

If not for WHIN...

# Advanced Manufacturing

These are innovations, networks, and initiatives that exist now in the Wabash Heartland Region that did not exist before WHIN.

## ▼ INNOVATIONS

These are the ideas and products that exist now in the Wabash Heartland that did not exist before WHIN.

## Facilities

### Purdue's Intelligent Manufacturing Testbed (IMT)



A peek through the window of the IMT facility shows testbed equipment ready to help small - and medium-sized enterprises (SMEs) work on solutions.

Purdue's Intelligent Manufacturing Testbed (IMT), a 13,000-square-foot testbed developed in collaboration with WHIN, is unique in its versatile approach to examining plant/factory costs and supply chain productivity. With this one-of-a-kind manufacturing lab, researchers examine capabilities for the smart digital factory, by sensor integration and distributed sensing in both equipment and material forms. In addition, the team utilizes manufacturing lines (with two to three supply chains represented) that are directly connected to the team's unique Technical Cost Modeling tool for real-time cost monitoring. This integration helps corporations determine how much money can be saved with

manufacturing step variations and level of robotization. These are exceptional tools that set Purdue-WHIN apart, said Prof. Jan-Anders Mansson, distinguished professor of Materials and Chemical Engineering. Together with Professors Nate Hartman and Jan-Anders Mansson, who serves as Co- Executive Director of the Indiana Next Generation Manufacturing Competitiveness Center (IN-MaC), the IN-MaC leadership team designed and facilitates the IMT. Saab is one of the many manufacturers eager to work with the IMT developed by WHIN funding. Hexagon is a Swedish company with more than 18,000 employees specializing in sensor, software, metrology and autonomous solutions. Hexagon committed to a \$3 million support package into smart factor solutions at the IMT.

### Ivy Tech's Advanced Manufacturing Testbed



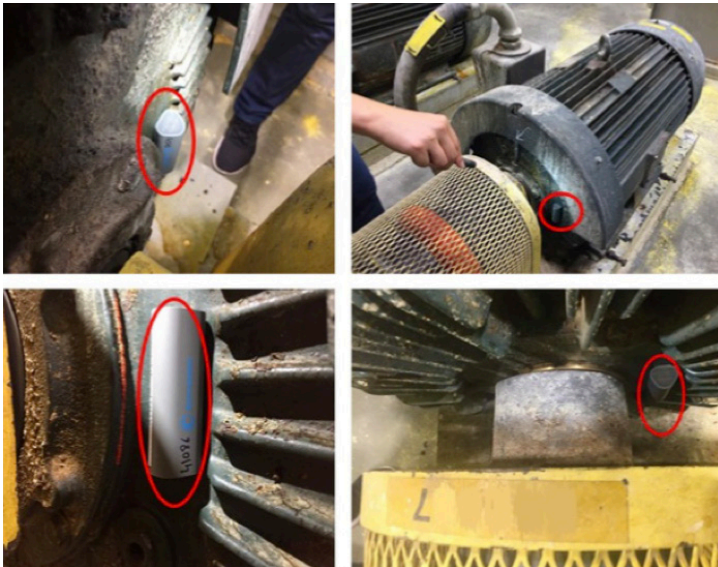
IFM Sensors monitor motor vibration and provide data analytics.



Sensors can be used for monitoring preventative maintenance in an Advanced Manufacturing setting, and Ivy Tech has teamed up with IFM Efector to install several real-world sensors for students to learn how these IoT technologies can be applied. IFM sensors have been installed on the air compressor system in the Manufacturing Teaching Lab in the Griffin Hall, which will monitor vibration issues and also airflow leakages. Additional sensors have been incorporated in course curricula to demonstrate several other ways IoT sensors can monitor manufacturing equipment. A cellular data

collection platform has been installed to demonstrate additional IoT capacities for potentially remotely located situations. A Mechatronics training unit was purchased from Amatrol for the laboratory space. Mechatronics training programs teach systems-level thinking and industrial automation skill-building that prepares learners to for mechatronics operation, hands-on PLC programming, and industrial maintenance and problem solving for real-world manufacturing environments. This trainer, coupled with IoT sensors, guides students into preparation for Industry 4.0 related maintenance skills.

## Research Partnerships



The Tate & Lyle pilot study started in July 2018. The study examined six of the plant's 700 motors, attached sensors to monitor vibration and temperature, and provides a constant stream of data to Purdue.

Tate & Lyle produces corn syrup and related products at two plants in Lafayette. Their operations rely heavily on the efficient operation of approximately 700 motor/pump combinations. An unexpected failure of one of these units can be very expensive.

But so is keeping an eye on them. To minimize failure, the plant performs three complex and highly sensitive tests manually on every pump, every month. There is a commercial IoT vibration solution that offers enough sensitivity to replace the manual tests, but the labor of this effort is also quite expensive.

Tate & Lyle partnered with Purdue's WHIN-powered IoT and manufacturing groups to search for a more feasible and cost-effective solution.

Researcher Nithin Raghunathan, professors John Sutherland and Bruno Riberio, along with a group of graduate students, started by outfitting the motor/pump units with commercially available, wireless IoT vibration sensor solutions.

