

Benchmarking Michigan's URC

Supplement to the Fifth Annual Economic Impact Report of
Michigan's University Research Corridor

Commissioned by Michigan's University Research Corridor

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University of Michigan
Wayne State University

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Executive Summary

INTRODUCTION AND PURPOSE

The University Research Corridor (URC) is an alliance of Michigan’s three largest academic institutions: Michigan State University, the University of Michigan, and Wayne State University. The purpose of this alliance is to accelerate economic development in Michigan by educating students, attracting talented workers to Michigan, supporting innovation, and encouraging the transfer of technology to the private sector. The URC universities have main campuses in East Lansing, Ann Arbor, Flint, Dearborn, and Detroit, but the URC’s reach extends to all areas of the state. Each URC university has research, teaching locations, and partner hospitals located throughout the state.

Since 2007, the URC has commissioned Anderson Economic Group to provide an annual report that estimates the economic impact of the URC’s activities on Michigan’s economy and compares its performance to peer universities nationwide. In the fall of 2011, the fifth annual report was released, but it did not include the peer comparisons due to a delay in the release of data needed to complete these comparisons.

This report contains the FY 2010 peer analysis and is meant as a supplement to the 2011 *Empowering Michigan* report. In this report we compare the URC universities to its peers on metrics including student enrollment, degrees awarded, research and development expenditures, and technology transfer activities.

PEER UNIVERSITY CLUSTERS

We selected six of the best-known groups of universities in California, Illinois, Massachusetts, North Carolina, and Pennsylvania to benchmark the URC’s performance. Each cluster includes three universities from the same geographical area. We selected peer clusters based on academic quality, research intensity, and size of the institution. We show the peer clusters in Table 1 below.

TABLE 1. Comparison Peer University Clusters

Michigan’s URC	Michigan State University	University of Michigan	Wayne State University
Northern California	University of California, San Francisco	University of California, Berkeley	Stanford University
Southern California	University of California, Los Angeles	University of California, San Diego	University of Southern California
Illinois	University of Chicago	University of Illinois at Urbana-Champaign	Northwestern University
Massachusetts	Harvard University	Massachusetts Institute of Technology (MIT)	Tufts University
North Carolina	Duke University	University of North Carolina (Chapel Hill)	North Carolina State University
Pennsylvania	Penn State University (all campuses)	University of Pittsburgh (all campuses)	Carnegie Mellon University

Source: Anderson Economic Group, LLC

SUMMARY OF FINDINGS

In Table 2, we present the URC’s performance on key measures since our first report in 2007. The URC has continued to increase its enrollment and degrees awarded during the past five years. The URC’s technology transfer rankings against its peers have remained consistent over time, with the URC ranking fifth on most measures. The URC’s expenditures, both on total operations and research and development, have grown steadily since 2007, as has the URC’s economic impact. We discuss the URC’s performance in more detail in the findings below.

TABLE 2. Summary of the URC’s Performance

	Benchmark: 2007 Report (2006 data)	2010 Report (2009 data)	Supplement to 2011 Report (2010 data)	Change Since Benchmark Year of 2007
<i>Student Performance</i>				
Fall Enrollment (Degree-Seeking Only) ^a	131,231	133,645	136,061	+ 4,830 students
Total Degrees Granted	30,337	31,935 ^b	32,157	+ 1,820 degrees
<i>Rank of Technology Transfer Activities^c</i>				
No. of Start-up Companies Cultivated	5	5	5	+0 Improvement
Patent Grants Awarded ^d	4	3	3	+1 Improvement
Technology Licenses Issued	5	5	5	+0 Improvement
<i>Economic Impact (from 2011 Report)^e</i>				
Operational Expenditures	\$6.5 billion	\$7.5 billion	\$7.7 billion	+\$1.2 billion
Total R&D Expenditures	\$1.451 billion	\$1.734 billion	\$1.878 billion	+ \$427 million
Net Economic Impact	\$12.9 billion	\$14.8 billion	\$15.2 billion	+2.3 billion
Tax Revenue Impact on State of Michigan	\$351 million	\$401 million	\$426 million	+\$75 million

Analysis: Anderson Economic Group, LLC; see remainder of report body for detailed sources and calculations.

- a. Fall total enrollment for undergraduate and graduate students from the Integrated Postsecondary Education Data System. Information for all years was updated to reflect the most current information reported by the universities.
- b. In the 2010 report, the URC’s total degrees granted was incorrectly reported at 28,095. The number here is correct.
- c. Rankings are based on five-year averages of annual activity and are out of seven clusters. The 2007 report uses 2002-2006 data, the 2010 report uses 2005-2009 data, and this (2011) report uses 2006-2010 data. A ranking of “1” indicates the university cluster with the highest technology transfer activity for that indicator.
- d. The benchmark year (2007 report) ranking reflects the revised patent grant data, which has since been used in our 2009 and 2010 reports.
- e. See Caroline M. Sallee and Patrick L. Anderson, *Empowering Michigan: Fifth Annual Economic Impact Report of Michigan’s University Research Corridor*, October 4, 2011.

1. The URC Ranks First in Student Enrollment and Number of Degrees Granted.

The URC’s 136,061 students in the fall of 2010 make it the largest research university cluster in terms of enrollment. The next largest is the Pennsylvania cluster with just over 124,000 students enrolled in the fall of 2010.

During the 2009-2010 academic year, the URC ranked first in total number of degrees (undergraduate and graduate) conferred overall (32,157). The Southern California cluster conferred the second most degrees (30,418). In terms of advanced degrees awarded, only the Illinois cluster (13,004) granted more than the URC (11,957). See “Total Degrees Granted” on page 2.

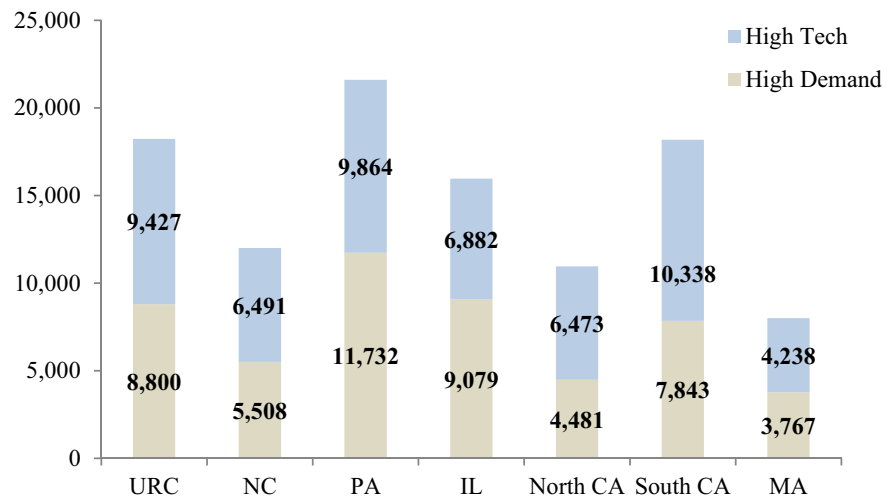
2. The URC Awards the Second Most High-Tech and High Demand Degrees.

