Lt. Governor's Commission on Higher Education & Economic Growth

Economic Benefits Work Group

Research Brief

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by

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This background information was prepared in response to questions raised at the last economic benefits meeting, as well as requests for additional information that could support a discussion of accelerating/enhancing commercialization from higher education in Michigan. We appreciate the short turnaround time for members to internalize the information and will present highlights at the meeting. Finally, some source and background materials are also being made available on the Web for work group members.

In addition, if you want to skip around in this document, it includes the following sections, in order:

I. TECHNOLOGY TRANSFER AND COMMERCIALIZATION: HISTORICAL AND THEORETICAL BACKGROUND

In the 1960s and 1970s there was concern that the true potential of the university to commercial enterprise was not being reached because not enough products were adapted by commercial firms. The research policy of the federal government following World War II had two primary elements. First, the government would support research in basic science in a decentralized manner, with federal agencies all supporting a proportionate share through competitive grants as reinvestment in the basic research, which led to the technology the agencies needed. This was a "pipeline model" of science, in which it was assumed that the basic research funded would support a private competitive economy of firms investing in innovations and applied research that would benefit them. The second element of the federal policy was that the technology created through the federal agencies would flow to industry through a "spinoff" process, which the government presumed would be automatic and low cost (Branscomb and Florida, 1998).

By 1968, the U.S. Commerce Department had noticed the erosion of the country's once-favorable high-tech trade balance, and by 1986, the country was in a high-tech trade deficit for the first time. Innovations were not being transferred to industry. Of the 28,000 patents held by the government prior to 1980, only 5 percent were licensed to industry. In general, federal agencies were reluctant to grant exclusive licenses. This, understandably, served as a disincentive to businesses regarding research and development (R&D) in any existing product since they could not retain the commercial rewards. A series of laws were enacted in the early

1980s in the United States to reverse this trend, the most notable of which was the Patent and Trademark Act of 1980—or the Bayh-Dole Act—which allowed federal agencies to grant exclusive licensure for inventions made with the agency's funds. With this law, Congress allowed universities to retain the scientific and intellectual property rights over discoveries made through federally funded research and encouraged firms to become directly involved in the commercialization process. This was a break from the spinoff model (Branscomb and Florida, 1998; Brooks and Randazzese, 1998; Council on Government Relations, 1999).

Technology transfer is the commercialization of innovations from university research and occurs when firms obtain technology from an external source, such as a university or federal lab. Thus the process is dependent upon scientists having access to the discoveries of other researchers (Reamer, Icerman, et al., 2003). Typically, a new product or procedure is licensed for commercial development to a private company. Technology transfer is a two-way flow between universities and industry in which academic involvement can take three forms: (1) the product is first invented at a university but is developed by an existing firm, (2) the invention originates outside the university and academic researchers help to improve it, and (3) the invention originates at a university and the faculty member participates in its commercial development through the establishment of a start-up firm (Etzkowitz, 1999).

It is difficult to quantify the impact these three types of technology transfer have on the economy of Michigan. Some things are easy enough to determine, like expenditures (or awards) for a given year. The number of university jobs supported by technology transfer and sponsored research is also knowable, as is the level of government investment in research and technology transfer activities. However, there are many factors that impede a truer determination of economic impact.

First, there is a significant lag time between innovation, development, and commercial viability—probably up to 10 years (Zacks, 2000). Thus, it is difficult to trace the effects back to the point of origin. Second, there is not a direct one-to-one link between a product and its impact. A product may need to be combined with others already in the corporate laboratory, during which time new discoveries could be made that actually foster the commercial potential. Or, several smaller innovations could lead to a larger one, perhaps through a partnership of companies or of universities years after the initial developments. Again, traceability becomes difficult. Finally, there are other circumstances, like the fact that start-ups created in the state might move to a state with more venture capital, thus causing a loss of potential economic benefits.

The link between federal and commercial investment and regional economic returns are apparent only if the university is appreciated as one part in a network of factors that produce returns (Kodama and Branscomb, 1999). Link (1999) states that economic impact is essentially a measure of the leveraging effects that the new knowledge, created and transmitted by the university, has on economic activities. It is an estimate of what has already occurred, not a prediction of what will happen in the future. Thus, it cannot serve as the basis for public budgeting because there is no guaranteed, direct linkage. These assessments are meant to show stakeholders what they are receiving for their investment in university research.

Assessing the true economic impact of technology transfer would require knowledge of the success of new firms and industries created from university research (Kodama and Branscomb, 1999). A true calculation of a university's impact on a region through technology would require ascertaining data on spillover effects. Technology can only affect the economy if it is connected with local industry through such mechanisms as start-ups, further development of innovations by industry R & D labs, the attraction of new industry R&D labs, or, on a long-term basis, by raising the education level of the area and thus providing workers for the new economy (Fogarty and Sinha, 1999).

Another required piece of data is the amount of pre-production investment the developing companies put into their products. Sales and jobs created after the fact are one thing, but significant amounts of money are spent and jobs are supported in bringing products to market. Some studies (Pressman, Guterman, et al., 1995) have attempted to determine economic impacts by obtaining data from companies about their development activities. It is also helpful to focus on anecdotal evidence presented through the success stories of new businesses and products, as well as other benefits that accrue to the state that don't lend themselves to quantification. These positive externalities include things like new technologies created for consumer benefit, new drugs and medical treatments, benefits to the environment, new software applications, as well as other long-term benefits that are still unknown.

One problem is that some regions are more suited to realize the benefits of technology transfer than others. As technology moves from universities to industry and the possible impacts of that technology increase, there is a decreased likelihood that those effects will be retained within its region of origin. For example, a commercial firm may not find it necessary to regularly consult the originating institution or development laboratory for further work and can manufacture the product itself in another city or state. Thus the opportunity to retain benefits is lost. Benefits at this stage are especially important because most likely, more jobs will be involved in its ongoing production than were created by its origination (Candell and Jaffe, 1999). Generally speaking, technology R&D spending benefits newer regions because they can more easily retain the spillovers that result from the creation of new knowledge. Older regions have weaker technology and R&D networks that are less able to take advantage of new knowledge (Fogarty & Sinha, 1999).

