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Michigan Small Tech Journal

Growing the micro and nano industry

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Guest Column: Gary Krause

Growing Michigan's micro and nano industry

Central to the Michigan Economic Development Corporation's (MEDC) mission is the identification and promotion of new technologies, which will play a critical role in the state's high tech economic future. Similar to highlighting the importance of its emerging life science industry through the Michigan Life Science Corridor, and fuel cell / alternative energy sources through NextEnergy, our attention now focuses on micro and nano technologies.

Like the all-inclusive role of information technology at the close of the 20th century, we view micro and nano devices as a "basic enabling technology." Cutting across and embedded in seemingly diverse industries as auto, furniture, medical devices, packaging, electronics, and environmental sensors, small tech will revolutionize product design, development and manufacturing in this decade. As the center of this country's industrial research and advanced manufacturing sectors, it is imperative that Michigan forges a leadership role in this critical emerging industry.

Fueled by research efforts at six of our universities and a rich history of companies who are "early technology adopters," Michigan is well on its way to becoming a small technology force. Through support of the Michigan Small Tech Association, a Web site (www.michigansmalltech.com) and this newsletter, MEDC is once again calling attention to an emerging industry critical to our economic future.

Welcome to Michigan's Small Tech Community – our objective is to grow the micro and nano industry – our limitation is our imagination.

Gary Krause

Manager Special Projects
Michigan Economic Development Corporation

Michigan launches drive to build small tech industry in state

By Gary Anglebrandt
Michigan Small Tech Journal Correspondent

Already among the country's top 10 states for small tech business and research, Michigan is playing a game of catch-up with the leading regions and making a strong push to grow the industry here.

At stake just may be the future's best jobs and most productive industries, say economic development experts.

California, Massachusetts and New York are among the leaders in small tech, said Tino Breithaupt, managing director of emerging business sectors at the Michigan Economic Development Corporation (MEDC) in Lansing.

Photo courtesy of University of Michigan

This bulk-micromachined neural probe from U-M, first produced in 1994,combines electrical recording and stimulation with drug delivery.

Small tech refers to micro and nanotechnology, technologies and systems too small to see with the naked eye and used in a variety of settings, including biological, computer, military and industrial applications such as automotive.

The MEDC in upcoming months is planning to

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Small tech business assistance	MEDC	Updated small tech news
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About us

Why small tech? The people behind the Michigan Small Tech Association (MISTA) have faced that question since the initiative was conceived. Why does this niche industry need an association in our state? Why does small tech matter to Michigan?

Our short answer is that small tech already exists and is helping propel our economy today. Here in Michigan many companies are knee-deep in small tech and the tide is rising. Whether it is in advanced manufacturing, automotive, homeland security, life sciences or the innovations being researched and developed at our universities, small tech will be an important element of Michigan's long-term economic structure.

The Michigan Small Tech Association is here to help members find products and markets by promoting collaboration and assisting them in connecting with business and industry leaders at every level.

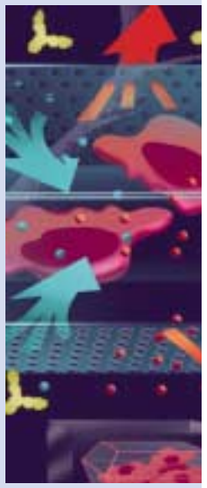
Highlights

Key state leaders are focusing on more than budget cuts. Learn what Michigan is doing to grow the small tech industry though the state's broad economic development programs and targeted initiatives. Page 1

Western Michigan University's nanotechnology center just landed $1 million in federal funding. Read about the important environmental cleanup and homeland security work under way on the Kalamazoo campus. Page 2

If you're working in small tech, here's what you need to know about the Michigan Small Tech Association, and what the new organization can do for you. Page 3.

Small tech is all about the science of the tiny. Remarkable developments will change your life in more ways than you know. Check out the Focus on Technology section for a glimpse of the future. Page 6



WMU's nano center lands $1million grant

By Gary Anglebrandt
Michigan Small Tech Journal Correspondent

A $1 million government grant announced in mid-March boosts Western Michigan University's efforts to help diversify the regional economy through commercialization of its environmental cleanup and homeland security research.

