

2018-2019

IN WITH THE NEW



4 additions
to DCMME

PG 8
NEW
FACES

DCMME graduate student trying out new technology in the Engagement Center (p.11)



Dr. Ananth V. Iyer
Center Director
Department Head and Senior Associate Dean
Susan Bulkeley Butler Chair in Operations Management

a special thank you
to our partners

- AAM**
- John Deere**
- Arcellor Mittal**
- GM**
- CAT**

from Ananth

We are pleased to present the DCMME Annual Report (DCMME refers to the Dauch Center for the Management of Manufacturing Enterprises). This year has been exciting, with many projects, new students, speakers, company interactions, grants and more. The center continues to evolve the role of the Smart Lean Engagement Center housed in Stewart Center. This hands-on lab showcases emerging technologies, from augmented reality to light guide devices, 3-D printing to drones

for internal use, video analytics to sensors. Students working at the center are adding to its capabilities, and we have hosted several managers and undergraduate student classes interested in hands-on learning about the opportunities afforded by smart technologies. We are working with companies to create prototype projects and assess their business benefits. We have aspirations for this lab to become a key part of student learning and collaborations with industry partners. Applied projects to improve operations

performance continue to thrive at the center. One of our projects, funded by the Lilly Endowment, is part of WHIN or Wabash Heartland Innovation Network. We are engaging with data, or in direct contact, with close to 300 manufacturing firms in the region. Our digital database of these companies and their capabilities is now connected to our efforts to enable a capacity marketplace to permit companies to collaborate using their individual capabilities to deliver against complex short-cycle opportunities. DCMME staff and faculty are also creating peer to peer networks of these companies to enable sustained learning, both from us and from each other. In short, we are working towards enabling a smart manufacturing eco-system in the WHIN region. Success on this front will enable DCMME to serve as a catalyst for manufacturing competitiveness of

WE HAVE GROWN RAPIDLY IN THE PAST FEW YEARS...

our region. Other projects sponsored by Procter and Gamble, the Indiana Department of Transportation, and the Department of Energy are all examples of opportunities for students and faculty to engage in the learning and enhancing of skills for our students. From all of us here at Krannert, thank you for being part of DCMME – your participation with the center enables us to nurture the passion for manufacturing that we hope to instill in our students. You can assist us by attending our conferences, talking to our students or faculty, emailing us with suggestions, calling us to chat about ideas or even perusing our website. Please be on the lookout for even more content in our website. We invite you to peruse this Annual report to get more detail, engage in a photo-journey with us, and join us in thanking the many industry and government representatives, students, staff and

faculty who helped us generate the vitality needed to keep the center growing. As you learn about the current activities at the center, we invite you to share ideas, comments and opportunities with us. All it takes is a phone call to Steve Dunlop or an email to dcmme@purdue.edu to start the collaboration. We will work with you to create solutions for your question using our team of graduate students and faculty. The upside for all is that great ideas are the core to student learning, business competitiveness and faculty research. We understand that problems and their solutions do not fall into neat functional area boundaries, so our Krannert faculty engagement across disciplines will ensure that we address problems with the breadth that is appropriate. We look forward to another year of successful collaboration. From all of us here at DCMME, thank you for your contributions to the center.



IN OUR STATE

In our new projects with the Wabash Heartland Innovation Network (WHIN), we are focused on manufacturing companies in the ten county region around Tippecanoe. Our goal is to ensure that technology adoption enables business.



ON OUR CAMPUS

Interdisciplinary engagement including the discovery park, agriculture, and engineering

REACHING GLOBALLY

in five continents through:

- projects
- student workers
- company partners
- study abroad
- conferences



1

new engagements

PERUVIAN PARTNER



“ We are excited about the solid global experience this new program offers our students.

-Heidi Allwes, Coordinator



Eduardo Huerta-Mercado is a '00 grad of the Krannert MBA program & current Director of Softeon LATAM & Director of INvent Technologies that DCMME is partnering with.