A recent report from the Economic Development Administration lays out the difficulty in realizing economic benefits from technology transfer (Reamer, Icerman, et al., 2003, pp. ix-x):

> Commercialization is the process of *transforming new technologies into commercially successful products*. The commercialization process includes such efforts as market assessment, product design, manufacturing engineering, management of intellectual property rights, marketing strategy development, raising capital, and worker training. Typically, commercialization is a costly, lengthy process with a highly uncertain outcome. The costs of commercialization can run from between 10 and 100 times the costs of development and demonstration of a new technology. Moreover, success is rare—less than five percent of new technologies are successfully commercialized. Even when successful, technology commercialization does not happen quickly. On average, the commercialization of university research takes over six years. Commercialization of radically new technologies can take well over a decade.
>
> Science, technology, and products are very rarely created in a vacuum, depending solely on internal expertise. In nearly every case, to a greater or lesser extent, scientists and engineers rely on technology transfer. For any particular technology-based product, one can trace the arc of science, technology, and product over time and from one set of

> scientists or engineers to the next. They draw on knowledge developed by others that they obtain through some combination of text (e.g., prior patents, journal articles, or working papers), legal permission (e.g., a patent license), and personal interaction (e.g., informal relationships, cooperative R&D, or technical assistance). Technology commercialization can be thought of as all the steps required to convert a technology into an economically successful product. In each trajectory of science, technology, and product, the process that unfolds is idiosyncratic, entirely dependent on context, individual and organizational capacities, and unique circumstances.

The report also outlines problems with geographic patterns for innovation—these could be important considerations when considering the challenges facing Michigan. Using patent activity as a proxy for technology development, the researchers found (Reamer, Icerman, et al., 2003):

- Technology development activity primarily takes place within larger metropolitan areas. Metropolitan areas receive 93 percent of U.S. utility patents and public R&D expenditures, and 19 percent of the metropolitan areas receive 66 percent of all patents. Also, metropolitan areas with more than one million jobs are far more likely to specialize in patenting (and have unit areas that specialize in patenting) than are metropolitan areas with fewer jobs.
- Public R&D is even more geographically concentrated than patenting. Only 20 percent of metropolitan areas specialize in public R&D, with 71 percent of metropolitan R&D expenditures and only 29 percent of metropolitan jobs. Moreover, over a quarter of metropolitan areas have no public R&D. Interestingly, as metropolitan area size declines, the range of R&D intensity widens considerably, particularly for metropolitan areas with fewer than 250,000 jobs.
- The presence of public R&D is not strongly correlated statistically with patenting activity. Overall, only 12 percent of unit areas specialize in both patenting and academic/nonprofit R&D. Nearly half of areas that specialize in patenting do not specialize in academic/nonprofit R&D. Conversely, 58 percent of areas that specialize in academic/nonprofit R&D do not specialize in patenting. This suggests that areas other than those with R&D centers can be involved in patenting activity.
- For unit areas, wage levels are boosted by industrial R&D, patenting activity, metro size, and educational attainment, while only educational attainment had a statistically significant impact on the expansion of regional job or wage base.

The report encourages greater interactions between governmental and regional development agencies and place-based technology transfer and commercialization programs, such as those at universities. Regions might also consider having clear distinctions between technology transfer and commercialization functions to allow for greater specialization within each area. Also, all regions are encouraged to explore ways to facilitate increased local firm access to technology developed elsewhere. That is, they should explore the ways in which technology transfer efforts can emphasize "demand-pull" rather than "supply-push." The primary focus in some regions on transferring technology from a local public R&D institution may not always be the best approach. Technology from anywhere can be commercialized locally (Reamer, Icerman, et al., 2003).

II. ECONOMIC DEVELOPMENT METRICS—TECHNOLOGY TRANSFER ACTIVITY IN MICHIGAN

Contributed by Kenneth Nisbet, Office of Technology Transfer, University of Michigan

Materials provided by the Partnership for Economic Progress in the *2nd Annual Assessment of Technology Transfer, 2002* provide a base for understanding the technology transfer performance of the state of Michigan as a whole against the "average" U.S. university. Several enhancements have been suggested to increase the understanding of statewide performance as well as individual school performance in relation to our peers. The following analysis and associated charts are intended to provide a more refined analysis.

A. Metric Comparison—Average of Four Michigan Universities vs. Average U.S. University

The chart below extends the base chart in the August 9th *Economics Benefits Work group—Research Brief* by including years 2001 and 2002 (not available in the source material).

Key findings include:

- Total research dollars absolute values and growth rates are higher, but we are losing ground in industry-sponsored research
- Normalized for the amount of research dollars:
  - Disclosure amounts and growth rates are on par
  - The growth rate of licensing activity is lower
  - The growth rate of start-ups created is much higher (although mainly from UofM)
  - Licensing revenues are 1.5 times the average and holding steady (but mainly from MSU)
  - The cumulative portfolio of active licenses is growing more than the average

Note: the metrics of conversion (ratio of licenses to disclosures and ratio of start-ups to disclosures is a poor metric on a yearly basis because of the time lag (1–6 years) between a disclosure and the eventual license.

TABLE A

Comparison of Four Michigan Universities in Technology Transfer to National Averages, 1999–2002

	1999			2000			2001			2002		
Metrics	MI	NATL	MI NATL	MI	NATL	MI NATL	MI AVG	NATL AVG	MI NATL	MI	NATL	MI NATL
Licenses and options yielding income	42	48	88%	52	53	98%	59	53.2	111%	69	56	123%
Adj. gross license income ($000's)	6,966	4,612	151%	7,584	7,579	100%	9,900	5,800	170%	9,500	6,400	148%
Total sponsored research ($000)	220,677	169,536	130%	237,657	181,339	131%	266,000	194,000	137%	294,000	211,000	139%
Industry sponsored ($000)	16,652	16,030	104%	15,935	15,591	102%	na	na	na	14,233	15,718	91%
Disclosures per $10M research	4.30	4.80	90%	5.20	4.20	125%	2.9	4	72%	3.5	4.00	88%
Licenses per $10M research	1.60	1.30	122%	1.60	1.40	112%	1.00	1.20	83%	0.85	1.20	71%
Number of start-ups	1.00	2.00	53%	2.00	3.00	67%	3.80	2.80	136%	1.30	2.40	54%
Start-ups/$10M research	0.04	0.13	31%	0.05	0.14	36%	0.13	0.14	93%	0.04	0.11	39%
Conversion rate—disclosures to license %	32	33.00	97%	26.9	33.4	81%	35.1	29.1	121%	24.5	30	82%
Conversion rate—disclosures to start-up %	1.25	2.81	44%	2.7	3.4	79%	4.9	3.5	140%	1.3	2.9	45%