The URC universities graduate a large number of students with degrees that prepare them for jobs in Michigan’s vibrant high-tech industry.¹ As shown in Figure 1 below, the URC awarded the third largest number of high-tech degrees (9,427). Only the Southern California (10,338) and Pennsylvania (9,864) university clusters awarded more high-tech degrees than the URC in 2010.

The URC also conferred the third largest number of “high demand” degrees (8,800). Using a survey done by the National Association of Colleges and Employers, we identified business, computer science, and engineering degrees as the ones most sought after by employers.² As shown in Figure 1 below, only the Pennsylvania and Illinois clusters awarded more high demand degrees than the URC.

In total, the URC confers more high-tech and high demand degrees (18,227) than every other university cluster except for Pennsylvania (21,596). See “High-Tech and High Demand Degrees” on page 5.

FIGURE 1. Completion of High-Tech and High Demand Degrees, 2009-2010



Note: See Appendix A for definitions of “High-Tech” and “High Demand” degrees.

Data Source: National Center for Education Statistics, IPEDS

Analysis: Anderson Economic Group, LLC

1. We define “high-tech” as degrees in biological and biomedical sciences, physical sciences, computer sciences, architecture, engineering, mathematics and statistics, and some agricultural sciences.
2. The National Association of Colleges and Employers’ *Job Outlook 2011 Report* surveyed approximately 200 employers from a variety of sectors. See “High Tech and High Demand Degrees” on page A-1 for our methodology.

3. The URC Had the Third Highest One-Year Growth in R&D Expenditures of the Peer Clusters, Reaching Almost \$1.9 Billion in 2010.

Expenditures on research and development by the seven university clusters in FY 2010 totalled over \$13.7 billion, which accounts for nearly a quarter of R&D expenditures by all U.S. universities. The URC universities spent \$144 million more on research and development in 2010 than in the prior year. This was the third highest increase in spending of the peer clusters; the URC universities spent 8.3% more in FY 2010 than in the prior year. Approximately 58% of R&D funding came from federal sources, bringing almost \$1.1 billion in federal dollars into the state of Michigan for research. See Table 3 on page iv and “Academic R&D Expenditures” on page 7.

TABLE 3. Growth in Total Academic R&D Expenditures

	FY 2009 R&D Expenditures (in millions)	FY 2010 R&D Expenditures (in millions)	Annual Growth 2009- 2010	Rank Growth 2009-10
Michigan’s URC	\$1,734	\$1,878	8.3%	3
Northern California	\$2,348	\$2,469	5.2%	4
Southern California	\$2,364	\$2,473	4.6%	5
Illinois	\$1,519	\$1,557	2.5%	6
Massachusetts	\$1,440	\$1,417	-1.6%	7
North Carolina	\$1,842	\$2,099	14.0%	1
Pennsylvania	\$1,612	\$1,816	12.7%	2
<i>All U.S. Universities</i>	<i>\$57,321</i>	<i>\$61,235</i>	<i>6.8%</i>	

*Data Source: National Science Foundation, Integrated Science and Engineering Resources Data System
Analysis: Anderson Economic Group, LLC*

4. Michigan’s URC is in the Lower Half of the Peer Clusters on Technology Transfer Activities.

An important outcome of university research is technology that is developed and then transferred to the private sector for commercialization. All universities perform research that sometimes is patented and licensed, which then provides revenue for the university. We show the most recent five year average for these activities in Table 4 on page v as year-to-year variation is high.

As shown in the table below, the URC ranks fifth in our group of seven peers on the shown technology transfer measures. During the past five years, the URC received

Executive Summary

an average of 135 patent grants and 129 licenses. The URC helped create an average of 14 start-up companies each year. See “Technology Transfers” on page 10.

TABLE 4. Average Annual Patent and Licensing Activity, 2006-2010

	Invention Disclosures	<i>Rank</i>	U.S. Patent Grants	<i>Rank</i>	Licenses/ Options	<i>Rank</i>	Licensing Revenue (in millions)	<i>Rank</i>	Start-up Companies	<i>Rank</i>
URC	481	5	135	4	129	5	\$37.0	5	14	5
North CA	747	3	245	1	162	3	\$125.0	2	23	3
South CA	791	2	135	3	110	6	\$59.6	4	33	1
IL	512	4	104	5	99	7	\$260.5	1	14	6
MA	830	1	197	2	174	2	\$85.0	3	31	2
NC	466	7	91	7	202	1	\$19.8	6	12	7
PA	477	6	92	6	148	4	\$16.1	7	19	4

Note: See footnotes for detailed data and methodology notes in Table 13 on page 11.

Data Source: Universities' websites and technology transfer offices, Association of Technology Managers (AUTM) Surveys

Analysis: Anderson Economic Group, LLC

**ABOUT ANDERSON
ECONOMIC GROUP**

Anderson Economic Group, LLC (AEG) is a consulting firm that specializes in economics, public policy, financial valuation, market research, and land use economics. AEG has completed economic impact studies for universities across the country. AEG has provided the URC with economic impact reports since 2007. See “Appendix B: About the Authors” for more information.

I. Education Benchmarks for the URC and Its Peers

STUDENT ENROLLMENT

The University Research Corridor had 136,061 students enrolled in the fall of 2010. This represents a small increase in enrollment from the fall of 2009, when total URC enrollment was just over 135,000. The number of undergraduate students increased, but graduate student enrollment at URC universities decreased 1.5%, slightly offsetting the undergraduate growth. See Table 5 below.

TABLE 5. URC Enrollment, Fall 2006-2010

	2006	2007	2008	2009	2010	Change 2009-10
Undergraduate	92,130	93,519	92,939	94,497	95,645	1.2%
Graduate	<u>39,101</u>	<u>40,126</u>	<u>40,025</u>	<u>41,025</u>	<u>40,416</u>	-1.5%
TOTAL	131,231	133,645	132,964	135,522	136,061	0.4%

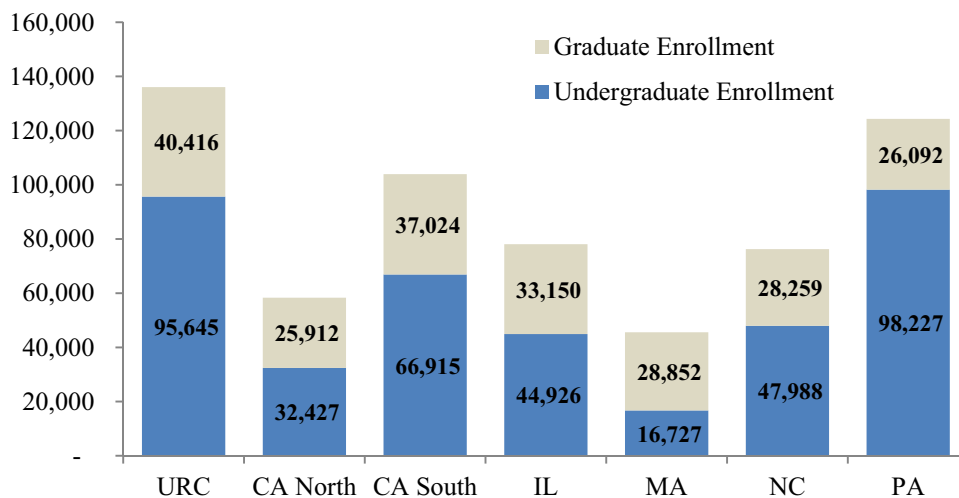
Note: Reports prior to 2010 had an "other" category that included non-degree students.