BUSINESS IN PERU STUDY ABROAD PROGRAM

The Business in Peru program plans to kick off the first internship over spring break 2020. This course is a two credit management level class hosted by the Center and Tlogistica of Lima, Peru. The program will target MBA students to provide them with the occasion to work on real-life business problems and provide solutions to businesses in Peru. Projects will be implemented by the companies involved and will be related to the subjects of supply chain, manufacturing and operations. In addition to a rich learning opportunity, students will be exposed to cultural activities as well including a weekend trip to Machu Picchu. This program is designed to further enhance student classroom learning.



Peruvian business executives touring the DCMME Engagement Center

PERU EXECUTIVE SUMMER VISIT TO CAMPUS

A group of business executives from various Peruvian companies came for a visit to campus fall 2018. The trip entailed several tours of supply chain related facilities in Indianapolis and locally including: Lowe's Distribution Center, General Electric, Fed Ex, Amazon, ClearObject, Birk Nanotechnology

Center, Bechtel Innovation Design Center, Indiana IoT Lab, and our Smart Lean Engagement Center here on campus. The group also got to tour Indy including the Indy car race track. The partnership with these Peruvian businesses was established through Eduardo Huerta-Mercado with hopes of providing insight into best practices and innovative technology used in and around the local area.

YEAR IN REVIEW

TVS INDIA INTERNSHIP



TVS INDIA INTERNSHIP FOR 14 YEARS

For fourteen years now the TVS India Internship has brought together a combination of business and industrial engineering students for a three week internship to Bangalore, India, the headquarters of TVS Motor Company who hosts the interns. TVS provides a list of projects related to their business operations that they hope to improve and implement. Students work with management on site to determine feasible options and suggestions for improvement. Kranert alumnus Venu Srinivasan is the chairman & managing director of TVS Motor.

MANUFACTURING CONFERENCE



MANUFACTURING COMPETITIVENESS CONFERENCE

The DCMME manufacturing conference Speakers included: KeyNote, James Keppler (Vice President of integrated supply chain & quality, Whirlpool); Cory Wykoff (Packaging Department Manager, Pepsico, Purdue Grad (Engineering); Dr. Satya Ramaswamy (Executive Vice President, Mindtree Limited); Lou Rives (President, Versa Tech Automation); Arun Gupta (IBM Watson Consultant); Angus McLeod (WHIN Education Consultant, VP of Coaching at AMA); and Roy Vasher (WHIN Education Consultant, Co-Author *Toyota Supply Chain Management*).

new projects

INDIANA & BEYOND

bridging industry, students, and faculty

in a very

sense.

A project with Indiana Department of Transportation

The primary objective of the Ohio River Bridges project was to develop a present value analysis by analyzing the funding structure of both INDOT and WVB partners to identify whether the P3 approach of DBFOM is profitable or not. The funding structure included the toll revenue

projection model (reflective of current traffic patterns) and the operations and maintenance cost of the bridges. The team also did a comparative study of Ohio River bridge with other bridges that have similar features (physical, financial, design, policies, etc.).

WHIN IN THE NEWS p.9

<https://krannert.purdue.edu/news/features/home.php?story=5053>



As president of Zojila, I have had the privilege and opportunity to work with Professors Ananth Iyer and Steve Dunlop for several years now. The collaborations have facilitated the exploration of new opportunities as well as the application of cutting edge ideas to the solution of existing problems in manufacturing and business practice. I am thankful to have access to Krannert and DCMME to further the growth of my business and would highly recommend it to anyone who has the opportunity to avail of their services.

OUR PROJECTS

WHIN EDUCATION

project scope

The key objective of the project was to collect extensive data including employee information, location, skills and core competencies for 270 companies in the 10-county region of Indiana with the goal to develop smart people, smart processes and smart technologies through various resources.

WHIN SUPPLY CHAIN

project scope

The WHIN Supply Chain Leakage project aims to solve the issue of the Supply

Chain Leakage in the Wabash 10-county region by developing a web database which will allow companies to easily access information about each other and take advantage of products and services available within the region itself resulting in reduced supply chain leakage. The database is being populated with information from participating company websites that will serve as a directory.

MONOSOL

project scope

The project aimed at documenting

the current state and mapping order processes using Visio, identifying and addressing the key gaps in the current state and proposing an anticipated future state for order process by building a Salesforce order queue for the plants located in the US.