Conclusion —Average Michigan University vs. Average U.S. University:		
	Relative Activity	Growth in Activity
Licenses and options yielding income	Equal	Higher
Adj. gross license income ($000's)	1.5 X	Equal
Total sponsored research ($000)	1.3 X	Slightly higher
Industry sponsored ($000)	Equal	Lower
Disclosures per $10M research	Equal	Equal
Licenses per $10M research	1.1 X	Substantially less
Number of start-ups	.6 X	Substantial growth nearly all UofM (FY02 was abnormal year)
Start-ups/$10M research	.4 X	Substantial growth nearly all UofM (FY02 was abnormal year)
Conversion rate—*disclosures to license %*	*Poor metric (ti*ming of disclose to licensing)	
Conversion rate—*disclosures to start-up %*	*Poor metric (timing of* disclose t*o start-up license)*	

B. Technology Transfer Comparison for Michigan Peer States

Charts B1 and B2 compare the combined metrics of the major research institutions within peer states of Michigan, ordered by scale of total research. This provides an idea of the mass of activity within these peer states to better understand the scale of economic activity and number of institutions contributing to this activity. Noting that the scale of activity within California and Massachusetts make comparisons among the other states more difficult, chart B2 excludes California and Massachusetts.

Key findings include:

- California is four times and Massachusetts is two times the scale of all metrics of the next tier of leading states (North Carolina, Minnesota, Illinois, Texas, Michigan, Washington, and Wisconsin.)
- Relative to the volume of research, Minnesota is performing very well (UofMN and Mayo)
- Texas is growing rapidly from a small base
- Michigan is positioned in the middle of this peer set of states

C. 2002 Peer Institution Benchmarking

One weakness of the state-by-state comparison is that the strong performance of one state university may mask needed improvements from others. For example, although average revenues for the entire state of Michigan match other leading states, much of these revenues are due to the Cisplatin licenses from MSU. Similarly, most of the start-up activity has centered around UofM. In addition, effective remedies to improve performance require an understanding of the performance, environment, and assets of individual universities. Table 3 provides a benchmarking of a set of peer institutions for fiscal year 2002, including both top five target peers as well as geographic neighbors. These data include both absolute metrics for performance (research, invention disclosures, patent applications, licenses, start-ups, and licensing revenues) and relative measurements. Note that 2003 data, not yet available for the other peer schools, is included for UofM for reference. Comparing disclosures to research is quite instructional as it relates the technology transfer potential to the underlying research volume. Other comparisons include licenses per disclosure (best done with multiple years of data, preferably offset), start-ups to total licenses, and annual revenue per license.

Key findings include:

- UofM has lagged in most metrics relative to research, but is growing faster than most peers.
- UofM performance is quite high for start-ups, and has improved dramatically for disclosures.
- UofM licensing activity and revenues trail our top peers, although improvements are apparent.

CHART B1

Comparison of Michigan on Technology Transfer with Other States and the Nation

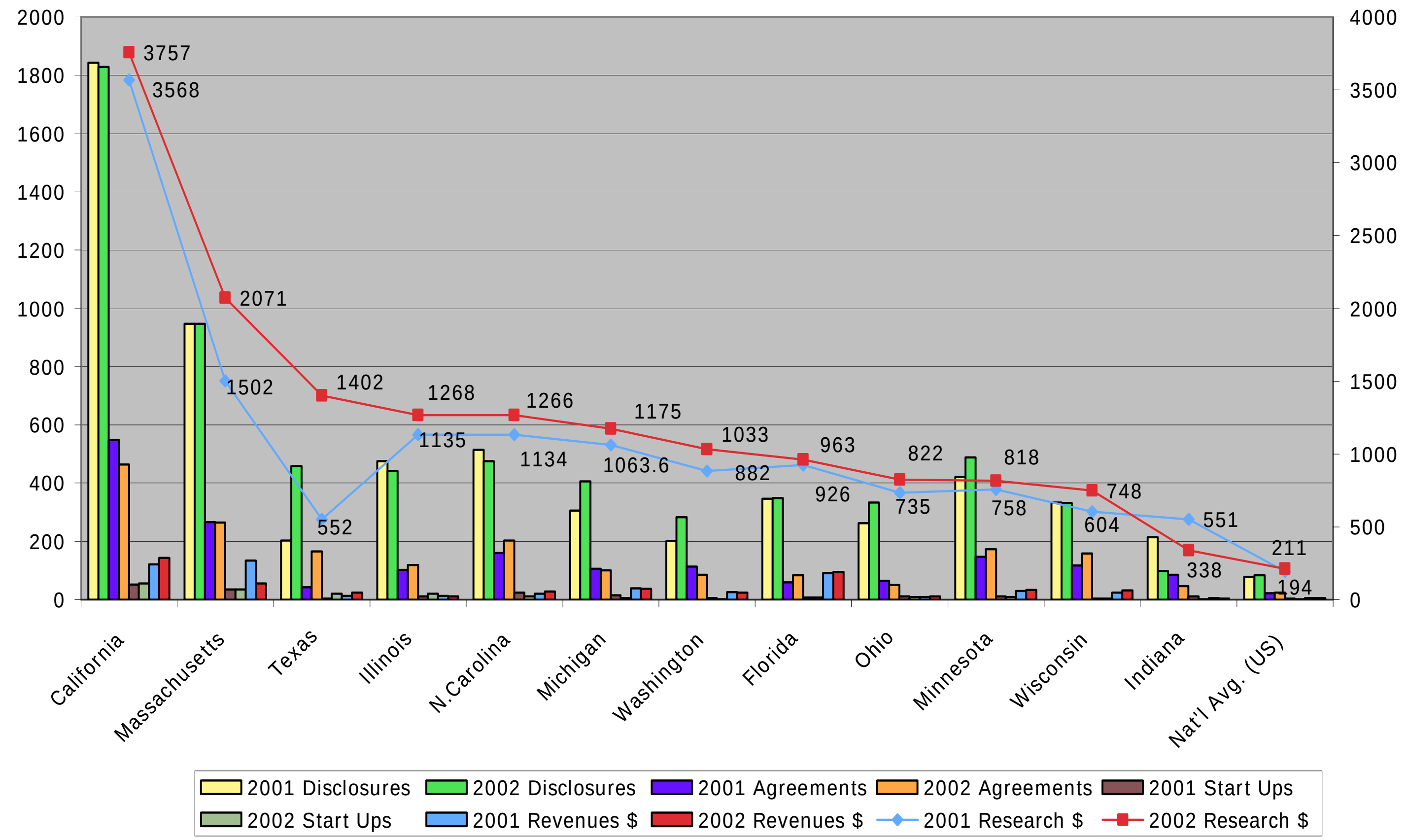


CHART B2

Comparison of Michigan on Technology Transfer with Other States and the Nation (without CA and MA)

