

Industry 4.0:

A Roadmap for Michigan's Global Leadership



 **Automation Alley**[®]

Michigan's Industry 4.0 Knowledge Center™

In partnership with the **Michigan Economic Development Corporation** and the **World Economic Forum**

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WHAT IS INDUSTRY 4.0?

Imagine a world in which engineers can interact with 3D models in an immersive environment, where doctors use artificial intelligence to create individually customized treatment plans, and where products wend their way independently through the production process. This is Industry 4.0, the Fourth Industrial Revolution, defined as the convergence of digital, biological and physical technologies disrupting manufacturing, agriculture, healthcare and all industries across the globe.

Automation Alley, Michigan's Industry 4.0 Knowledge Center, identifies Industry 4.0 as a collection of eight emerging technology sectors, all of which require new ways of thinking and working:

- The Industrial Internet of Things
- Big Data
- Robotics
- Additive Manufacturing & Advanced Materials
- Artificial Intelligence
- Cloud Computing
- Cybersecurity
- Modeling, Simulation, Visualization & Immersion

GLOBAL STRATEGIES AT A GLANCE

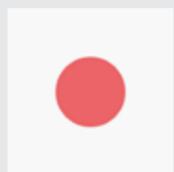
Industry 4.0 is the name given to the rapid disruption created by technology in all industries, particularly in manufacturing, healthcare, and agriculture – Michigan's prime GDP generators. Governments around the world are preparing in different ways to tackle this changing landscape.



Germany - Industrie 4.0 is the name given to the German strategic initiative to establish Germany as a lead market and provider of advanced manufacturing solutions, technological leadership in industrial production and research and development.



China - Made in China 2025 is a strategic plan of China issued by Chinese Premier Li Keqiang and his cabinet in May 2015. The goals of Made in China 2025 include increasing the Chinese-domestic content of core materials to 40% by 2020 and 70% by 2025 and positioning China as the dominant manufacturing hub of the world. Industry 4.0 technologies play a dominant role in the strategy.



Japan - Society 5.0, proposed as a future society that Japan should aspire to, follows the hunting society (Society 1.0), agricultural society (Society 2.0), industrial society (Society 3.0), and information society (Society 4.0). It is defined as a human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space. Again, Industry 4.0 technologies are at the core of the initiative.

These are nation state led strategies, funding multi-billion-dollar initiatives, to dominate manufacturing. In the United States, we do not have a national manufacturing strategy, to our detriment. It is critical that we have a Michigan strategy.

WHY INDUSTRY 4.0 MATTERS FOR MICHIGAN

Industry 4.0 is having a dramatic technical and cultural impact as it disrupts socio-technical ecosystems in the state of Michigan and around the world. Today, in factories across the globe, manufacturers are attempting to wrap their heads around the magnitude of change involved with Industry 4.0. Connected, smart factories are creating new ways to design and produce products, changing the way companies operate and revolutionizing the role humans will play in the labor economy.

According to the World Economic Forum, 65% of children entering primary school today will ultimately end up working in completely new job types that currently do not exist.

Here in Michigan, we have an incredible opportunity to become the national leader in the implementation of Industry 4.0 because of our manufacturing prowess. This is a region with a high concentration of skilled talent, unparalleled knowledge of how the supply chain works and a vision for the future.

The full impact of Industry 4.0 remains to be seen and is rightly of concern to the state and the World Economic Forum. Currently, there are no unified U.S. national policies aimed at Industry 4.0 integration, implementation and education (as in Europe and Asia). Michigan, through Automation Alley, the Michigan Economic Development Corporation and in partnership with the World Economic Forum, is positioned well to lead the U.S. in Industry 4.0.



IMPACT ON OUR STATE

Disruption of Michigan's Technical Industry Due to Industry 4.0:

- The lack of Industry 4.0 qualified talent, across all spectrums of work, is impacting the entire technical and manufacturing workforce from the shop floor to the C-suite.
- Foreign competition in Industry 4.0 expertise, particularly in Germany and sometimes China, is causing tech companies to look overseas for advanced technological knowhow.
- Financial risk associated with Industry 4.0 implementation is burdensome for small and medium manufacturing companies, while OEMs and Tier 1s wrestle with the pace of change.