DOE PROJECT #1

project scope

This project is assisting one of the scientists in finding product/market fit, economic value, and ROI for a new technology to produce synthetic graphite which would have a huge impact on cost

of electric vehicle batteries and drive EV sales.

DOE PROJECT #2

project scope

This project is assisting a scientist on Techno-economic analysis of production and separation of rare earth metals and developing a product roadmap for the technology. The team is also studying purity vs. cost of purification vs. price of Dysprosium, Cerium & Neodymium.

DOE PROJECT #3

project scope

The team is developing a game to simulate the capacity game and its outcomes based on various constraints on information sharing using ASP, MySQL & HTML and will launch this game to train students.

OPENCV PEOPLE TRACKING

project scope

This project focuses on the identification and tracking of all people in the engagement center. In this project, live video feed from

new projects cont'd

cameras set up in the center was used as input. OpenCV algorithm using tensorflow library identified and tracked people.

OPENCV CROWD ANALYSIS

project scope

In this project we will be leveraging video analytics to perform crowd analysis over visitors in a room. The objective of the project is to detect and count the number of people in a room every 15 minutes. Live feed and images from pre-installed cameras will be processed by the algorithm, providing us the number of people at that instance in the room.

FEEDBACK

DCMME gives both students & current practitioners insights into emerging ideas that will give their companies a competitive advantage in reaching a worldwide audience.

--Dean David Hummels

The center offers professional industry interaction, deadlines, and results from teamwork. --Dr. Olga Senicheva



Cummins DBU Engineering worked with a DCMME Purdue Team on an engineering cost model. Cummins has been very pleased to have this outside team like Purdue which has brought new vision to situations and independent views based on actual data. We are working to extend this relation with more projects.

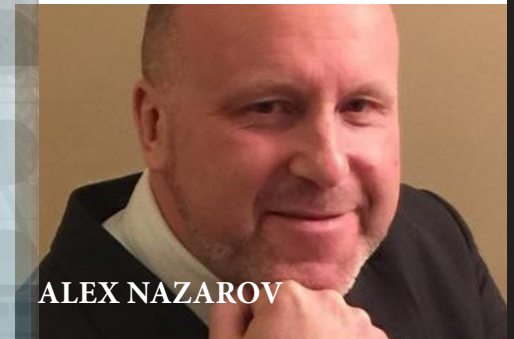
-- Alexander Nazarov, Cummins



DEAN HUMMELS



OLGA SENICHEVA



ALEX NAZAROV

OPTION CERTIFICATE

2018-2019

2017-2018

2016-2017

The DCMME Center offers two certificates to our Master's Students: GSCM and MTM Option Certificates. The GSCM option allows students to take courses to help them prepare for supply chain related concerns, and the MTM option focus allows students to prepare for manufacturing challenges.

3

new faces

OUR CONSULTANTS



MEET OUR NEW CONSULTANTS

Roy & Angus are consultants on the WHIN project with the DCMME Center.

► Roy is responsible for development of Next-Gen educational programs for manufacturing companies in the 10 county area adjacent to Purdue University. Roy is also an assistant professor for Purdue's Executive Management of Business Administration program and is the instructor for the course "AI for Lean Business." Roy also provides technical assistance to HDS Mercury, a Silicon Valley start-up company, that is developing a robotics solution for fulfillment centers and manufacturing material handling operations. Roy's previous experience included 19+

years at Toyota Motor Manufacturing & Engineering, North America in Kentucky. His roles at Toyota included the General Manager of Information Technology for Toyota's North American Manufacturing business as well as Project General Manager for Toyota's Supply Chain reengineering program. Roy co-authored the book *Toyota's Supply Chain Management: A Strategic Approach to Toyota's Renowned System*.