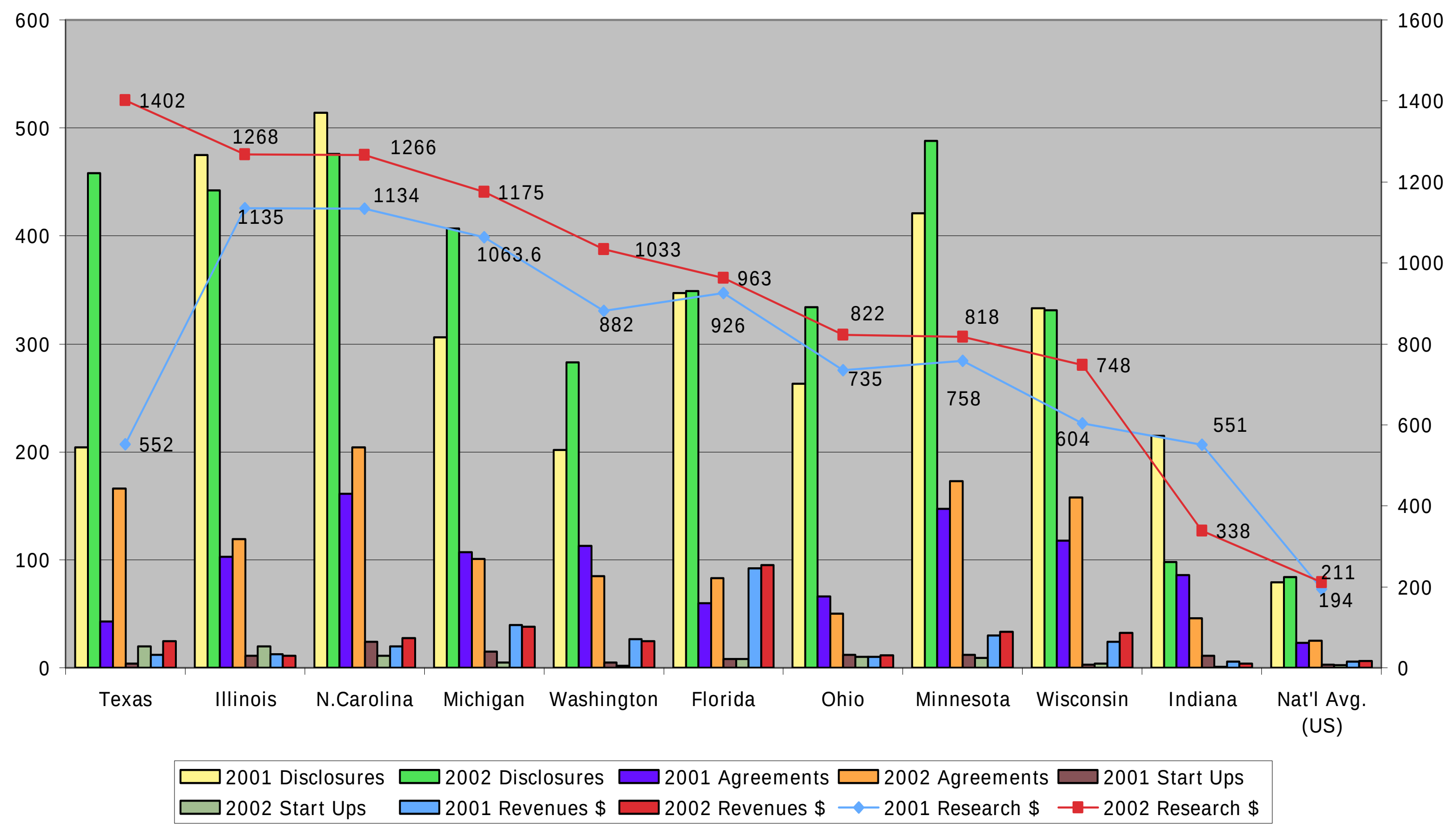


TABLE C
Top Michigan Research Institutions Compared with Nationally Leading Institutions

Research Dollars $MM		Disclosures		Patent Applications		New Licenses		Start-ups		Annual Revenue $MM	
U Cal Sys	$2,418	U Cal Sys	973	U Cal Sys	884	U Cal Sys	222	MIT	23	U Cal Sys	$82.0
J. Hopkins	$1,350	MIT	484	J. Hopkins	492	Wisconsin	156	U Cal Sys	23	Stanford	$50.0
MIT	$899	J. Hopkins	367	MIT	465	MIT	122	Stanford	13	Wisconsin	$32.1
UofM-2003	**$749**	Stanford	321	Stanford	324	Stanford	106	Illinois	12	**MSU**	**$29.8**
Illinois	$687	Wisconsin	308	Harvard	219	J. Hopkins	98	**UofM-2003**	**9**	MIT	$26.3
Washington	$684	**UofM-2003**	**257**	Wisconsin	204	UNC-CH	87	Ga Tech	8	Minn	$25.9
Wisconsin	$662	**UofM-2002**	**237**	Minn	170	Harvard	85	Harvard	7	Washington	$23.0
UofM-2002	**$656**	Minn	236	Illinois	158	**UofM-2003**	**76**	Minn	6	Harvard	$15.5
Stanford	$573	Washington	225	Duke	137	Minn	71	**UofM-2002**	**5**	**UofM-2003**	**$9.1**
Harvard	$522	Illinois	221	Washington	125	Illinois	70	UT-Austin	4	J. Hopkins	$8.1
Minn	$494	Ga Tech	192	**UofM-2002**	**124**	Washington	67	Wisconsin	4	Iowa	$7.9
Wash Univ	$417	Harvard	140	**UofM-2003**	**113**	**UofM-2002**	**61**	Duke	3	Illinois	$6.6
Duke	$404	Duke	133	UNC-CH	99	Duke	51	Iowa	3	Wash Univ	$6.4
Ga Tech	$344	UNC-CH	119	UT-Austin	96	Wash Univ	46	J. Hopkins	3	**UofM-2002**	**$5.7**
UT-Austin	$321	Chicago	110	Chicago	79	Iowa	37	UNC-CH	3	Duke	$4.5
MSU	**$290**	UT-Austin	83	Iowa	77	UT-Austin	35	Chicago	2	UT-Austin	$3.9
Iowa	$289	**MSU**	**82**	**MSU**	**60**	Chicago	32	Washington	2	Chicago	$3.1
UNC-CH	$275	Wash Univ	82	Ga Tech	55	Ga Tech	25	**MSU**	**0**	WSU	$2.2
Chicago	$225	Iowa	80	Wash Univ	45	**MSU**	**22**	WSU	0	Ga Tech	$2.1
WSU	$199	WSU	49	WSU	19	WSU	10	Wash Univ	0	UNC-CH	$1.2