Disruption of Michigan's Education System Due to Industry 4.0:

- The demand for talent is outpacing supply. The current education system is struggling to produce quantities of graduates with the Industry 4.0 skills, from shop floor to C-suite.
- Competing education/government collaborative systems are attracting thought leaders away from the state, toward their Industry 4.0-focused, university/state programs.
- The education system is not well suited to rapid changes. Educational models lack the agility to account for Industry 4.0 disruptions, particularly in technical content and skill-mix.



A ROADMAP TO SUCCESS: NAVIGATING THE FUTURE OF INDUSTRY 4.0 IN MICHIGAN

To set priorities and establish milestones and metrics to measure success, Automation Alley has drafted a guiding vision for how we would expect the world to view Michigan. To win the Industry 4.0 race, we believe that we must convince global industry that:

- Michigan is the undisputed U.S. leader in Industry 4.0 thought leadership and action in manufacturing, agriculture and healthcare
- Michigan is an innovator and trailblazer in human well-being (Society 5.0)
- Michigan is a global leader in sustainability

ACADEMIA ROADMAP

Currently, academia views Industry 4.0 technologies in segregated silos. Few programs, if any, align the interacting segments. Academia is still aligned with the traditional engineering disciplines (mechanical, electrical, chemical, etc.) associated with Industry 2.0. To succeed in Industry 4.0, Michigan educators will be required to radically rethink their models, methods and offerings to meet the needs of industry and a rapidly changing society.

Human Capital

- New education models: Embrace flexible online courses, and rapidly adopt immersive

training using augmented and virtual reality.

- Accessibility: Broadly increase student access to emerging technologies via smart factories and other real-world settings.
- Lifelong continued learning: Transition workers from single-task traditional careers (mechanical engineer) to multi-track careers (engineer, data analyst, network administrator).

Technology

- Applied research and use cases: Increase educator engagement with current industry use cases and trends via applied research. This will ultimately improve the alignment and agility of industry

and education.

- Student engagement: Increase student and parent awareness of the career options available in advanced manufacturing, and how Industry 4.0 disruptions are rapidly reshaping career choices.
- Industry collaboration: Re-align educator curriculum at all levels simultaneously to bring it closer and in better alignment with the needs of industry.

INDUSTRY ROADMAP

The disruptive nature of Industry 4.0 is transforming business models, cost structures, work processes and the role of human labor. The

development of a new corporate mindset and new skillsets will be critical for the growth and survival of Michigan companies in the digital age.

Human Capital

- Upskilling workers: Continue rapid upskilling programs at all levels. The upskilling and retraining workers will determine how swiftly companies can adopt new technologies.
- Exposure to new technology: Rapid technological advancement will require continuous education opportunities.
- Creating a learning culture: Drive culture change as a core tenet. The lines between traditional businesses and tech companies are beginning to blur. Companies today need to change their culture and embrace digitization in order to compete and thrive.
- Overlay a digital mindset on physical businesses: Innovation created around human-centric dynamic thinking will continue to emerge as critical survival skills and growth strategy. Workers will need specific technical digital skills contextualized and applied in physical environments.

Technology

- Make option-like bets: Teach small companies to make option-like bets. Bringing a digital approach to small investments can promote and encourage learning and help develop use cases of Industry

4.0. Option-like bets have a small and limited expense, but a large and unbounded potential.

- Get past the pilot phase: Help companies advance beyond the pilot phase on Industry 4.0. Cited by the World Economic Forum as a key impediment to success for most manufacturers.
- Collaborate with academia: Help industry and academia to create case studies and best practices for quick action and to prepare the workforce of the future.
- Embrace the physical/digital duality: Drive cultural change at the executive level at companies of all sizes. Companies will need to integrate physical and digital disciplines in the creation and scaling of new processes and products.

GOVERNMENT ROADMAP

State government must increase investment and build additional capacity to support Industry 4.0 initiatives and programs, strengthen current collaborative models and identify new and more efficient mechanisms to navigate the changes and disruptions of Industry 4.0.