► In his position with Purdue, Angus McLeod brings together a wealth of experience in corporate leadership at the Board Director level, in thirteen companies in the UK and USA. His consultancy work includes national

Government, CBRE., Johnson & Johnson Medical, British Aerospace and Glencore-Xstrata where he has delivered management and leadership development as well as leadership coaching. He does ongoing work with leadership on four programs at Wharton College. He is author of books, including 'Performance Coaching', 'Self-Coaching Leadership and Me, Myself, My Team'. He supervises PhD students at the Business School of Birmingham City University, UK. He has over 20,000 graduates from his web-based trainings and designs digital apps for leadership and for Small & Medium-Sized Manufacturing Enterprises via Gnowbe.com

“The WHIN grant for the 10-county region focuses on one of the largest manufacturing sectors in the state and Purdue's role in enabling its competitiveness.”



Steve Dunlop, Center Mng, Director

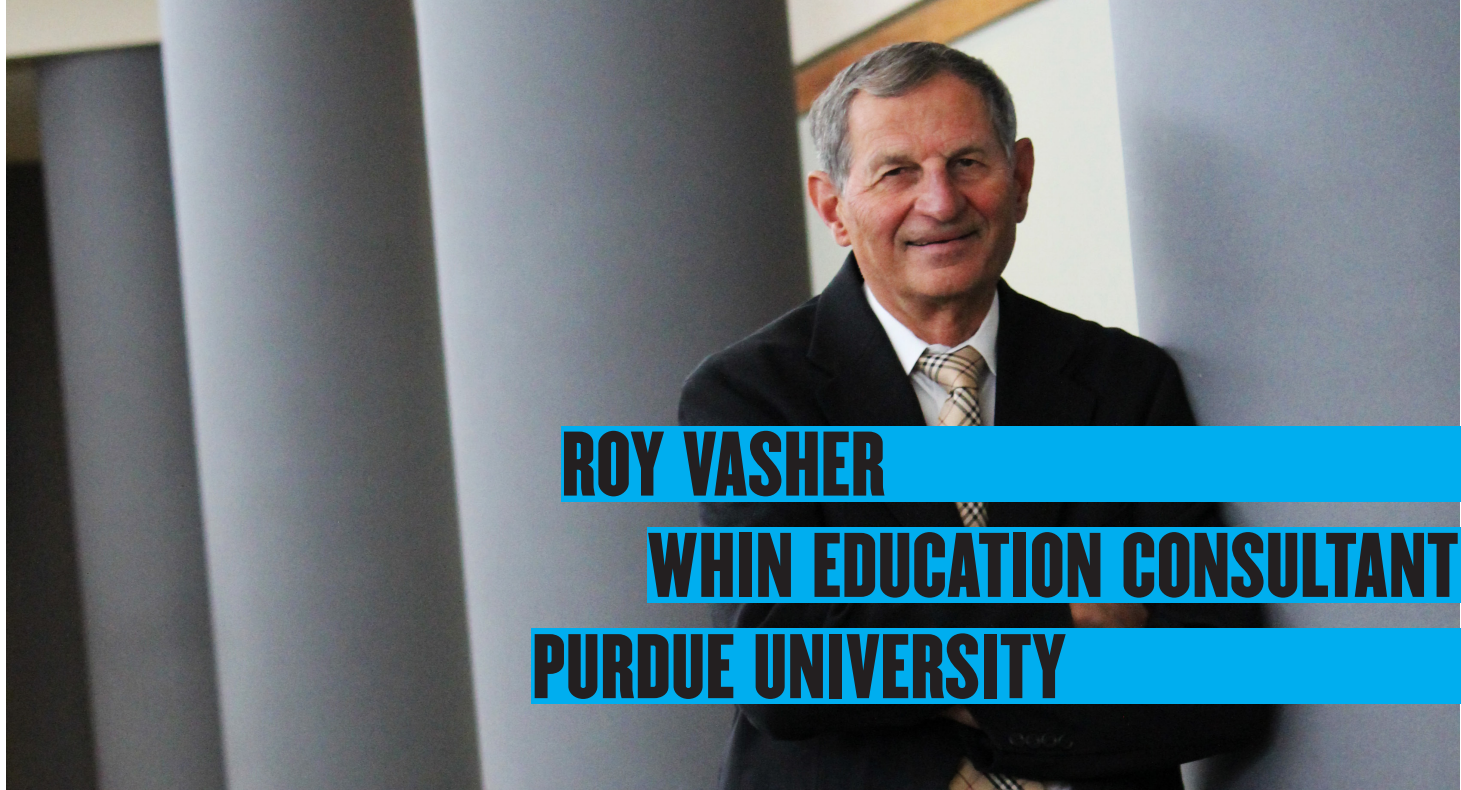
Can you picture a Silicon Valley ... in Indiana? Within the next five years, north-central Indiana is aiming to make its mark as a developing global epicenter, technologically revolutionizing agriculture and manufacturing. Leaders envision a hub that draws innovative new businesses and ultimately prosperity to the region. Community leaders