Data Source: IPEDS fall enrollment for undergraduate and graduate; 2006-2010.

Analysis: Anderson Economic Group, LLC

As shown below in Figure 2, the URC is the largest university cluster of those in this analysis with over 136,000 students. Pennsylvania is the second largest with 124,319 students. During the 2010-2011 academic year about 70% of the URC's students were undergraduates and 30% were graduate students. With almost twice as many undergraduate students as graduate students, the URC has the second highest ratio of undergraduates to graduates, following the Pennsylvania cluster, which had the highest ratio. Massachusetts is the smallest cluster and has more graduate students than undergraduates. Nearly 60% of the Massachusetts cluster's students are graduate students.

FIGURE 2. Student Enrollment for the URC and Peer Clusters 2010-2011



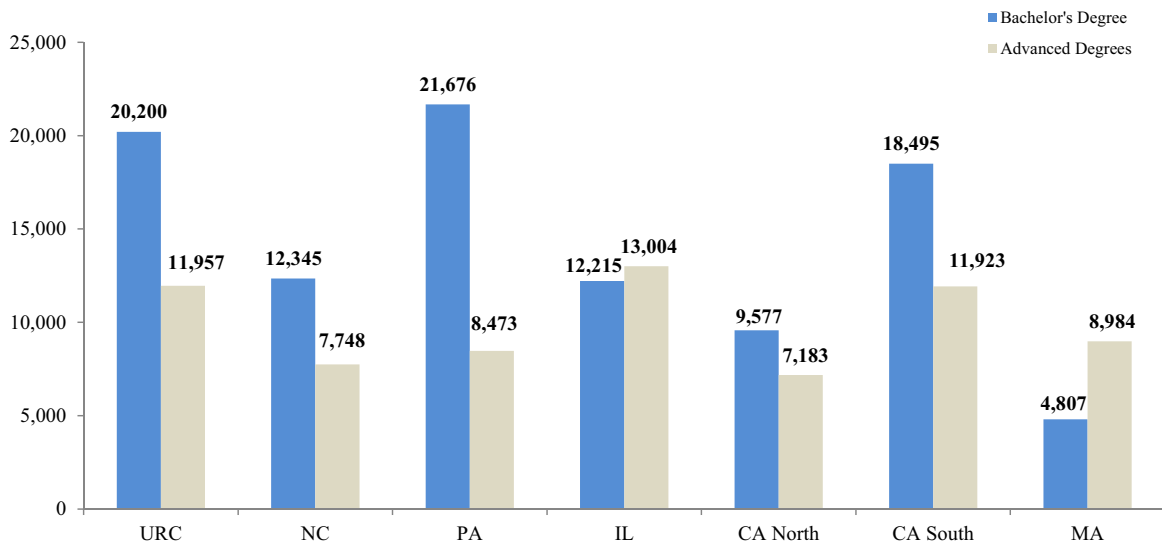
Data Source: IPEDS Enrollment, URC Offices of Registrar

Analysis: Anderson Economic Group, LLC

TOTAL DEGREES GRANTED

During the 2009-2010 academic year, the URC ranked first in total number of degrees (undergraduate and graduate) conferred at 32,157. The Southern California cluster conferred the second most degrees (30,418 total degrees). As shown below in Figure 3, the URC issued 20,200 bachelor degrees and 11,957 advanced degrees. Only the Pennsylvania cluster awarded more bachelor degrees (21,676) and only the Illinois cluster awarded more advanced degrees (13,004) than the URC.

FIGURE 3. Completions by Type of Degree, 2009-2010 Academic Year



Data Source: IPEDS Degree Completions
 Analysis: Anderson Economic Group, LLC

DEGREES BY PROGRAM AREA

We present the number of degrees granted by the URC and the peer university clusters by subject area in this section.

Academic Programs

The academic program areas used in this section are based on the National Center for Education Statistics (NCES) Classification of Instructional Programs. We created the following academic program area:

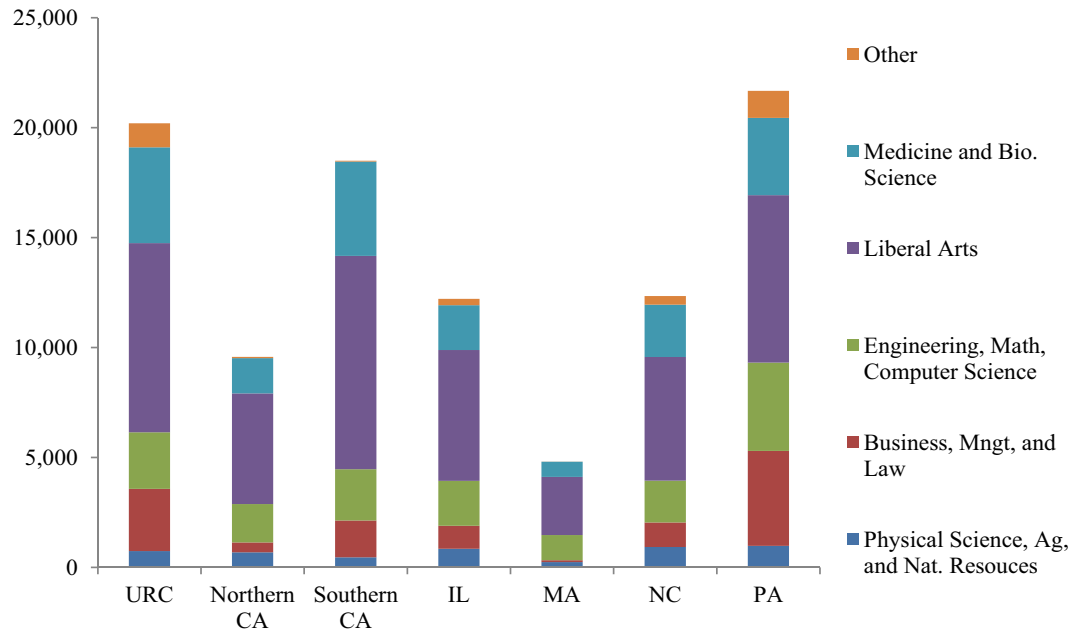
- Physical Science, Agriculture, and Natural Resources
- Business, Management, and Law
- Engineering, Mathematics, and Computer Science
- Liberal Arts
- Medicine and Biological Science
- Other

See “Academic Program Definitions” on page A-1 for the composition of each program area.