Human Capital

- Collaborate with academia and industry: Wholesale and dramatic change needs to be considered at the K-12 level to prepare students for an Industry 4.0 world.
- Provide upskilling support: Provide financial support and alternatives for teachers and workers to become Industry 4.0 leaders and knowledge creators.

- Brand Awareness: Position the state of Michigan as an Industry 4.0 destination nationally and globally so that stakeholders can make data driven and informed decisions related to Industry 4.0 challenges and opportunities. It is critical to develop messaging highlighting the attractiveness of digitally transformed traditional businesses in manufacturing, agriculture, and health-care as places to work and grow.

Technology

- Fund early pilots: Fund projects that reduce the gap between companies exploring digital manufacturing strategies – via technologies such as automation, robotics, AI, and the Internet of Things – and those that are implementing them successfully.
- Support transformation of the supply chain: Help small and medium enterprises change their cultures into learning organizations that are resilient to digital disruption.
- Incentivize the creation and retention of pilot plants: Drive the development of Industry 4.0 pilot plants to ensure factory design skills and knowledge stay and continue to be developed in Michigan. It will also serve to strengthen the Industry 4.0 entrepreneurship ecosystem and attract venture capital. These “living” R&D centers also function as demonstration sites for small and medium businesses to observe cutting-edge technologies on the factory floor.



ACCOMPLISHED MILESTONES

Regions that thrive and prosper will be the ones that bring industry, education and policy makers together around common objectives combined with the ability to be agile and reactive to continued disruption and change in the marketplace. Automation Alley's role, in partnership with the MEDC, and along with the support of the World Economic Forum, is to drive this collaboration and create unified outcomes by **bringing academia and industry together, positioning industry to thrive and driving inspired policy development for Michigan's future.**

MICHIGAN ADVANCED MANUFACTURING HUB (AMHUB)

In May of 2019, following a second roundtable with Michigan business leaders, Automation Alley and World Economic Forum jointly established the Michigan Advanced Manufacturing Hub (AMHUB) to position the state as a global leader for advanced manufacturing.

This multi-stakeholder collaborative ecosystem is based at Automation Alley's headquarters in Troy, Mich. and is connected globally through the World Economic Forum.

According to an April 2019 white paper on the new era of manufacturing in the Fourth Industrial Revolution published by the World Economic Forum, in collaboration with Automation Alley and Accenture Strategy, Industry 4.0

has the greatest potential to affect Michigan's production systems while delivering an annual opportunity worth \$7 billion to the state by driving competitiveness and creating sustainable growth in the automotive sector. Further, as more industries adopt these technologies, the potential value-add to the state can far exceed that number.

AMHUB will convene leading stakeholders from government, academia and Michigan's technology and manufacturing corporations, as well as small- and medium-sized businesses and startups, with defined goals and measurable outcomes to ensure the state is prepared for the rapid innovations of the Fourth Industrial Revolution, also known as Industry 4.0. Activities will include community

building, knowledge exchange and driving action.

AMHUB's first order of business will be to set up and define two working groups:

1. Future of Michigan's Workforce working group: How are companies using tech like AR for training? What is the role of government or public/private partnership in supporting upskilling/reskilling?
2. Technology Adoption working group: How to collaborate between government and private sector to support and scale technology adoption. How to accelerate sharing of best practices and pilot implementation projects.

STRATEGY DEVELOPMENT:

Academia

Automation Alley has placed education at the heart of its Industry 4.0 initiatives in order to uncover academia's needs and strengthen the talent pipeline during a time a great technological change. In April of 2018, Automation Alley debuted its Technology in Industry Report, revealing strengths and gaps in Industry 4.0 readiness among the manufacturing supply chain and academia. Research for the report was conducted by Automation Alley's collaborative team of academic partners representing seven leading colleges and universities from across the state.

Following the research, interviews, and industry activity, new insights were uncovered and we found many consistencies through the participants' experiences. While technology opinions varied from participant to participant, the most common need identified was for more and better employees with manufacturing skills. The Federal government is reporting that the U.S. economy is creating over 800 manufacturing jobs daily through 2018. Interview participants reported that their growth was limited by a lack of skilled workers.