The project has shown both Purdue and Tate & Lyle some of the limitations of commercially available sensors in the marketplace. The Purdue team is currently working with Tate & Lyle to install another round to low-cost sensor packages that are under development by the Purdue Research and IoT groups.

## Aviation & Aerospace Cluster



Marcus Wallenberg, Saab Chairman of the Board, and his team enjoys a tour of the Intelligent Manufacturing Testbed (IMT) by Professor Jan-Anders Mansson.

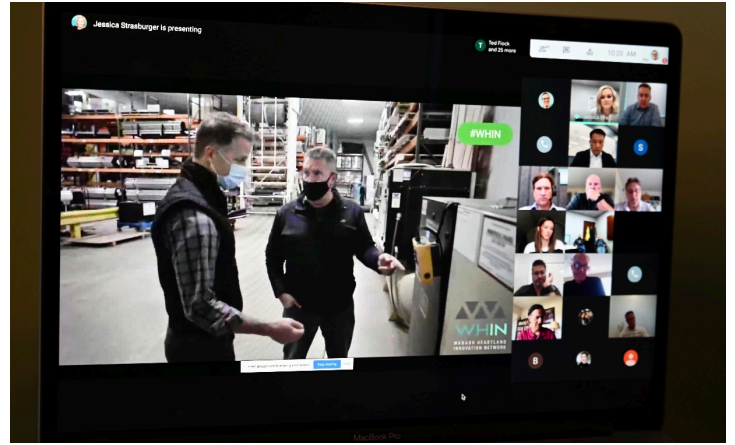
The regional economy reflects Purdue's strength in aviation and aerospace. GE Aviation's LEAP engine plant in Lafayette and SAAB Global Defense and Security's facility in Purdue's Discovery Park District, join Butler Aerospace & Defense in the Purdue Research Park as the hub of the area's aerospace cluster.

Saab, a Stockholm-based company, built a \$37 million facility located at Discovery Park District Aerospace on the west side of the Purdue University campus, in an area known as the Aerospace District. The Saab plant will manufacture a significant portion of the Boeing T-X advanced pilot training aircraft, which will help train future U.S. Air Force pilots for generations to come. Saab

is both a partner and supplier to Boeing on the program.

Every CEO and industry leader -- such as Marcus Wallenberg, Saab Chairman of the Board - feels a major differentiator for WHIN is the research team's close collaboration with manufacturers in the region, such as Kirby Risk, Evonik, Subaru, Wabash National, Standard Industrial, Oscar-Winski, TMF, ZF, and Drug Plastics, said Professor Jan-Anders Mansson. These regional collaborations are not common but extremely informative and beneficial. "The local SMEs (small and medium enterprises) are anchors, providing us with vital insights," said Mansson. "These insights help us become better collaborators with global industries, as well as the regional partners. This allows us to research and design better manufacturing tools and methods overall."

## WHIN Manufacturing Alliance



In November 2020, WHIN Administration hosted a virtual WHIN Manufacturing Alliance Summit with 52 attendees.

### ▼ NETWORKS

These are the discussion groups, alliances, and portals that exist now in the Wabash Heartland that did not exist before WHIN.

## WHIN Administration

15

WHIN Manufacturers in Alliance

52

WHIN Manufacturers have attended two Manufacturing Alliance Summits since 2019

11,000

Employees of WHIN Manufacturing Alliance companies

WHIN's Manufacturing Alliance—with 15 members (representing 11,000 employees)—vets innovative IoT products, subsidizes the start-up cost for accelerated adoption, and shares the data for research and education purposes. So far, WHIN has on-boarded two WHIN Advanced Manufacturing Tech Partners, giving them access to progressive customers and research collaborations. To date, these tech partners include: 1) Fluke (sensors collecting vibration and temperature data from 100+ manufacturing machines) and 2) Guardian (preventive maintenance).

KA Components made the decision to join the WHIN Manufacturing Alliance because, like virtually all manufacturers, their operation relies on motors and air compressors to run machinery. In their case, that includes a lumber grinder and a variety of presses. If the motors fail or air compressors leak, the business loses productivity and money.


“

For a company like ours to have a vendor like Fluke vetted for us; that provides value. It's an easy entry into the game, otherwise a lot of us (SMEs) don't have the resources to dedicate to the review process.”

**Brian Kerkhoff, KA Components (Benton County)**

## WHIN-Purdue Peer Network Groups and Special Interest Groups



 The WHIN-Purdue manufacturing education team (left to right: Dr. Angus McLeod, Roy Vasher, Steven Dunlop, and Dr. Ananth Iyer) created Peer Network and Special Interest groups in the Wabash Heartland region in 2018.

WHIN's manufacturing education team formed the first WHIN regional peer group from non-competitive manufacturers in Pulaski, White, and Cass counties. Up to 10 company groups meet six to eight times annually with the objective to inform, cooperate, and test out projects of common interest.