WMU's Nanotechnology Research and Computation Center, approved in December, aims to attract even more government funding and produce a spinoff effect throughout west Michigan's emerging tech corridor.

The center's director, Subra Muralidharan, also is seeking partnerships with more companies and government agencies. The center will share the $1 million Department of Energy grant with a corporate partner, Altair Nanotechnologies Inc. of Reno, Nev. It also has about $1.5 million in other government funding and it is seeking to secure $5 million to $10 million in 2003.

Western's multidisciplinary center is pitted against large research universities such as the University of Michigan and the University of California, Berkeley, said Muralidharan, who is also a chemistry professor at the university.

"If Western wants to play with the big dogs, we need something that's uniquely ours so people will sit up and take notice," Muralidharan said.

Photo courtesy of Western Michigan University

Professor Subra Muralidharan, director of WMU's Nanotechnology Research Center, wants to move nanobioenvironmental research from the lab to the marketplace.

That niche is biological and environmental, or "nanobioenvironmental," chemistry, which the center is using to develop nanotechnologies for environmental cleanup efforts and protection against chemical and biological warfare and terrorism.

The center builds off other nanotech research, most notably a lab-on-a-chip project of Muralidharan's that in February 2001 won $750,000 in funding from the state's Life Sciences Initiative. A lab-on-a-chip contains microfluidic channels that quickly separate liquids and gases to allow microsensors to better analyze their properties.

Pharmacia Corp. and Argonne National Laboratory are also partners in the development of the chip, which is supposed to speed up the drug discovery process. Argonne is operated by the University of Chicago for the U.S. Department of Energy and supports a range of research projects.

Muralidharan is testing a prototype of the chip and expects to have a finished device in three to four months.

Altair is working with the center on a process to separate radioactive nucleotides from nuclear waste. The Department of Energy grant announced March 17 helps fund that work, along with sensors for detection of chemical and biological agents.

WMU and Altair are working to create sensors that could be embedded in soldiers' clothing. Sensors in a skin patch would detect harmful agents and release different agents into the bloodstream to counteract the harmful ones. A $1 million Department of Defense grant is pending, Muralidharan said.

The nuclear waste research has taken on increased importance in Nevada, where protests arose in the past year over the storage of waste in the state's mountains. The amount of radioactive material actually in nuclear waste is usually very little, Muralidharan said. Removing the nucleotides means less waste. WMU and Altair hope to obtain additional grants worth $1 million or more per year.

Another partnership with Xerox Corp. would use nanoparticles to make toner used in printers less expensive. While details of the project are bound by a nondisclosure agreement, Xerox has given the center a $60,000 initial grant to begin work, Muralidharan said. Additional funding for the project could come from the National Science Foundation.

Illustration courtesy Western Michigan University

An artist's rendering of the Nanotechnology Research and Computation center at Western Michigan University, slated for a mid-spring opening.

WMU faces stiff challenges as it seeks to define a niche that will separate it from the many universities around the world that are making serious efforts to attract funding for nanotechnology research, said David Tomanek, a physics professor at Michigan State University in East Lansing.

Tomanek has conducted research on nanotubes and fullerenes and is chairman of the board of a nanotube-producing company based in the nation of Cyprus called Rosseter Holdings Ltd.

Tomanek said in today's competitive climate, any university has to offer something significantly innovative if it wants to make its mark.

"It's a very competitive field. I wish (Western) very good luck," he said.

The center fits into a business plan at Western, which also has a Business and Research Technology Park. The park is a collaboration of the university and Southwest Michigan First, a local economic development organization, to use the university's

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Michigan Small Tech Association News

I'd like to welcome everyone to Michigan Small Tech, and the Michigan Small Tech Association (MISTA). This Journal is just one component of a statewide initiative that debuted on March 6, 2003, with the launch of www.michigansmalltech.com. Our launch was the first step of many taken to help incorporate small tech business into the mainstream of Michigan's economy. While this initiative is new, the foundation for small tech was built long ago. Leaders in business, research and government have been working for years to prepare Michigan for the expected impact that small tech promises. The Michigan Small Tech Journal, Web site, Association, Directory and Business Service Program are the next steps in helping Michigan companies capitalize on this emerging technology.