III. MICHIGAN PERFORMANCE ON KEY INDICATORS: RESEARCH AND DEVELOPMENT, TECHNOLOGY TRANSFER, TECHNOLOGY

The Technology Administration and its Office of Technology Policy recognize that a one-size-fits-all policy formula that works to foster technology development and innovation does not exist for all regions of the country; rather each region can determine an appropriate policy given its strengths and weaknesses (Devereaux, Campbell, et al., 2004). The Office of Technology Policy's report on state science and technology indicators used measures that fell into three main categories: (1) funding in-flows, (2) human resources, and (3) capital investments and business assistance.

Michigan ranked first or in top 10 for the following indicators: R&D expenditures per $1,000 GSP (4); industry R&D per $1,000 GSP (1); percentage of science and engineering BS degrees granted out of total BS degrees (7); percentage of employment in high-tech NAICS codes (1); percentage of payroll in high-tech NAICS codes (6); patents issued per 10,000 businesses (9); average annual earnings among jobs (10). Michigan did moderately well (11–20) in NAEP math test scores (14); percentage of science and engineering graduate students in the population aged 18–24 (11); engineers per 10,000 workers (11); recent science and engineering BS degrees per 10,000 workers (15); percentage of establishment in high-tech NAICS codes (20); and average annual earnings (11). Areas in which Michigan did less well (ranked higher than 30th) were federal R&D expenditures per $1,000 GSP; federal obligations for R&D per $1,000 GSP; percentage of population with bachelor's degree (39); life and physical scientists per 10,000 workers (35); venture capital invested per $1,000 GSP (35); SBIC funds disbursed per $1,000 GSP (35); IPO funds raised per $1,000 GSP (34); and business incubators per 10,000 businesses (38); fast 500 companies per 10,000 businesses (32); inc 500 companies per 10,000 businesses (32); labor force participation rate (39); and percentage of workforce employed (41).

To summarize how Michigan fares, we are doing moderately well in several indicators, although clearly not all, and poorly in some that measure funding in-flows, human resources, technology intensity of our business base, and outcome measures; but we are consistently doing poorly in capital investment and business assistance (venture capital invested, SBIC funds disbursed, IPO funds raised, and business incubators). Given these indicators, we can see it is not simply about venture capital (although this is one indicator where we have much room to improve in that we are ranked 35th nationally). SBIC funding, IPO fund-raising, and business incubation are additional areas where we can improve, all areas in which MEDC is working to move Michigan's economic development. Utilization and coordination of MEDC efforts provide Michigan with its best opportunity to improve.

IV. COMMERCIALIZATION AND ECONOMIC DEVELOPMENT: EXAMPLES FROM OTHER STATES

Looking at a few of the examples of economic development/commercialization programs from other states that were mentioned at the previous two benefits work group meetings, a range of possibilities begins to emerge. Some programs are private, other public, and still others a combination of private/public. One works exclusively with one university and focuses on a combination of moving research ideas through the patent and licensing processes, matching patents with entrepreneurs/businesses for commercialization, and funding institutional R&D (WARF). Another focuses exclusively on economic development through support of business within a general region (UCSD CONNECT). One does both these activities (commercialization and support for new and established businesses) in partnership with a university (USC Business Link) while another works with multiple universities but is strictly bound by a geographic location in terms of a research park that provides the space, culture, and opportunities to share ideas and provide support services to entrepreneurs and larger established technology firms (NCRT). Below are some descriptions of the programs gleaned from information from their websites.

Wisconsin Alumni Research Foundation (WARF)

WARF is a private nonprofit organization founded in 1925 that helps move research discoveries to commercialization in the marketplace. WARF works with inventors by acquiring patents (about 100 year), matching discoveries with potential developers for commercialization through licensing agreements, and returning revenue to inventors, their departments, and University of Wisconsin-Madison (UW-Madison) to use as they see fit. The money is often used to fund early research for which there are few available sources.

To date WARF has processed approximately 4,000 inventions created by UW-Madison faculty and staff, obtained nearly 1,400 patents on these inventions, completed over 1,200 license agreements with companies all over the world, and given $170 million to the UW-Madison in the form of unrestricted, annual grants. The university has used the money to support more than

47,000 research projects, including 1,320 in 2002–2003, funded hundreds of graduate fellowships, including 200 in 2002–2003, partially or fully pay for the construction of nearly every research facility on campus (50 total). Today WARF manages over 600 pending and 800 issued U.S. patents on UW-Madison technologies, as well as 1,700 foreign equivalents, offers more than 3,300 technologies for licensing, maintains more than 440 active license agreements, almost 25 percent of which are with Wisconsin businesses, holds equity in 30 UW-Madison spin-off companies.

WARF was founded by UW-Madison professor Harry Steenbock in collaboration with the deans of agriculture and the graduate school and the financial support of wealthy UW alumni. It was sanctioned by the UW board of regents and has a charter filed with Wisconsin's Secretary of State. It has its own trustees.