and local economic developers are collaborating with Purdue University to advance the Wabash Heartland Innovation Network (WHIN), a consortium of 10 counties in north-central Indiana that already is leading the state in agriculture and manufacturing. It was funded in 2017 by a \$39 million grant from Lilly Endowment Inc. WHIN serves

to develop the region into the global epicenter for digital agriculture (engaging agriculture producers and business in the development of agriculture IoT testbeds, career-ready certificates and digital-readiness training) and next-generation manufacturing (real-time analytics of manufacturing systems, workforce education and manufacturing IoT

WITH 85% OF OEM PURCHASING GOING OUTSIDE THE STATE OF INDIANA, ANYTHING THE WHIN SUPPLY-CHAIN TEAM CAN DO TO IMPROVE VERTICAL MOVEMENT OF GOODS AND SERVICES WILL IMPACT BUSINESS SUCCESS AND ECONOMIC GROWTH IN OUR AREA.

**DID
YOU
KNOW**



ROY VASHER

WHIN EDUCATION CONSULTANT

PURDUE UNIVERSITY

testbeds) empowered by Internet of Things (anything connected to the Internet, particularly Internet-enabled sensors of all types). In addition, the organization's regional cultivation initiative is designed to increase the education, vitality, and connectivity of the Wabash Heartland region. DCMME is working on developing a curriculum for a variety of courses and certification programs. But they're also developing a supply chain tool to retain more money in the region. Krannert's Global Supply Chain Management Initiative (GSCMI) is a tool designed to reduce supply chain leakage, which occurs when manufacturers source their components outside the region. This tool is mapping all manufacturers and their capabilities so that new supply chains can be prototyped to develop emerging products and services.

WHIN stands for Wabash Heartland Innovation Network.

What does the acronym WHIN stand for?

There are 10 counties in the WHIN Initiative.

How many counties are included in the initiative?

To support the ten county area around Purdue to revive and stimulate economic advance of the WHIN area.

What is the mission statement of WHIN?

Dr. Ananth Iyer, Steve Dunlop, Roy Vasher, Dr. Angus McLeod

Who is leading WHIN Education & Supply-Chain?

With c. \$39 Million in support from the Lilly Foundation

Who provided the funding for the grant?

- Benton**
- Carroll**
- Cass**
- Clinton**
- Fountain**

- Montgomery**
- Pulaski**
- Tippecanoe**
- Warren**
- White**

What counties does the ten county region include?

Q&A about WHIN

The grant supports three broad initiatives:

- Resident 'connectivity' such as broadband, waterways and transportation
- 'Vitality' including projects of community benefit with more attractive spaces, and
- 'Economic sustainability and education' including training and development access to prepare current and future employees for work in smart manufacturing and digitally-enabled agriculture.

What initiatives does WHIN support?

4

new tech

Meet the new members of the DCMME engagement center.

A close-up photograph of the Anki Vector personal home robot. The robot is black and grey, with a central lens and two articulated arms. The word "hello" is written in a bright green, hand-drawn script across the robot's face. Below the word, a white rectangular box contains the text "Step in and say".

hello

Step in and say

— → *Anki Vector personal home robot*

▶ **OPENCV** is a video analytics software

that allows users to track, classify, and recognize animals, people, objects and specific features on them. DCMME uses this technology in the engagement center to track the number of people entering and exiting the room and is working on a project with a local farm to monitor the number of cattle in their livestock fields.

▶ **THE MICROSOFT HOLOLENS** is an augmented reality headset

that allows users to interact with the virtual world while maintaining a connection to the real world. It does this by projecting images and holograms onto the user's surroundings and lets them manipulate these projections using physical and verbal cues. The applications for this technology are limited only by the user's creativity and imagination.