As advances in technology enable us to manipulate smaller and smaller elements, we in turn will be able to build increasingly smaller devices with them. Just as similar advances took a computer that once filled a classroom and made it small enough to fit in the palm of your hand, small tech advances potentially will allow that handheld computer to be reduced to the size of a dime, or smaller.

The small tech industry will bring so much more than just a reduction in size. It will spark a fundamental change in how products are developed and delivered. It is our hope that the Michigan Small Tech Association will help that spark ignite and bring new jobs and commercial development to Michigan.

MISTA promises to work tirelessly to support, promote and accelerate the growth of small tech in Michigan. If your company is involved in or supports small tech development, I encourage you to join the Michigan Small Tech Association. The Association, in collaboration with the Michigan Economic Development Corporation, will help as the traditional economic base in Michigan integrates small tech into their business. Promoting economic growth will be the underlying theme of all Association actions and our success will be measured by helping members work with companies, governments and universities.

Achieving this will not be easy. Tight budgets, tough economic times and competition from other areas, will force us to collaborate like never before. Fortunately, Michigan's economic base has the advantage that manufacturing companies are ready to embrace micro and nanotechnology. Our challenge is to help provide a climate in Michigan for companies to develop and incorporate small tech, which will increase our global competitiveness.

John Bedz

John Bedz
Michigan Small Tech Association

Business Services:

The Michigan Small Tech Association wants to help members find professional business assistance. The MISTA Professional Service Provider Program (MPSPP) will connect members with qualified vendors in the fields listed below that are committed to small tech growth in Michigan.

- Accounting & Administration
- Education & Training
- Insurance
- Interactive Sevices
- Legal
- Real Estate
- Research and Consultation
- Staffing & Human Resources

If you are interested in participating or finding out more about this program, please contact us at 734-528-6258.

Mission Statement:

The Michigan Small Tech Association (MISTA) is a community of companies, universities and individuals involved in or supporting micro and nanotechnology development in Michigan. Our goal is to promote acceleration of the industry through research, commercialization and the fostering of business relationships.

The Michigan Small Tech Association will act as a conduit for members in connecting with business, academic and government leaders. Our Web site features Events, News Releases, Funding Opportunities, Tech Transfer/IP Highlights and University pages that will tout the sector and its growth here in Michigan. Organizations will be allowed to post available IP and promote the successful integration of micro and nanotechnologies into their products. We'll also help small tech companies with our Business Services Program, by working with professional service providers willing to help grow the sector. If your organization works with micro and nanotechnologies and would like to learn more about becoming a member visit us at www.michigansmalltech.com/association

Forum set for May

Investing In Innovation Forum May 13-14, 8 a.m. - 5 p.m. at the Kalamazoo's Radisson Plaza Hotel is the first Midwest investment forum that features presentations from venture capital funds. Selected venture funds will pitch to an audience of individual investors, fund managers, institutional investors and entrepreneurs.

For more detailed information visit www.investinnovation.com To register email innovation@southwestmichiganfirst.com.

Building Small Tech from page 1

identify and promote small tech business and research, which has multiple-industry applications that can help boost a wide range of Michigan industries, Breithaupt said.

"We haven't up to this point had a business development focus to attract and retain small tech business to Michigan," Breithaupt said. "We're now trying to get a grip on how many small tech companies we have relative to the rest of the country."

In March the MEDC announced the Michigan Small Tech initiative, which includes underwriting a Web site to provide coverage of the growing small tech industry in the state, business services and development of an industry association. The Michigan Small Tech Journal newsletter is part of that effort.

In 2002, $880 million in small tech venture capital deals were made in the United States. About $12 million was in Michigan, according to an analysis by Small Times Media L.L.C. in Ann Arbor, (parent company of Michigan Small Tech Journal). Michigan ranked ninth in small tech development. The state's strengths include research expenditures and its wealth of workers with engineering and science doctorate degrees, according to the media organization's analysis.

California, Massachusetts and New Mexico were the top three regions, followed by Arizona, Texas, Maryland and New York.

With a lingering economic downturn and war in Iraq crimping investment dollars, plus states across the country also competing to land new industry, stiff challenges remain.