University of California at San Diego CONNECT (UCSD CONNECT)

UCSD CONNECT was founded in 1985 at the urging of San Diego's business community to create a regional program that links high-technology and life science entrepreneurs with the resources they need for success: technology, money, markets, management, partners, and support services. It has a dual role in accelerating growth: it provides added value and delivers targeted, high-level expertise to San Diego's technology business community by teaming up with the region's most prominent industry-specific organizations and individuals and by partnering with world-class UCSD resources, such as the School of Medicine, Jacobs School of Engineering, San Diego Super Computer Center, and Scripps and Salk Institutes. Members may include companies currently developing new technologies, companies conducting scientific research, and individuals in the high-technology or biotechnology industry not directly affiliated with a company.

CONNECT is a globally recognized university-based public benefits organization fostering entrepreneurship in the San Diego region by catalyzing, accelerating, and supporting the growth of the most promising technology and life sciences businesses. It supports entrepreneurship at each level of the life spans of businesses.

Cutting-edge technology licensing opportunities and technology assessment capabilities for entrepreneurs are being forged through a partnership between UCSD CONNECT and Los Alamos National Laboratory's Technology Transfer Division. The Los Alamos lab is operated by the University of California for the Department of Energy's National Nuclear Security administration, employing approximately 7,500 UC employees and 3,200 contractor personnel with an annual budget of $2.2 billion.

CONNECT is entirely self-supporting and receives no funding from the university or the state of California. It is supported through membership dues, course fees, and corporate underwriting for specific programs.

North Carolina Research Triangle Regional Partnership and Foundation

The state of North Carolina's constitution prohibits local governments from offering major incentives to corporations, instead relying on a number of public investments, infrastructure improvements and public financing mechanisms and programs that have been put into place to enhance the operating environment in the Research Triangle region.

The Research Triangle Regional Partnership is a public-private partnership of economic developments agencies that works collaboratively with the North Carolina Department of Commerce to market the state's 13-county Research Triangle Region. It was created by community leaders in Raleigh, Durham, and Chapel Hill in 1990 to market their communities together. Additional communities were included in 1993. It provides the following services: regional data, custom research, special reports, virtual property search, marketing trips, media relations, "smart" meeting room, VIP hosting, site selection services, and community briefing/tours.

RTP Foundation created a physical space for high technology companies to locate within close proximity to each other and several institutions of higher learning in 1959. The park encompasses 7,000 acres of North Carolina pine forest and has approximately 1,100 acres for development and 131 organizations. Almost 40 percent of park employers have fewer than 10 employees and the average salary of an RTP employee is $56,000. It currently houses 100 research and development facilities, which employ over 38,500 Triangle residents. Development surpasses 19 million square feet, capital investment exceeds $2 billion, and total payroll is estimated at $2.7 billion.

From 1990 to 2000 more than 42 new companies have established facilities in RTP. A research business incubator was formed to provide interim laboratory facilities for early-stage companies. Also located in the Park is the North Carolina Biotechnlogy Center—a state-supported initiative that provides grants and creative services to support biotech companies. MCNC offers advanced resources in microfabrication and telecommunications and houses the North Carolina Supercomputing Center—both of which provide resources to North Carolina companies, the universities, and area entrepreneurs.

University of South Carolina Columbia Business Link

Created in 2003, University of South Carolina (USC) Business Link brings together five USC economic development and research resources important to the business and economic development communities with a "no hassles" approach. It is directed by the Research and Economic Development of the University of South Carolina. It focuses on linking the small to medium manufacturers, intellectual property, industrial agreements, USC small business development center, technology incubator, and USC faculty, students, staff, and facilities.

The staff supports industrially sponsored programs at USC and negotiates on USC's behalf (research agreements, master/umbrella agreements, SBIR/STTR agreements, intellectual property allocation agreements, technology transfer agreements, clinical trial agreements, and training agreements). They do this by marketing USC's resources to the economic development and business communities, streamlining the economic development and business connection to USC resources, and increasing USC's public-private partnerships. It is funded by federal, state, and private funds.

To date USC Business Link has worked with nearly 5,000 clients, helped create or save more than 5,400 jobs, supported business investments statewide to taking over $207 million, and received over $32.6 million in industrial sponsored research revenue and almost $1.3 million in royalties. Currently, they are working with state agencies and other economic development allies and with more than 100 businesses, and on lean manufacturing, marketing, and business development, capacity utilization, and technology transfer and R&D.

The technology incubator not only attracts in-state companies/entrepreneurs, but also "landing parties" – established companies relocating to South Carolina or opening an office in Columbia. They market their *full service* business support in providing resources needed to increase productivity and competitiveness. They note that comparable programs are community focused with derivative benefits to business or stop at technology transfer, whereas USC Business Link goes further (*http://uscbusinesslink.sc.edu/Website.pps*).

V. WHAT MICHIGAN IS DOING

The Michigan Economic Development Corporation (MEDC) is the state of Michigan's "one-stop resource for businesses seeking to grow in Michigan." Its SmartZones and Business Accelerators programs are efforts to create talent centers in distinct geographical locations for tech-based firms, entrepreneurs, and researchers. These programs are similar to the North Carolina Research Triangle in that the combined effort of commercialization *and* business support (e.g., services that support entrepreneurs and small businesses) is duplicated across the state; however, SmartZones are tied closely to one another in ways other than through MEDC. Also, while MEDC is a critical and efficient organization for supporting economic development in the state, it could more smoothly coordinate with higher education institutions conducting R&D and all institutions (public and private, four-year and two-year) to produce talented individuals for our workforce. Following is a description of the SmartZones and Business Accelerators programs.