Education Benchmarks for the URC and Its Peers

Undergraduate Degrees Conferred. The URC conferred the most *Medicine and Biological Science* degrees, and the second most number of undergraduate degrees in every other area except for *Physical Science, Agriculture, and Natural Science*, in which they conferred the fourth highest. See Figure 4 and Table 6 below.

FIGURE 4. Undergraduate Degrees Conferred by Area, 2010



Data Source: IPEDS Degree Completions
Analysis: Anderson Economic Group, LLC

TABLE 6. Undergraduate Degrees Conferred by Area, 2010

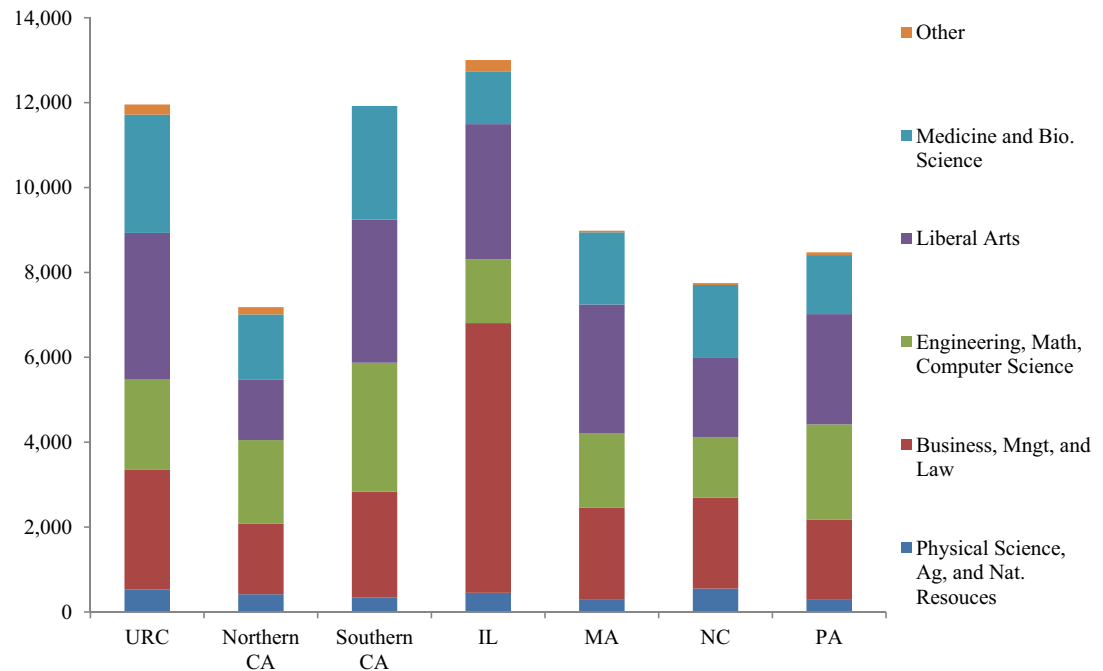
Field	Michigan's URC	Northern CA	Southern CA	IL	MA	NC	PA
Physical Science, Ag, and Nat. Resources	742	688	458	847	244	930	980
Business, Mngt, and Law	2,830	447	1,674	1,047	82	1,113	4,320
Engineering, Math, Computer Science	2,573	1,745	2,334	2,041	1,144	1,903	4,013
Liberal Arts	8,606	5,033	9,701	5,953	2,646	5,625	7,620
Medicine and Bio. Science	4,358	1,605	4,294	2,039	690	2,379	3,511
Other Areas	<u>1,091</u>	<u>59</u>	<u>34</u>	<u>288</u>	<u>1</u>	<u>395</u>	<u>1,232</u>
Total Degrees	20,200	9,577	18,495	12,215	4,807	12,345	21,676

Note: See the academic program definitions in Appendix A for information on the composition of each academic program area.
Data Source: IPEDS, Degree Completions, Academic Year 2009-10
Analysis: Anderson Economic Group, LLC

Education Benchmarks for the URC and Its Peers

Graduate Degrees Conferred. The URC awarded the most advanced degrees in *Medicine and Biological Science, Liberal Arts*, as well as *Physical Science, Agriculture and Natural Resources*, and second in the other three academic programs. See Figure 5 and Table 7 below.

FIGURE 5. Graduate Degrees Conferred by Area, 2010



Data Source: IPEDS Degree Completions
Analysis: Anderson Economic Group, LLC

TABLE 7. Graduate Degrees Conferred by Area, 2010

Field	Michigan's URC	Northern CA	Southern CA	IL	MA	NC	PA
Physical Science, Ag, and Nat. Resources	533	415	336	450	302	550	301
Business, Mngt, and Law	2,815	1,663	2,500	6,357	2,152	2,145	1,878
Engineering, Math, Computer Science	2,128	1,970	3,038	1,504	1,762	1,416	2,240
Liberal Arts	3,454	1,421	3,372	3,182	3,029	1,873	2,598
Medicine and Bio. Science	2,788	1,541	2,677	1,245	1,700	1,721	1,392
Other Areas	<u>239</u>	<u>173</u>	<u>0</u>	<u>266</u>	<u>39</u>	<u>43</u>	<u>64</u>
Total Degrees	11,957	7,183	11,923	13,004	8,984	7,748	8,473

Note: See the academic program definitions in Appendix A for information on the composition of each academic program area.
Data Source: IPEDS, Degree Completions, Academic Year 2009-10
Analysis: Anderson Economic Group, LLC

HIGH-TECH AND HIGH DEMAND DEGREES

We identified the number of degrees awarded that prepare students for jobs in the “high-tech” industry or that are in “high demand” by employers. We discuss both categories below and define them in Appendix A.

High-Tech Degrees. Michigan has a vibrant high-tech industry, and the URC universities graduate a large number of students with degrees that prepare them for jobs in this industry. AEG’s definition of high-tech jobs (one that we use regularly to assess Michigan’s high-tech industry in Southeast Michigan) includes jobs in the advanced manufacturing, life sciences, professional services, and information technology industries.³ We define high-tech degrees as those in biological sciences, physical sciences, computer sciences, engineering, architecture, and some agricultural sciences. See Appendix A for the complete definition of high-tech degrees.