Stephen Benoit, President and CEO of NanoMed Pharmmaceuticals Inc. of Kalamazoo, a nanotech drug delivery company, believes a relative scarcity of venture capital and people to lead startups are two major hurdles.

"The number one issue that needs to be addressed is availability of investment capital," said Benoit.

The MEDC will build off its existing 11 SmartZones to encourage small tech business, research and commercialization. SmartZones began in 2000 and use special property tax rules to support development of high-tech laboratories and research centers.

Michigan's workforce in the automotive, information technology and life science industries is an asset, Breithaupt said.

Photo courtesy of Wayne State University

A researcher in the Wayne State-Delphi lab, a state-of-the art facility for commercial development of microsystems. The lab, part of the Smart Sensors and Integrated Microsystems program at WSU's College of Engineering, opened in March.

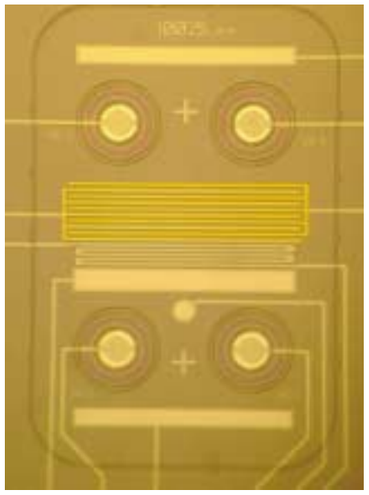


Illustration courtesy Sensicore

Sensicore's Silicon Sensor Array for Chemical water profiling analysis.

Not surprisingly, the intellectual hub of Ann Arbor—home to the University of Michigan and part of the Washtenaw County SmartZone—has a significant portion of Michigan's small tech business and research. A handful of small tech companies sprang up in Ann Arbor in recent years, many as a result of tech transfer efforts through the university's various science and engineering departments and programs.

Using microsystems technology licenses from U-M, for example, Ann Arbor-based Sensicore's initial applications will employ silicon chips with sensors to analyze different ions in water. Sensicore developed a lab-on-a-chip multi-sensor device used for a variety of water and wastewater applications, including process control and environmental monitoring. Sensicore is owned by industry accelerator Ardesta, parent company of Small Times Media.

Another U-M spinoff, TAL Materials Inc., an Ann Arbor firm making nanopowders from metal oxides, is profiled on page 5.

Also at the university are several small tech programs and research centers, including the Center for Biologic Nanotechnology, the Center for Nanomaterials Science, and the Engineering Research Center for Wireless Integrated Microsystems.

Western Michigan University in December 2001 announced approval of a Nanotechnology Research and Computation Center. The center's focus is on biotechnology and research in the environmental and national security areas. (See page 4.)

Other Michigan hotspots for small tech are:

East Lansing: Michigan State University conducts molecular, nanomaterial and microsensor research at its Cluster Science Collaboration, Micro and Nano Engineering Center and Automotive Research Experiment Station groups.

Mount Pleasant: Central Michigan University's Center for Applied Research & Technology, active in researching dendrimers, or molecularly precise plastics.

Houghton: Home to Michigan Technological University, which is engaged in small tech research, and the Keweenaw Nanoscience Center, which is located in nearby Lake Linden and conducts for-profit contract nanotechnology research.

Detroit: Wayne State University's planned Research and Technology Park could add to its research in nanosensors. WSU also is home to the Smart Sensor Integrated Microsystems laboratory, which opened a clean room complex in collaboration with Troy-based Delphi Corp. on March 18 (see Michigansmalltech.com).

TAL Materials' CEO upbeat despite economy

By Steve Pardo

Michigan Small Tech Journal Correspondent

The struggling economy hasn't been kind to small companies with big ideas recently but Steve Swanson, CEO of TAL Materials Inc. of Ann Arbor, sees hope on the horizon.

"We have seen a little pickup in inquiries so I'm going to knock on wood and say that's a trend we expect to see throughout the year," Swanson said.

It will take more than luck for TAL Materials to ride its metal oxide nanopowders to success. Initially, the company is targeting the orthopedics and coatings markets — hoping for example, that its products will some day be used to make self-cleaning paints.

