. If you spend four years earning a four-year degree, you'll pay less – and probably incur a lot less debt – than taking five or six years to accomplish the same thing. It's simple math that should be a part of the college cost and debt debate in Wisconsin. Our recommendation: Examine ways to speed time to graduation, which varies greatly within the UW System; consider ways to improve portability of credits within institutions; and accelerate programs that allow high-school students to get a “head start” on college through advanced placement courses and similar strategies.

More than 311 UW-related startup companies



Entities affiliated with the UW-Madison:



Source: Northstar Economics

CONCLUSION

COMING TO GRIPS WITH ACCESS, AFFORDABILITY, RETENTION AND COMPETITION

With 13 two-year campuses within the UW System and 16 technical college districts running nearly 50 campuses or centers, is there cause to believe Wisconsin taxpayers are spending too much to educate people who are working toward something less than a baccalaureate degree?

That's when it gets complicated. A reactive "yes" fails to take into account the different missions of the technical colleges and the UW System's two-year campuses. The former is designed primarily to train workers for specific careers and trades, while the latter provides a launch pad for students who aren't yet ready – or cannot afford – a four-year college experience.

In either system, graduates can continue their education if they want, or immediately enter the workforce. At a time when Wisconsin should be worried about keeping young people at home, the tech colleges and the two-year UW campuses have demonstrated they can do both.

That doesn't mean there aren't unrealized efficiencies, however, and other states offer models for what amounts to a "community college system" that helps to realize those efficiencies.

In Minnesota, such a process led to the creation of 11 consolidated community and technical colleges. According to the Office of the Legislative Auditor in Minnesota, the merger made it easier for students to transfer credits, improved financial oversight, improved working relationships between institutions and clarified regional efforts. A similar consolidation in Georgia was carried out recently with the goals of increasing opportunities to raise education attainment levels; improve accessibility,

regional identify and compatibility; avoid duplication of academic programs, create significant potential for economies of scale; and streamline administrative services.

It should be noted that better credit transfer is possible without merger. At Silver Lake College in Manitowoc, half the student body has done their first two years at a technical college. On the other hand, being part of a system does not guarantee easy credit transfer. The Sullivan Commission – chaired by Tim Sullivan, former CEO of Bucyrus International – reported instances on UW campuses where basic coursework did not transfer.

Rethinking higher education in Wisconsin – its many "flavors," its competitive pressures, its costs, its economic value and its role in meeting the state's needs for skilled workers – is best done comprehensively. That's why proposed efficiency solutions should be considered in context.

- Wisconsin has grappled successfully with major issues in the past by taking a bipartisan approach, often with the help of blue-ribbon citizen commissions. Our recommendation: The governor and Legislature should appoint a blue-ribbon commission to consider questions related to UW System general-purpose revenue funding; administrative flexibility; campus consolidation; tuition freezes; supporting a "second" research university; supporting research and technology transfer on non-doctoral campuses, and how to get the most out of two-year campuses that make up the separate Wisconsin Technical College System and the UW System's two-year centers.

Before the 2017 state budget process gets underway, this commission could examine best practices and models elsewhere, and to bring more voices into the debate before the Legislature votes. Questions that could be up for discussion include:

- It is important to recognize that only three states out of 50 are spending as much on higher education per student today as they did before the Great Recession, which means cuts in higher education have been a national trend. Within that context, however, it's important to understand where efficiency ends and competitive advantage is threatened. According to the Center on Budget and Policy Priorities, Wisconsin spent 16.5 percent less in inflation-adjusted terms in 2008 through 2015. That decline in real spending suggests further cuts would harm access, affect overall quality and erode economic competitiveness.
 - Does it make sense for state government to provide just 20 percent of the UW System's total budget but to exercise a much higher degree of control over its tuition, capital projects, personnel decisions and more? Further, do current administrative transfer practices between the state and the UW System contribute to a lack of transparency about true costs of operation?
 - Rather than inflicting pain across all campuses, should the UW System consider closing those four- or two-year campuses that fail to attract enough students to truly pay for themselves?
 - Does it make sense for state government to freeze all tuition rates? Freezing in-state tuition is one thing, because those are Wisconsin students who may have limited means. However, market forces should guide how much the UW can charge out-of-state students, graduate students and students in its professional schools. For example, an Illinois resident can attend the UW Veterinary School for less money than it would cost to attend the University of Illinois Vet School at resident tuition rates. Low tuition for in-state and out-of-state students does little to nothing to improve access and affordability.
- Low tuition does not change behavior of those well-off enough to attend college anyway. Low tuition strains state tax-funded programs such as financial aid (Wisconsin Grants) which, if funded appropriately, would have positive effect on access and affordability for qualified students who have financial need. Tuition freezes hurt universities and students alike.
- The state needs a second major research and development campus, especially given the importance of the Milwaukee region to the overall Wisconsin economy. That has worked for states such as Michigan, Illinois, Ohio, Iowa and Indiana. How can the state most effectively support the efforts of UW-Milwaukee, the largest campus in the Milwaukee region, to build on its R1 research university status?
 - Within the context of ensuring adequate teaching time, what can be done to help four-year campuses outside of Madison and Milwaukee unleash the academic horsepower to conduct major research?
 - Assuming that faculty governance and tenure remain foundational to higher education in the 21st century, how can the state ensure that both concepts are living, breathing organisms that adapt to the economic and social conditions surrounding them?
 - What is the full economic impact of the UW System on the Wisconsin economy, starting with the Tier 1 research institutions in Madison and Milwaukee? That begins with the UW's biggest product – its students, who are needed to fill tomorrow's jobs – but extends to company creation, company assistance and more. Agreeing upon ways to measure that full impact would enhance civic and political understanding of the economic value of higher education while providing valid national comparisons.



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