As shown in Figure 6, the URC awarded the second most number of undergraduate high-tech degrees (6,292) and the most advanced high-tech degrees (3,135) in the 2010 academic year. In total, the URC awarded the third most high-tech degrees of the peer clusters at 9,427. Only the Southern California (10,338) and Pennsylvania (9,864) university clusters awarded more high-tech degrees than the URC.

FIGURE 6. Completion of High-Tech Degrees, 2009-2010



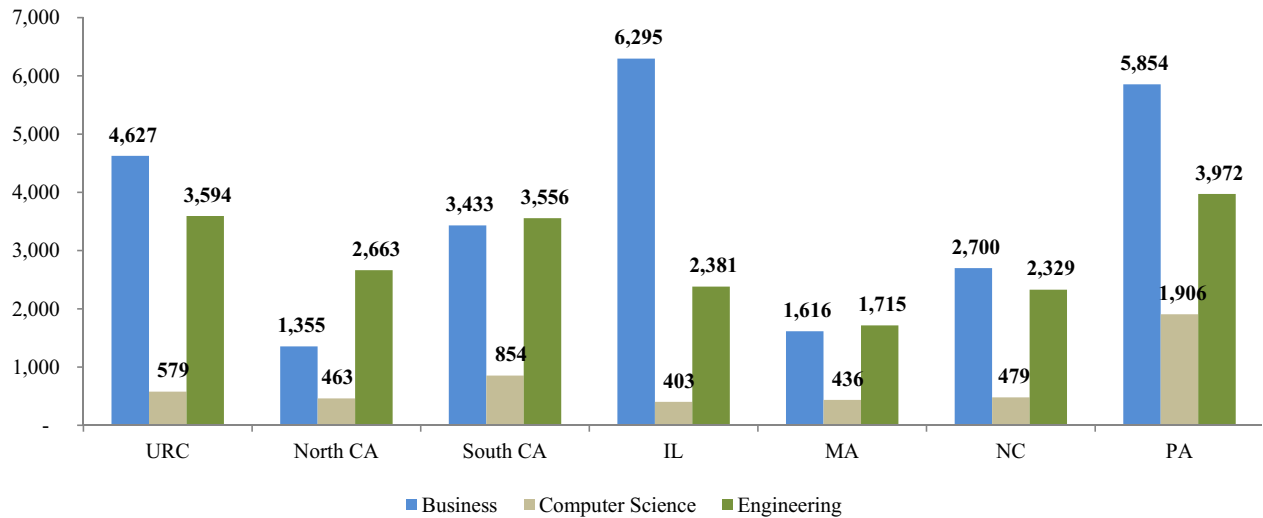
Data Source: IPEDS Completions
 Analysis: Anderson Economic Group, LLC

3. See Scott D. Watkins, Cameron Van Wyngarden, and Lauren Hathaway, *Driving Southeast Michigan Forward*, prepared for Automation Alley (November 2008).

High Demand Degrees. The three fields of study with the highest demand among employers surveyed in 2011 were business, computer science, and engineering.⁴ We analyzed the number of degrees awarded at the undergraduate and graduate levels in these fields in 2010.

Figure 7 below shows the total number of high demand degrees conferred by academic area for the URC and each peer cluster. The URC conferred the third highest number of high demand degrees in 2010. Pennsylvania awarded the most (11,732) and Illinois the second most degrees (9,079). The URC awarded the second highest number of Engineering degrees (3,594), with only Pennsylvania awarding more (3,972).

FIGURE 7. Completion of High Demand Degrees 2009-2010



Data Source: IPEDS Completions

Analysis: Anderson Economic Group, LLC

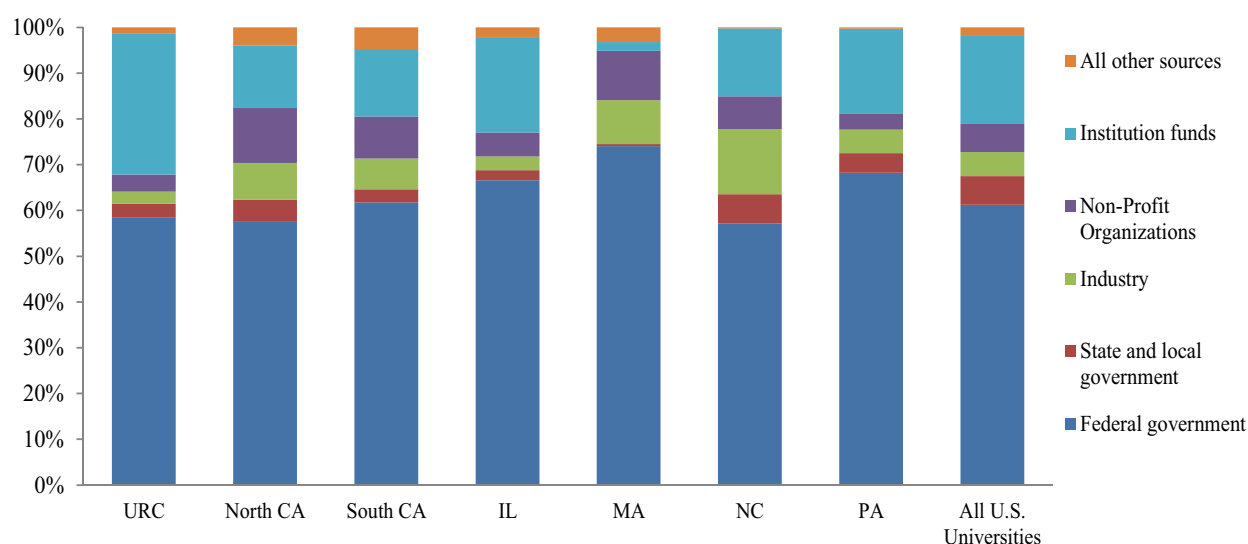
4. The National Association of Colleges and Employers' *Job Outlook 2011 Report* surveyed approximately 200 employers from a variety of sectors. We describe the degree categories in "Degrees by Program Area" on page A-2.

II. Research Benchmarks for URC and its Peers

ACADEMIC R&D EXPENDITURES

Using the most recent data available from the National Science Foundation, we show the research and development (R&D) expenditures for each university cluster in Figure 8 and Table 11 below. Total R&D expenditures by the seven university clusters totaled approximately \$13.7 billion in 2010, making up about 22% of R&D expenditures by all U.S. universities. In 2011, the URC had the fourth largest R&D expenditures of the seven university clusters at nearly \$1.9 billion.