Venture capital is critical to success for TAL at this stage. And getting companies to invest has gotten tougher. Relatively high unemployment, the dot-com crash, the stagnant national economy and the lead up to war in Iraq are cited as factors in the fall-off of venture capital.

Still, with a piqued interest from the military and from major corporations with long lead times on their research and development, Swanson expects a positive year.

"We're going to move this company from the research and development to the commercial within the next 18 months," he said. "We've had an uptick and a surprisingly strong interest in the things we're doing."

If the company does flourish this year, it will be bucking a venture capital trend that has lasted three years. Funding has dropped sharply over the period and Michigan as a state lags behind several others in terms of venture capital investments, explained David Littman, chief economist with Comerica Bank.

"Michigan is below average in its terms of attractiveness to venture capitalists," Littman said. "Regulations and taxes makes it relatively unattractive."

State officials said they are working hard to dispel that image.

The five Midwest states of Illinois, Ohio, Indiana, Pennsylvania and Michigan have attracted only 3 percent to 4 percent of the venture capital in the past, said Mahendra Ramsinghani, director of venture capital initiatives for the Michigan Economic Development Corporation (MEDC). But he said Michigan's track record is getting better — especially over the last two years since the MEDC became involved.

Photo courtesy of TAL Materials Inc.

Prosthetic material is shown before (left) and after processing.

"After we started focusing on the venture capital industry eight new funds have started in Michigan," Ramsinghani said. "In the last year we have had a role in creating four new venture capital companies and we did a mix of grants or investments to help them get off the ground."

Companies have been reluctant to come to Michigan, with its focus on the automotive industry, but comparing the state with areas on the East and West coasts isn't apples-to-apples, he said.

"The best comparison is with our self," he said. "If we're able to help attract more companies year after year, we are going to be making progress. The struggle in talking with venture capital companies is they feel there are not enough good, fundable companies in Michigan. We are trying to address that area too. It is improving, definitely, but I feel we have a long way to go."

Nationwide, venture capital investments have plummeted in recent years. More than $106 billion was invested in 603 venture capital funds in 2000. By 2001, that number dropped to $40.7 billion among 331 funds. In Michigan, 19 venture capital funds managed just over $2.1 billion in 2001.

The majority of the $72.9 million in venture capital invested in Michigan last year – $46.1 million – went to software and biotechnology companies. About $12 million went to firms engaged in small tech activities.

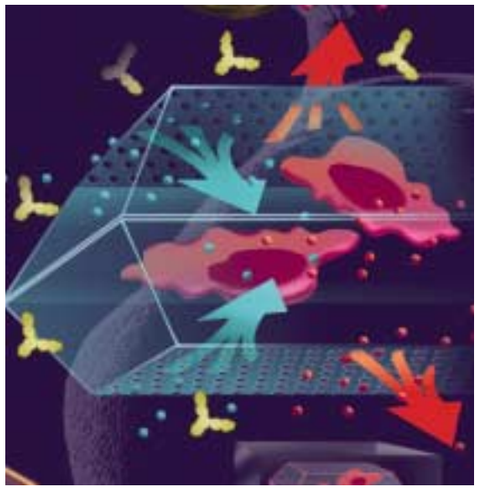
TAL Materials was founded in 1996 as a commercial spinoff from the Material Science and Engineering Department of the

Continued on page 7

Focus on Technology

A Cure for Deafness

With wireless communication capability and quadruple the normal amount of electrodes, this MEMS-based cochlear implant, smaller than a penny, could one day eliminate deafness.



Life Without Needles for Diabetics

This tiny capsule contains healthy pancreatic cells. Its tiny pores allow oxygen and glucose to enter and insulin to flow out, but keep harmful antibodies from getting inside.

Small Tech: What is it?

Small tech refers to the world of tiny machines – microsystems, including MEMS, and nanotechnology. Almost all the experts paying attention to research and development under way in companies and academia think these tiny systems will have a substantial impact on the way we live, play and work.

In medicine, they will enable the creation of machines so small they can flow through the bloodstream, targeting cells for treatment. New developments promise to make deafness a thing of the past, cancer a target for destruction without harming healthy tissue and people capable of safely testing themselves for a variety of diseases in the privacy of their own homes.

In leisure, expect them to improve everything from movies to travel to video games and toys.