"Peer groups have created a platform for like-minded companies in close proximity to share best practices, problem-solve, and present the products and services their company has to offer," said one of the peer groups' first members, Bryce Brumm, president of Standard Industrial in Winamac (Pulaski County). "They are able to use the experience and expertise of the Purdue facility to present topics of discussion that are relevant and helpful to every member of the group. The value of peer groups will be evident in those companies that tap into the wealth of information in their backyard."

Since they began meeting in late Fall 2018, peer groups have spawned other special interest groups in education and supply chain, as well as regional cooperation and project groups. The first of these was an ERP (Enterprise Resource Planning) Special Interest Group. Topic areas for this group have included value-stream mapping, business cases for investment, coaching skills for supervisors, staff retention best practices, on-boarding, and leadership. Comprised of companies that are "next door" and non-competitive, there is a higher potential for

real collaborative synergy to drive change and innovation. The Peer Network groups helped the WHIN-Purdue manufacturing education team better understand some regional labor condition issues, pre-COVID-19.

### ▼ INITIATIVES

These are the projects, trainings, and degree-seeking courses that exist now in the Wabash Heartland that did not exist before WHIN.

## Purdue

**163**

manufacturers from 64 companies attended 5 workshops

**50**

companies participated in 5 peer network groups and 4 special interest groups

**91**

manufacturers from 46 companies attended 188 in-person class sessions

**39**

IoT sensor research projects ongoing with WHIN Region partners

## WHIN-Purdue Manufacturing Gateway

The Purdue-WHIN Manufacturing team, in response to feedback from regional stakeholders, have developed a highly valuable program and website that streamlines the process of connecting Indiana manufacturing companies to Purdue. This resource is called the Purdue Manufacturing Gateway. The Gateway's single most important role is to act as a "front door" to the university, making it easy for manufacturing companies to get connected and create engagements with Purdue. The

Gateway also serves, supports, and assist manufacturers with the challenges they face in today's global business environments. Indiana companies can now get connected to the university through the Gateway website at: [www.purdue.edu/industry/pmg](http://www.purdue.edu/industry/pmg).

## Workshop Series

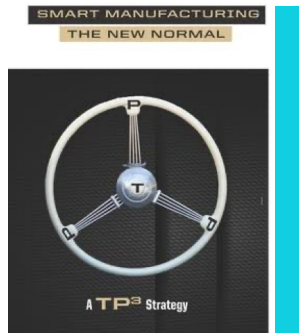
The WHIN - Purdue Manufacturing Team hosted a series of 2019-2020 workshops, through IN-Mac and DCMME. Overall, through these workshops, nearly 450 attendees have attended, focusing on a variety of technical and non-technical topics. Some of the more recent workshops have featured:

### IoT and Gathering Data

Professors Martin Jun and Brittany Newell shared knowledge on the use of IoT on the factory floor; the identification of potential business impacts; and applying IoT to enhance the capabilities of legacy equipment.

### Merging Metrology, Materials and Model-Based Techniques

Professors Nate Hartman and Michael Sangid introduced the flow of product and process information throughout the product lifecycle; and applications to harness data within the digital thread to improve one's ability to make decisions.



## Cost Optimization in Robotics and Co-Robotics Driven Production

Professors Richard Voyles, Jan-Anders Mansson, and David Capelleri provided an overview of available robotic and co-robotic technologies; and introduced techniques to assess the economic impact for various production scenarios.

## Planning for the New Normal in Manufacturing

Professors Ananth Iyer and Steve Dunlop, along with Roy Vasher and Angus McLeod, shared content from their recently published book. Several leaders of WHIN organizations also shared some of the impacts on their operations and how they have adapted their manufacturing environments in light of their recovery efforts beyond COVID-19.

## Digital Supply Chain Tool (DSCT)



The Digital Supply Chain Tool (DSCT) enables companies to find one another to help them rapidly purchase goods locally that meet a specific standard. As of March 2020, over 250 local company profiles have been generated within the portal and over 140 have been verified and updated by companies. No advertising is sold on the portal, so all companies know information for each company is presented entirely fairly. Any company in the WHIN region is eligible to join.

WHIN believes one of the ways to reduce the regional leakage (of 85%) is to provide this DSCT that would allow the companies in the region to easily identify potential suppliers by specific capabilities and requirements needed for the job. "We have companies in the WHIN region that are both suppliers and manufacturers, and they want to move up the value chain," said Steven Dunlop, Managing Director for the Management of Manufacturing Enterprises (DCMME). "They can use the Digital Supply Chain Tool developed by Purdue University to optimize their ability to do that. WHIN can assist them in finding local suppliers, reducing their logistics costs, and making stronger connections."



The Purdue Center for Regional Development (PCRD) has been involved in the Wabash Heartland Innovation Network (WHIN) since 2016 as the research/assessment component of the project. PCRD has provided WHIN with grant-writing assistance, a comprehensive data dashboard, regional placemaking surveys, biannual reports, and this midpoint impact analysis.



[pcrd.purdue.edu](http://pcrd.purdue.edu)



[pcrd-web@gmail.com](mailto:pcrd-web@gmail.com)