SmartZones

Contributed by Jeffery Mason, Michigan Economic Development Corporation

- Designed to stimulate growth of businesses/jobs by aiding in the creation of recognized technology clusters that provide nurturing environments for technology companies
- Began in 2001 after the passage of legislation and a competitive request solicitation for proposals to Michigan communities
- $19.7 million was awarded for infrastructure and marketing in addition to the ability for SmartZones to capture taxes from new growth within the boundaries of the SmartZone via tax increment financing (TIF)
- Encourages partnership/collaboration between local community, businesses, research universities, economic development partners, and the state/MEDC
- Eleven areas received SmartZone designation
    1. Houghton/Hancock/MTU & OU
    2. Mount Pleasant/CMU
    3. Kalamazoo/WMU
    4. Grand Rapids/VAI, GVSU & GRCC
    5. Oakland County/Troy/Southfield/Rochester Hills/LTU & OU
    6. Ann Arbor/Ypsilanti/UofM & EMU
    7. Detroit/WSU
    8. Battle Creek/WMU & Kellogg CC
    9. Muskegon/GVSU
    10. Wayne County/Romulus/Huron Township
    11. Lansing/East Lansing/MSU

- Local Development Finance Authorities (LDFA's) are allowed to collect TIF within the boundaries of the zone to pay for public infrastructure, business incubators, eligible businesses, laboratories, etc. within the certified technology park
- Since April 2001:
  - 100 companies have located in the zones
  - 3,546 jobs have been created
  - 301 companies have received assistance (includes business accelerator assistance)
  - $87 million public investment
  - $266 million private investment

Business Accelerators

- Program began in 2002 after a competitive request for proposals among the eleven designated SmartZones. Business Accelerators provide a variety of services including: technology mining, technology assessments, business feasibility studies, business planning, entrepreneurial training, venture capital preparation and introductions, market analysis, product development, management recruitment, and business development mentoring. The Business Accelerators located with these seven SmartZones offer assistance to technology companies and start-ups covering a broad range of technologies.
- Seven Business Accelerators designations at existing SmartZones
  1. Michigan Tech Enterprise Center (Houghton/Hancock/MTU)
  2. Center for Applied Research & Technology (Mt. Pleasant/CMU)
  3. Southwest Michigan Innovation Center (Kalamazoo/WMU)
  4. West Michigan Science & Technology Initiative (Grand Rapids/GVSU/VAI)
  5. Automation Alley Technology Center (Oakland County/LTU/OU)
  6. Ann Arbor IT Zone (Ann Arbor/UofM/EU)
  7. TechTown (Detroit/WSU)
- MEDC provided $4.5 million to the seven Business Accelerators for two years of support until TIF revenues pick up.
- Since September 2002:
  - 67 companies have enrolled in a business accelerator program
  - 21 companies have started up
  - 220 jobs have been created
  - 301 companies have received assistance (includes SmartZone assistance)
  - $46.8 million in non-MEDC investment
  - $7 million in private capital raised by companies
  - $26 million in public capital raised by companies (SBIR/STTR, TTC, etc.)

VI. INDEPENDENT COLLEGES AND UNIVERSITIES: FILLING IN THE MISSING PIECE

Independent colleges and universities in this country provide affordable access to higher education to students from a diverse array of backgrounds and enable them to successfully reach their educational goals. The following information comes from the National Association of

Independent Colleges and Universities (NAICU) and two of their reports (NAICU, 2003; NAICU, 2004).

National

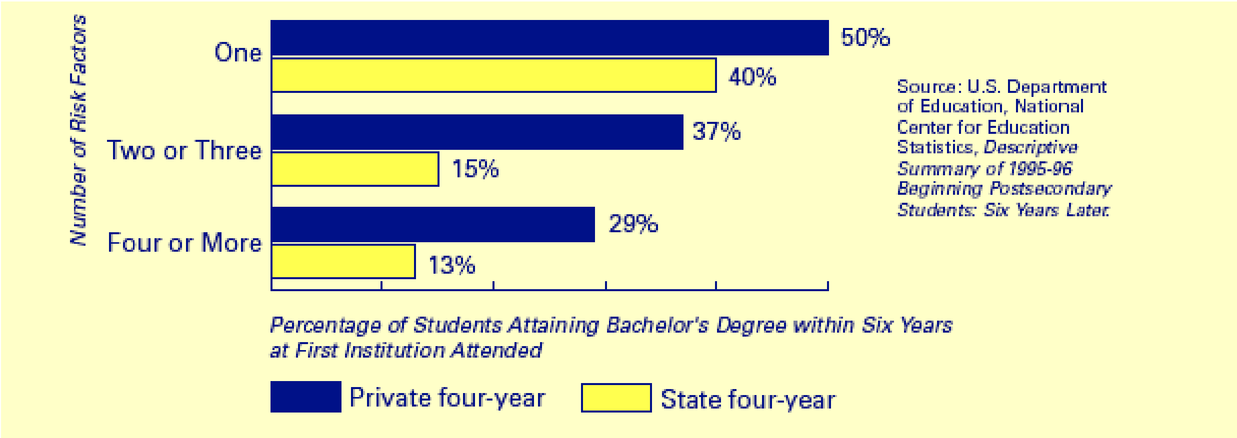
Participation: Most students pay less than the published tuition at private colleges and universities after grants and scholarships (only about 60 percent of average published tuition). Nationally 76 percent of full-time, full-year undergraduates at private institutions receive grant aid from institutional, federal, state, or private sources. Some individual institutions can support over 90 percent of their student body. The average tuition students pay at private colleges has actually *declined* over the past decade, once you subtract grant aid and adjust for inflation. Most of the financial aid undergraduates receive at private colleges and universities is based on *financial need*. The average net tuition for students in the lowest income quartile decreased by nearly 15 percent between 1995 and 1999 so that on average these neediest students paid 40 percent or less of published tuition prices.

Private colleges and universities utilize a combination of need- and merit-based grant aid to support talented students from all socioeconomic and academic backgrounds, targeting financially needy students primarily, which accounts for two-thirds the grants awarded.

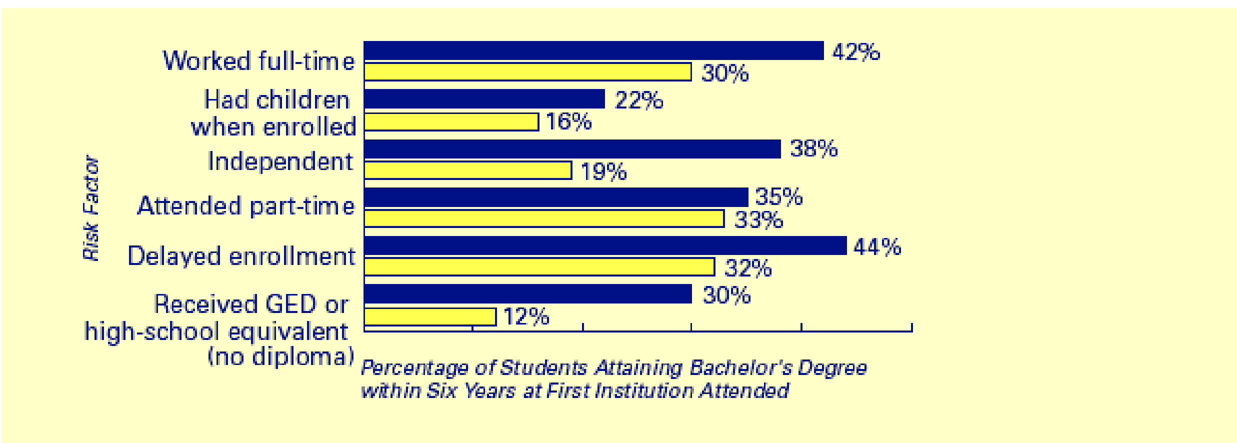
And the tuition itself covers only 62 percent of the cost of instruction, technological and other related expenses that make up the true cost of educating a student, indicating that private colleges and universities are among the few sectors of the economy that successfully "sell" their product for less than the cost of producing it.