In business, they will change the way we manufacture, store and ship products, and make it easier to communicate and store information.

Research by Adina Lipsitz
Illustration by David Edgington

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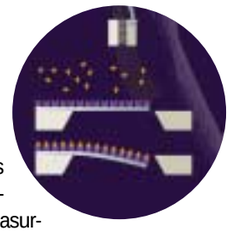
Early Detection of Cancer and Other Diseases

These one-inch chips will enable simultaneous testing for multiple diseases at early stages, when they are most treatable.

Dozens of arrays per chip. Thousands of cantilevers per array



The cantilevers bend when the disease they target is present, producing a measurable change in their capacity to store an electric charge.

WMU from page 2

talent to develop and retain business.

The park includes the planned Southwest Michigan Innovation Center to attract biomedical, pharmaceutical, engineering, and other technology-focused companies by offering amenities such as wet lab space. The center is scheduled for completion in mid-spring of this year.

The park is at about 50 percent occupancy, with 13 companies either headquartered or with a presence in the park. NanoMed Pharmaceuticals Inc., a drug-delivery company; and Esperion

WESTERN MICHIGAN UNIVERSITY
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Therapeutics Inc., a biopharmaceutical company, both are involved in small tech.

Lack of investment capital and the Michigan state budget have made things difficult for startups, said Stephen Benoit, president and CEO of NanoMed. A lack of venture capital has his company sweating the upcoming year.

But the center's founders are hoping to address the funding problem. The university created the center to help attract more federal dollars, which tend to go more often to multidisciplinary projects, Muralidharan said.

"There's no money anywhere at all and there won't be for another year," said Barry Broome, CEO and executive director of Southwest Michigan First. By creating the center in an economic downturn, the center will be ready to attract money when money becomes available, he added.

TAL Materials from page 5

University of Michigan's College of Engineering. The company uses a patented flame spray pyrolysis (chemical decomposition) process developed at U-M that involves heating a solution including metals in a reaction chamber. The end result is a powder with each individual grain less than 100 nanometers in size.

Current commercial applications of nanopowders produced by other companies are in sunscreens and coatings and cars. But TAL's advantage, according to Walt Garff, vice president of sales and marketing for the company, is that TAL produces nanopowders involving a combination of metals.

"Most other companies make single metal oxides," Garff said. "We make mixed metal oxides. That's our claim to fame. That's not common."

The company is working on research and development with five corporations that remain unnamed because of nondisclosure agreements, Swanson said. Agreements are in the works with an additional four corporations, he said.

One of the applications currently under way involves orthopedics. The company is exploring the use of fixation devices — screws and pins — that surgeons would use inside the body. Devices made from mixed metal oxide nanopowders would be stronger and less intrusive to the body than traditional fixation devices.

Building an item from nanopowders translates to strength by reducing the flaws in the material.

"It's nothing more than imagining three bags in front of you," Swanson explained. "With a bag of marbles, you can see voids between the marbles. With a bag of BB's, there are still voids — admittedly, much smaller. With the right combination of an ultra-fine process, you can essentially do away with the faults."

Another short-term application involves the field of prosthetics and a longer-term goal is translucent prosthetics.

"If you could provide (the orthopedic surgeon) a prosthetic that can visibly provide flaw detection, you've got something."

Coatings are another project on the near horizon.

Providing transparent materials that could improve lasers or be used for armor for the military are potential products.

Swanson has his own personal stake in the company. He owned Swanson Capital Management, a money-management firm in Ann Arbor, for 24 years before selling it in 1997 to co-found Arbor Partners LLC, a venture-capital firm. In late 2001, he became part of an angel investment group that pledged its own money — not money from Arbor Partners, he stressed, to TAL. The angel investors have pledged in the neighborhood of $800,000 since then, Swanson said.

"The investing is an ongoing process to keep the company fluid," he said. "But we will have a major increase in funding this year."

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Michigan Economic Development Corporation

The Michigan Economic Development Corporation (MEDC) is the most effective economic and business development organization in the nation, ranked No. 1 for five consecutive years by Site Selection magazine. Its mission is keeping good jobs in Michigan and attracting more of them. The MEDC is focused on growing the small tech sector in Michigan by providing research assistance to universities and business support to companies.

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