FIGURE 8. Source of Funding for R&D Expenditures, 2010



Data Source: National Science Foundation (NSF), 2010 Academic R&D Expenditures
 Analysis: Anderson Economic Group, LLC

TABLE 8. Source of R&D Expenditures in 2010 (in millions of dollars)

	Total R&D Expenditures	Federal Government	State & Local Government	Industry ^a	Non-Profits ^b	Institution	All Other Sources
Michigan's URC	\$1,878	\$1,097	\$57	\$50	\$70	\$577	\$27
Northern California	\$2,469	\$1,420	\$120	\$198	\$297	\$336	\$98
Southern California	\$2,473	\$1,527	\$71	\$166	\$226	\$364	\$118
Illinois	\$1,557	\$1,036	\$35	\$46	\$81	\$321	\$36
Massachusetts	\$1,417	\$1,049	\$6	\$136	\$153	\$27	\$45
North Carolina	\$2,099	\$1,199	\$135	\$298	\$151	\$312	\$4
Pennsylvania	\$1,816	\$1,239	\$78	\$94	\$64	\$337	\$5

Data Source: NSF Higher Education Research and Development Survey, FY 2010
 Analysis: Anderson Economic Group, LLC

- This category is labeled "business" in the NSF survey, but we have kept the category label "industry," as we have in prior reports.
- This is a new category for NSF's annual survey. In prior years non-profit funding was included in the industry category of funding.

Research Benchmarks for URC and its Peers

As shown in Table 8 on page 7, the majority of funding for R&D comes from the federal government. In 2010, the federal government provided 58% of the URC's funding. The URC also relies on institution funds (which come from the universities themselves rather than outside entities) for a higher share of its research and development spending than the average university and more than every other cluster. In 2010, the URC universities relied on their own funds for 31% of R&D expenditures.

Between 2009 and 2010, the URC increased total expenditures on R&D by 8.3%, which is the third highest percentage increase of the university clusters, as shown below in Table 9. This growth rate was higher than the average increase by all U.S. universities.

TABLE 9. Growth in Total Academic R&D Expenditures, FY 2009-2010

	FY 2009 R&D Expenditures (in millions)	FY 2010 R&D Expenditures (in millions)	Annual Growth 2009- 2010	Rank Growth 2009-10
Michigan's URC	\$1,734	\$1,878	8.3%	3
Northern California	\$2,348	\$2,469	5.2%	4
Southern California	\$2,364	\$2,473	4.6%	5
Illinois	\$1,519	\$1,557	2.5%	6
Massachusetts	\$1,440	\$1,417	-1.6%	7
North Carolina	\$1,842	\$2,099	14.0%	1
Pennsylvania	\$1,612	\$1,816	12.7%	2
<i>All U.S. Universities</i>	<i>\$57,321</i>	<i>\$61,235</i>	<i>6.8%</i>	

*Data Source: NSF, Integrated Science and Engineering Resources Data System
Analysis: Anderson Economic Group, LLC*

Between 2008 and 2010, the URC increased its science and engineering R&D expenditures by 20.3%, which is the second highest percentage increase of the university clusters, as shown in Table 10. This growth rate was higher than the average increase by all universities.

TABLE 10. Growth in Science and Engineering R&D Expenditures, FY 2008-2010

	FY 2008 Science and Engineering R&D Expenditures	FY 2010 Science and Engineering R&D Expenditures	Growth 2008-2010	Rank Growth 2008-2010
Michigan's URC	\$1,482	\$1,783	20.3%	2
Northern California	\$2,166	\$2,405	11.1%	4
Southern California	\$2,233	\$2,412	8.0%	6
Illinois	\$1,342	\$1,481	10.3%	5
Massachusetts	\$1,252	\$1,323	5.7%	7
North Carolina	\$1,659	\$2,085	25.7%	1
Pennsylvania	\$1,507	\$1,796	19.1%	3
<i>All U.S. Universities</i>	<i>\$51,934</i>	<i>\$58,338</i>	<i>12.3%</i>	

*Data Source: NSF, Integrated Science and Engineering Resources Data System
Analysis: Anderson Economic Group, LLC*

Research Benchmarks for URC and its Peers

Table 11 shows each cluster's R&D expenditures in the science and engineering fields as a percentage of total spending. Research priorities vary across the university clusters. In 2010, the North Carolina and California clusters spent a larger share of research dollars on life sciences, while the Massachusetts and Pennsylvania clusters spent significantly less than the U.S. average. Furthermore, the Pennsylvania and Illinois clusters spent significantly more on math and computer sciences than any other cluster and the U.S. university averages, as did the URC on social sciences. The URC is consistent with U.S. university averages in most fields, although with slightly lower-than-average spending for environmental sciences and math and computer sciences.

TABLE 11. Share of Total R&D Expenditures by Science and Engineering Fields, 2010

	Environmental Sciences ^a	Life Sciences ^b	Math & Computer Sciences	Physical Sciences ^c	Psychology	Social Sciences ^d	Other Sciences	Engineering ^e	All Non-S&E fields
Michigan's URC	1%	59%	2%	8%	2%	8%	0%	15%	5%
Northern CA	2%	66%	1%	8%	1%	3%	5%	12%	3%
Southern CA	7%	63%	7%	6%	2%	2%	1%	9%	2%
Illinois	1%	57%	8%	10%	2%	2%	1%	13%	5%
Massachusetts	4%	43%	5%	13%	1%	3%	6%	22%	4%
North Carolina	3%	77%	3%	3%	2%	4%	0%	7%	1%
Pennsylvania	4%	53%	9%	5%	3%	2%	1%	21%	1%
<i>All U.S. Universities</i>	<i>5%</i>	<i>57%</i>	<i>4%</i>	<i>8%</i>	<i>2%</i>	<i>3%</i>	<i>2%</i>	<i>15%</i>	<i>5%</i>

*Data Source: National Science Foundation, Survey of Research and Development Expenditures at Universities and Colleges
Analysis: Anderson Economic Group, LLC*

- Environmental sciences includes atmospheric and earth sciences, oceanography, and other miscellaneous sciences.
- Life sciences includes agricultural, biological, medical, and other miscellaneous life sciences.
- Physical sciences includes astronomy, chemistry, physics, and other miscellaneous physical sciences.
- Social sciences includes economics, political sciences, sociology, and other miscellaneous social sciences.
- Engineering includes aeronautical, biomedical, bioengineering, chemical, civil, electrical, mechanical, metallurgical, and other engineering fields.

Universities devote their time to different types of research: basic, applied, and development. The NSF defines *basic research* as research undertaken primarily to acquire knowledge without any particular application or use in mind, and *applied research* as research conducted to meet a specific, recognized need. *Development* is the systematic use of research towards the production of useful materials, devices, systems, or methods, including the design and development of prototypes and processes.

In Table 12 on page 10 we show the percentage of R&D funds going towards basic research, applied research, and development. The URC spends the second highest amount of their funding on applied research (31.7%), only behind the Pennsylvania cluster (34.0%).