The proportion of students from racial and ethnic minorities (24 percent at private and 25 percent at public institutions) and from low- and middle-income households (16 percent are from families that earn <$25,000) at private colleges and universities is almost the same as at four-year state institutions. Many older, working and part-time students attend private colleges and universities, along with "traditional" full-time students just out of high school. Students who have dependents or support themselves attend private colleges and universities at about he same rate as at four-year state institutions. Private colleges and universities educate "nontraditional" (44 percent), first generation (50 percent), and part-time students (29 percent) and students who work full time (29 percent) and part time (49 percent). The private institutions serve a greater proportion of "at-risk" students than the public ones (19 percent and 14 percent, respectively) and graduate a higher percentage of these students. Students with multiple risk factors are more likely to graduate from private than from public institutions, and do so in four years.

Students with Multiple Risk Factors Are More Likely to Succeed at Private Colleges and Universities Than at Four-Year Institutions



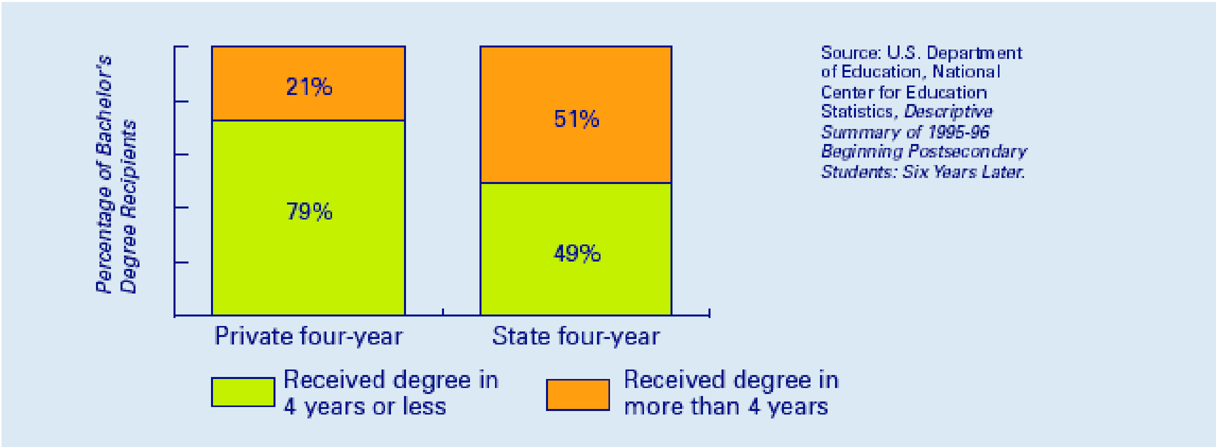
Students with Each Risk Factor Are More likely to Succeed at Private Colleges and Universities Than at Four-Year State Institutions



Private colleges and universities are more likely than public ones to serve financially and academically challenged students.

Persistence: Students who work full time, have a high school equivalency diploma (GED), or face other challenges are *far more likely* to graduate from a private college or university than a state institution. *All* types of students are as likely to earn their degree in four years at a private college or university as they are to do so in *six* years at a state institution. Students who earn bachelor's degrees are able to do so sooner at private colleges and universities than at state institutions, avoiding additional tuition and beginning their careers earlier.

Time-to-Degree for Students at Four-Year Colleges and Universities



How Time-to-Degree Affect's the "Price" of a Bachelor's Degree

	Private College or University	State College or University	
	4 years to degree	*5 years to degree*	*6 years to degree*
Years 1-4	Average Net Tuition (after grant aid): $8,900 x 4 years = $35,600 *Student earns a degree and enters the work force*	Average Net Tuition (after grant aid): $2,700 x 4 years = $10,800 *Student continues in school*	Average Net Tuition (after grant aid): $2,700 x 4 years = $10,800 *Student continues in school*
Year 5		5th year average net tuition: $2,700 Average lost income in 5th year: $27,000 *Student earns a degree and enters the work force*	5th year average net tuition: $2,700 Average lost income in 5th year: $27,000 *Student continues in school*
Year 6			6th year average net tuition: $2,700 Average lost income in 6th year: $27,000 *Student earns a degree and enters the work force*
	Time-to-Degree *4 years*	**Time-to-Degree** *5 years*	**Time-to-Degree** *6 years*
	Net tuition: $35,600	Net tuition: $13,500	Net tuition: $16,200
	Lost income during add'l time-to-degree: $0	Lost income during add'l time-to-degree: $27,000	Lost income during add'l time-to-degree: $54,000
	Total price of degree: $35,600	Total price of degree: $40,500	Total price of degree: $70,200

Sources: U.S. Department of Education, National Center for Education Statistics, *Descriptive Summary of 1995-96 Beginning Postsecondary Students: Six Years Later.;* Beginning Postsecondary Students – BPS:96/01 Data Analysis System. Analysis by the National Association of Independent Colleges and Universities.

Michigan

In Michigan the private four-year colleges and universities enrolled 102,302 students in 2003–2004, enrolling the third largest sector of the student population in Michigan (Chronicle of Higher Education, 2004). (The public two-year institutions enrolled 199,258 students, and public four-year institutions enrolled 282,896.) Of the number of students the private institutions enroll, 21.2 percent are minority students—a significantly higher percentage than the public four-year institutions (17.3 percent) and public two-year institutions (17.9 percent). In Michigan the 58 private four-year institutions educate a significant portion of the overall student population, and specifically are serving traditionally underserved student populations—students of color.

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