In academia, the consensus was that our university system, while strong in science and engineering, currently lacks the ability to bring together the variety of skills needed for Industry 4.0 in their rigid management of post-secondary education instruction and delivery. Many cited that

precious few programs understand the full scope of changes coming to industry and fewer still know how to ably skill the workforce needed.



When speaking on the K-12 system, most cited that the largest gap in understanding I4.0 might lie with the parents and teachers. Manufacturing careers moving forward will require a diversity of skills and workers willing to embrace innovation and a dynamic work environment. Skills which could be developed in K-12 go unexplored due to parents and educators not understanding the high value potential of manufacturing careers.

Industry

Automation Alley's membership base is made up of 800 companies from the technology and manufacturing sectors. The common challenge for industry identified through our interactions is dealing with the rapid pace of change, having the team in place to meet this challenge and the need for a consistent business environment to allow for growth. A key factor cited by interviewees in the World Economic Forum project was the challenge presented by the disruption of Industry 4.0 technologies as they become utilized in production environments. As capabilities change, traditional manufacturing companies will need to change with the technology and be able to deliver these new products, or they'll be displaced by those that do.

Government

When asked what was needed from government, participants in the Automation Alley/World Economic Forum Roundtable cited consistency at the local, state and national level. Assistance in training workers throughout their career was also ranked highly as skill development and enhancement is an ongoing activity. Energy costs were also ranked as a concern for Michigan businesses as were roads and other infrastructure components. Michigan's business environment was held in high regard and subjects desired a continuation of business-friendly policies.



INDUSTRY 4.0 INITIATIVES

INDUSTRY 4.0 INITIATIVES UNDERWAY

Automation Alley has already begun, in partnership with the MEDC, several initiatives to fulfill the vision.

They include:

- **Integr8:** This global Industry 4.0 conference debuted at Detroit's Renaissance Center in 2017 to a sold-out audience of 500 tech and manufacturing business professionals from across the globe. In 2018, the conference returned with over 800 attendees and is moving to Cobo Center in 2019 to accommodate demand. The goal of Integr8 is to create awareness and knowledge around Industry 4.0 technology. The conference includes 80-plus speakers in breakout sessions, a Smart Technology Expo, keynote presentations, a fireside chat and many opportunities for networking and learning from other technology and manufacturing representatives.
- **Technology in Industry Report:** In collaboration with regional academic research partners and industry partners, Automation Alley publishes an annual data-rich, comprehensive report complete with industry case studies. This report identifies Industry 4.0 trends in technology sectors and recommends action steps that each reader can apply to his/her business.
- **ACT 4.0:** Automation Alley provides this customized program to help companies facing digital disruption transform into learning organizations, built on a foundation of trust and an ownership mindset. This enables them to strategically adopt cutting-edge technologies associated with Industry 4.0 to increase revenues and reduce costs.
- **Tech Takeover Series:** This weekly Industry 4.0 event series takes place at Automation Alley headquarters and is livestreamed, providing an opportunity for technology companies to educate manufacturing companies on the applications of technology to improve their business.
- **Global Trade Missions:** Automation Alley coordinates trade missions to countries with a high demand for Michigan made products and serves as a resource for companies interested in doing business overseas.
- **MI Smart Factory Tour:** Automation Alley's MI Smart Factory Tour is an innovative program that gives college and university students an opportunity to learn about Michigan's technologically advanced manufacturing companies and career pathways available to them in Michigan. This program allows students to gain a practical understanding of Industry 4.0 from an implementation perspective by touring smart factories in Michigan and offers an opportunity for high-level networking while they discover the wealth of job opportunities available in these high-tech, in-demand fields.
- **Industry 4.0 Supplier Reboot:** Automation Alley's Industry 4.0 Supplier Reboot is a unique full-day, customizable workshop tailored to fit a technology or manufacturing company's needs and created to strengthen their supply chain through practical, implementable recommendations focused on Industry 4.0 best practices.

NEXT STEPS

Automation Alley, in collaboration with the MEDC and the World Economic Forum, intends to continue to validate the roadmap including development of objective metrics and KPIs (Key Performance Indicators). Additional tactical programs will need to be developed to support key initiatives.