TABLE 12. Share of R&D Expenditures Spent on Basic, Applied, and Development Research

University Cluster	Basic Research	Applied Research	Development
Michigan's URC	64.8%	31.7%	3.4%
Northern California	79.6%	13.3%	7.1%
Southern California	63.0%	30.4%	6.6%
Illinois	76.5%	18.4%	5.1%
Massachusetts	66.8%	25.0%	8.2%
North Carolina	67.4%	12.6%	20.0%
Pennsylvania	51.2%	34.0%	14.8%
<i>All U.S. Universities</i>	<i>66.5%</i>	<i>24.9%</i>	<i>8.6%</i>

Note: Due to non-responses from universities on this new question, some of the data is estimated by NSF.

Data Source: NSF Higher Education Research and Development Survey, 2010

Analysis: Anderson Economic Group, LLC

TECHNOLOGY TRANSFERS

University research and development expenditures often lead to the production and sale of new products and services in the private sector. The success of academic research and development activities is often evaluated in terms of technology transfer to the private sector. The pharmaceutical, medical, computer technology, consumer electronic, telecommunication, agricultural, and manufacturing industries are among the many industries benefiting from research and development conducted at universities. Common indicators of tech transfer achievement include the number of patent applications and the number of inventions disclosed in a given year.

While these statistics show activity, they do not necessarily indicate the effectiveness of the activity. Other statistics, such as the number of patents granted, the number of licenses or options entered into, royalty revenue, and the number of new start-ups are more informative indicators of technology transfer. We examine these indicators and compare the URC's performance to that of the other clusters.

The URC ranks in the lower half when comparing its 2006-2010 average annual technology transfer activities to the peer university clusters. The URC ranks fourth in average annual number of patent grants, and fifth in invention disclosures, licenses and options issued, and licensing revenue. See Table 13 on page 11.

TABLE 13. Average Annual Patent and Licensing Activity, 2006-2010

	Invention Disclosures	<i>Rank</i>	U.S. Patent Grants	<i>Rank</i>	Licenses/Options	<i>Rank</i>	Licensing Revenue (in millions)	<i>Rank</i>
Michigan's URC^a	481	5	135	4	129	5	\$37.0	5
Northern California ^b	747	3	245	1	162	3	\$125.0	2
Southern California ^c	791	2	135	3	110	6	\$59.6	4
Illinois ^d	512	4	104	5	99	7	\$260.5	1
Massachusetts ^e	830	1	197	2	174	2	\$85.0	3
North Carolina ^f	466	7	91	7	202	1	\$19.8	6
Pennsylvania ^g	477	6	92	6	148	4	\$16.1	7

*Data Source: Universities' websites and technology transfer offices, Association of Technology Managers (AUTM) Surveys
Analysis: Anderson Economic Group, LLC*

- a. Michigan State University, the University of Michigan, and Wayne State University information was obtained from the URC.
- b. The University of California provided statistics for all their campuses through their Office of Technology and its Annual Reports for 2005-2010. Stanford University provided all statistics for 2005-2010 through their website and Office of Technology Licensing.
- c. The University of California provided statistics for all their campuses through their Office of Technology and the office's Annual Reports for 2005-2010. USC data for 2006 was collected from the AUTM survey and through USC's Stevens institute for 2007-2010.
- d. Northwestern University provided all statistics for 2006-2009 through their website. Northwestern data for 2010 was collected from the AUTM survey. University of Chicago provided all statistics through their Office of Technology & Intellectual Property. University of Illinois, Urbana-Champaign provided all statistics through their Office of Technology Management website.
- e. MIT, and Tufts reported 2004-2010 data on their websites. Harvard data were collected from the 2006 AUTM survey and through Harvard's Office of Technology Development for 2007-2010.
- f. Data for UNC Chapel Hill and NC State University were collected from their Office of Technology Development. Data for Duke University was provided by AUTM in 2006 and through their Office of Licensing & Ventures for 2007-2010.
- g. Data collected for the Pennsylvania cluster was from the University of Pittsburgh's Office of Technology Management, Penn State's Intellectual Property office, Center for Technology Transfer, and the 2006 AUTM surveys.

Research Benchmarks for URC and its Peers

The URC's rankings in recent years follow a longer-run trend of technology transfer activities from 2002 to 2010. Looking at the average annual activity for a longer period, the URC ranks fifth in average number of invention disclosures, third in patent grants awarded, fifth in licenses and options, and fifth in licensing revenue. See Table 14 below.

TABLE 14. Average Annual Patent and Licensing Activity, 2002-2010

	Invention Disclosures	Rank	Patent Grants	Rank	Licenses/Options	Rank	Licensing Revenue (in millions)	Rank
Michigan's URC	455	5	132	3	121	5	\$39.0	5
Northern California	688	3	224	1	173	2	\$143.6	2
Southern California	709	2	130	4	120	6	\$45.5	4
Illinois	457	4	122	5	101	7	\$150.4	1
Massachusetts	769	1	203	2	190	1	\$72.6	3
North Carolina	430	7	83	7	157	3	\$14.0	7
Pennsylvania	433	6	107	6	141	4	\$14.1	6

Data Source: Universities' websites and technology transfer offices, Association of Technology Managers (AUTM) Surveys
Analysis: Anderson Economic Group, LLC

From 2008 to 2009, nearly every cluster's number of start-ups declined, as shown in Table 15 below. Startups increased in 2010. The number of URC cultivated start-ups increased from 8 in 2009 to 14 in 2010. On average, 14 new companies are started each year with licensed technology from a URC university. The URC is tied for fifth in number of start-ups it has helped to create.

TABLE 15. Annual Number of Start-ups Cultivated at University Clusters, 2006-2010

	2006	2007	2008	2009	2010	Average, 2006-10	Rank
Michigan's URC^a	18	14	17	8	14	14	5
Northern California	18	27	27	18	23	23	3
Southern California	36	25	31	29	46	33	1
Illinois	13	16	12	13	14	14	6
Massachusetts	29	35	34	30	25	31	2
North Carolina	14	9	16	9	14	12	7
Pennsylvania	21	21	16	16	21	19	4

Data Source: Universities' websites and technology transfer offices, see also footnotes in Table 13 on page 11
Analysis: Anderson Economic Group, LLC

a. We revised the 2008 data to exclude the number of start-ups assisted by the URC that did not involve a licensed technology. The number for 2008 dropped from 28 to 17.

To measure the success of each university's R&D expenditures, we examined the amount of licensing revenue generated by each dollar of expenditure on fields of science and engineering. Since licensing revenue can have large year-to-year variations caused by the sale of a large license, we compared the average revenue over a five-year period (2006-2010) to the S&E R&D expenditures in 2010 (the most

recent year for which data is available). Table 16 shows that the URC has performed better than the North Carolina and Pennsylvania clusters in terms of revenues earned per science and engineering R&D dollar spent.