▶ **3D PRINTERS** have advanced greatly

over the past few years and now have the capability to print using all kinds of material from plastics to metals to even concrete. In the engagement center, we have printers that print in ABS plastic and use them to create unique and complex gadgets and trinkets that would be very difficult to machine using conventional methods.

▶ **THE LIGHT GUIDE SYSTEM** is another form of utilizing augmented reality

technology. It does this by projecting a digital operating "canvas" onto any work station to help train and improve the efficiencies of line workers through video and audio prompts. The prompts help ensure that the workers are following specifications so each product produced comes out perfectly each and every time.

**SMART LEAN
ENGAGEMENT
CENTER**

Open for
tours Mon-Fri
9:00am-4:00pm
STEW 162



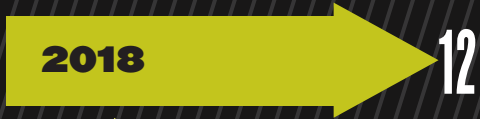
our staff pick



nick wright, mba '19

The HoloLens is our favorite technology. The applications of this technology range from employee training, to on-site maintenance assistance, to life size 3D modeling of complex parts, and even to entertainment in the form of interactive games. The possibilities are seemingly endless, and that makes it incredibly powerful in transforming businesses for the future. ● ● ●

FACULTY



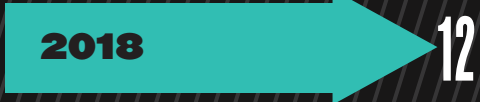
STUDENTS (GA'S & PROJECT)



PROJECTS



GRANTS



BRIDGING INDUSTRY, STUDENTS AND FACULTY.

REVENUE

Gifts

Grants

Operations

Engagement Center

EXPENSE

Project Work



dinggo

ALUMNI FEATURE

"It's a web and mobile application, designed to make picking a movie, a piece of cake!" -Nick

NICK MOLTER
CEO & OWNER, DINGGO
MBA '18, DCMME TVS INTERN

Dinggo is an app that aggregates all of the content from Netflix, Hulu, and Amazon Prime Video, and allows the user to swipe through those options with ease. This app is available for download on the App Store and Google Play.

OUR FUTURE HOLDS AN EXCITING PROMISE WITH EVEN MORE COLLABORATIONS....

Our future goal is to enhance our global reputation for thought leadership in competitive manufacturing. We see a bright future leveraging emerging technology (3D printing, video analytics, IOT, sharing economy) for business success. Accomplishing this goal will require leveraging Krannert's faculty expertise and its students to engage with resources across Purdue, alumni and companies. We have already started along this path by executing successful projects with Krannert and Engineering students in partnership with industry personnel. But with the addition of new programs in collaboration with the Engineering School, and new partnerships with Industrial Design partners, the Dauch Center, will have even more opportunities for hands-on learning and realization of "design thinking."

We will build our footprint in the manufacturing education space. We envision creating a stream of digital assets through blogs, videos, learning modules, and white papers, along with our strong reputation of informative conferences in order to become the centerpiece of digital knowledge within the manufacturing industry.

Thus, we propose to add additional resources to shore up our position as a leading world-class research center in manufacturing. If you are interested in partnering with us, please contact us. Your partnership will permit the Dauch Center to expand our role in providing industry relevant research on manufacturing trends, enhance existing components of the center, while implementing new initiatives in transforming the manufacturing industry with the following initiatives:

- World Class Conferences
- Student Case Competitions
- Scholarships/Fellowships
- Double the size of our Engagement Center in order to enable hands-on opportunities to experience the power of disruptive technologies. 3D printing, video analytics, shared economies and IOT
- Enhance DCMME's digital footprint
- Build new capabilities such as Blockchain
- Significantly increase DCMME's undergraduate student opportunities
- Enhance executive and student company visits and projects
- Increase student scholarships
- Expand our global network links with other centers
- Engage even more interdisciplinary faculty in research and projects



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PURDUE
UNIVERSITY®

DAUCH CENTER FOR THE MANAGEMENT
OF MANUFACTURING ENTERPRISES