TABLE 16. Average Annual Licensing Revenue as a Percent of S&E R&D Expenditures, 2006-10

	Average Licensing Revenue 2006-2010 (in millions)	Average S&E R&D Expenditures 2006-2010 (in millions)	Revenues per Expenditures	Licensing Revenue per S&E Expenditure Ranking
Michigan's URC	\$37.0	\$1,536	2.4%	5
Northern California	\$125.0	\$2,196	5.7%	3
Southern California	\$59.6	\$2,219	2.7%	4
Illinois	\$260.5	\$1,344	19.4%	1
Massachusetts	\$85.0	\$1,260	6.7%	2
North Carolina	\$19.8	\$1,720	1.2%	6
Pennsylvania	\$16.1	\$1,538	1.0%	7

Data Source: See footnotes in Table 15.

Analysis: Anderson Economic Group, LLC

Appendix A. Methodology

ACADEMIC PROGRAM DEFINITIONS

The academic program areas used in this section are based on the National Center for Education Statistics' Classification of Instructional Programs (CIP) codes that they use in their Integrated Postsecondary Education Data System (IPEDS). The composition of each program area is as follows:

The *Physical Science, Agriculture, and Natural Resources* academic program area includes the following fields of study: agriculture, agriculture operations, and related sciences; natural resources and conservation; and physical sciences.

The *Business, Management, and Law* academic program area includes the following fields of study: legal professions and studies; and business, management, marketing, and related support services.

The *Engineering, Mathematics, and Computer Science* academic program area includes the following fields of study: architecture and related services; computer and information sciences and support services; engineering; and mathematics and statistics.

The *Liberal Arts* academic program area includes the following fields of study: area, ethnic, cultural, and gender studies; communication, journalism, and related programs; education; foreign languages, literatures, and linguistics; family and consumer sciences/human sciences; English language and literature/letters; liberal arts and sciences; general studies and humanities; library science; multi/interdisciplinary studies; philosophy and religious studies; theology and religious vocations; public administration and social service professions; social sciences; visual and performing arts; and history.

The *Medicine and Biological Science* academic program area includes the following fields of study: biological and biomedical sciences; psychology; and health professions and related clinical sciences.

The *Other* academic program area includes the following fields of study: personal and culinary services; parks, recreation, leisure, and fitness studies; security and protective services; construction trades; mechanic and repair technologies/technicians; precision production; transportation and materials moving; undesignated fields of study; communications technologies/technicians and support services; engineering technologies/technicians; military technologies; and science technologies/technicians.

HIGH TECH AND HIGH DEMAND DEGREES

High-Tech Degree Definition. As described in "Degrees by Program Area" on page 2, AEG's definition of high-tech degrees is one that we use regularly to assess Michigan's high tech industry in Southeast Michigan.⁵ As with the academic definitions, we used the CIP codes in IPEDs to pull degrees that fit our definition of high-tech.

High-tech degrees include:

- agriculture, agriculture operations, and related sciences (we include only 10% of this field of study as most agriculture is not high-tech)
- architecture and related services
- biological and biomedical sciences
- communications technologies/technicians and support services
- computer and information sciences and support services
- engineering technologies/technicians
- engineering; mathematics and statistics
- physical sciences

High Demand Degree Definition. The three fields of study with the highest demand among employers are business, computer science and engineering, according to a survey done by the National Association of Colleges and Employers. Their 2011 *Job Outlook Report* surveyed approximately 200 employers from a variety of sectors and found that computer science, engineering, accounting, finance, and business administration were in the most demand by employers. For the purposes of this analysis we combined the three business related majors (accounting, finance, and business administration) into one category due to substantial overlap between these degrees at the undergraduate level in many universities. Specifically, our data source (IPEDS) does not distinguish clearly between them.

Additionally, for engineering degrees awarded, we included “engineering” and “engineering technologies/technicians,” because the IPEDS database presents highly related concentrations under each and they likely signal similar skill sets in the entry level job market.

5. See Scott D. Watkins, Cameron Van Wyngarden, and Lauren Hathaway, *Driving Southeast Michigan Forward*, prepared for Automation Alley (November 2008).

Appendix B: About the Authors

CAROLINE M. SALLEE

Ms. Sallee is a Senior Consultant and Director of the Public Policy and Economic Analysis practice area at Anderson Economic Group. Ms. Sallee's background is in applied economics and public finance.

Ms. Sallee is the primary author of the *Annual Economic Impact Reports* for the University Research Corridor. Her recent work includes fiscal and economic impact studies for the University of Chicago, and the benchmarking of Michigan's business taxes with other states in a project for the Michigan House of Representatives. She has also completed detailed state tax and budget analysis for Business Leaders for Michigan.

Prior to joining Anderson Economic Group, Ms. Sallee worked for the U.S. Government Accountability Office (GAO) as a member of the Education, Workforce and Income Security team. She also has worked as a market analyst for Hábitus, a market research firm in Quito, Ecuador, and as a legislative assistant for two U.S. Representatives.

Ms. Sallee holds a Master of Public Policy degree from the Gerald R. Ford School of Public Policy at the University of Michigan and a Bachelor of Arts degree in economics and history from Augustana College.

ERIN GROVER

Ms. Grover is a Senior Analyst at Anderson Economic Group, working in the Public Policy and Economic Analysis practice area. Her background is in applied economics and communicating economic ideas.

Ms. Grover's recent work consists of several economic and fiscal impact analyses of counties and business ventures throughout the U.S.; evaluating policy changes and potential public funding mechanisms; as well as an analysis of the economic contribution research universities make in Michigan. She is also currently contributing to the book, *Economics of Business Valuation*, a forthcoming publication of Stanford Press.

Prior to joining AEG, Ms. Grover worked as a contract consultant providing research and detailed data analysis to economic and finance consulting firms in Michigan and Ohio. She was also one of four students selected as a graduate fellow at the Mercatus Center in Arlington, Virginia. While there she contributed to their Gulf Coast Recovery Project, which received the Templeton Freedom Award for Special Achievement. Ms. Grover has also conducted original fieldwork on the political economy of charter schools in New Orleans, which she presented at an international conference for the Association of Private Enterprise Education.

Ms. Grover holds a masters degree in economics from George Mason University and a Bachelors of Science degree in Political Economy from Hillsdale College.

COLBY SPENCER

Colby W. Spencer is a Senior Analyst at Anderson Economic Group, working in the Public Policy and Economic Analysis and Market and Industry Analysis practice areas. Ms. Spencer's background is in econometrics, public policy, local government, urban and social policy, and education.

Prior to coming to Anderson Economic Group Ms. Spencer worked with the Michigan Municipal League on the 21st Century Communities project providing consulting services to local governments in Michigan concerning local economic development initiatives. Ms. Spencer held a fellowship at Columbia University as a teaching assistant for Quantitative Analysis and Operations Management. She has also taught in the District of Columbia Public Schools.

Ms. Spencer holds a Bachelor of Science in Education from New York University and a Master of Public Administration from the School of International and Public Affairs at Columbia University.