Leveraging Universities to Advance Manufacturing Innovation Through the MEP National Network | PHASE 2

EXECUTIVE SUMMARY

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Executive Summary

The National Institute of Standards and Technology's Hollings Manufacturing Extension Partnership (NIST MEP) is interested in exploring how universities can develop and scale partnerships with MEP programs to increase the capacity of small and medium sized manufacturers (SMMs) to adopt technologies that are key for their success in the evolution to Industry 4.0.

Industry 4.0 refers to the fourth industrial revolution—the next phase in the digitization of the manufacturing sector. Industry 4.0 includes a suite of technologies that are disrupting the manufacturing value chain. They include the following:

- Data and connectivity technologies such as cloud computing, blockchain, and sensors;
- Analytics and intelligence technologies such as advanced analytics, machine learning, and artificial intelligence;
- Human-machine interaction such as virtual reality, augmented reality, robotics, and autonomous guided vehicles; and
- Advanced engineering such as additive manufacturing (3D printing) and nanoparticles.

This report provides findings from a pilot project that paired three universities with three MEP Centers. The project aimed to enhance the competitiveness of SMMs and the effectiveness of the MEP National Network in the United States by:

- Identifying and describing innovative and successful examples of collaboration between MEPs and universities with the goal of new technology adoption, particularly of Industry 4.0 technologies, by SMMs.
- Assessing and articulating the factors that contribute to the success of these examples.
- Applying the knowledge of those success factors to build tools and reference materials that can help to scale the successful examples for use by more university-SMM-MEP partnerships.

The pilot project took place from August 2020 to December of 2022. The three project teams were:

- The University of Louisville (UofL) and the Advantage Kentucky Alliance (AKA)
- Northern Illinois University (NIU) and the Illinois Manufacturing Excellence Center (IMEC)
- Ohio University (OU), Ohio MEP Southeast Center, and the Appalachian Ohio Manufacturers' Coalition (AOMC)

Throughout the project, the project team assessed the progress of the partnerships and their work with SMMs through monthly check-ins. The teams gathered once per quarter to share what they were learning from their partnerships and share resources and tools for resolving challenges.

As we gathered information from each of the teams on their pilot project experiences, a set of key points began to emerge as the teams reflected on their experiences, both in the moment and as the project came to an end. Those key points fall into five categories:

- **Set the partnership up for success.** Allow time to develop principles of partnership prior to rushing into the work with manufacturers. This includes identifying what each partner believes will be the drivers and barriers to success.
- **Develop a shared understanding of culture, roles, and responsibilities.** This can be essential to ensuring that the three-way partnership doesn't damage existing relationships and leads to success for the SMM.
- **Identify opportunities to address talent and workforce development issues for the manufacturers.** This is where the missions of universities and MEPs have a natural intersection and can have substantial impact on the success of the manufacturers, the students, and for the regional manufacturing industry overall.
- **Keep the focus on the needs of SMMs.** Although universities and MEPs may have other objectives for the partnership, prioritize the needs of the SMM in the project.
- **Expand the partnership by identifying opportunities to leverage partner assets for greater impact.** Universities have many assets that can be useful to manufacturers and identifying how they might be leveraged for greater impact can lead to rewards for both the university and the MEP.

Partnerships between universities and MEP Centers can effectively accelerate the adoption of Industry 4.0 technologies by SMMs, provided the partnerships are designed and implemented with a focus on the needs and goals of the SMMs. While attending to those needs, keep in mind the following:

1. **Establish principles of partnership.** Partners must acknowledge and accommodate the divergent goals, incentives, and environments of universities, MEPs, and SMMs.
2. **Recognize and attend to the drivers and barriers to successful partnership.** The principles of partnership should address issues such as how staff will be trained, how workflow will be managed, and what communication channels will be used.
3. **Recognize that other partners may have assets to offer the partnership.** Universities are not the only institutions of higher education that can offer SMMs the opportunity to learn about, adapt, and adopt Industry 4.0 technologies.
4. **Keep in mind the broader goal of a manufacturing sector that is efficiently employing Industry 4.0 technologies.** Partnership work should focus not only on

the benefits to the SMM, but also more generally on the opportunity to advance the adoption of appropriate Industry 4.0 tools across the manufacturing industry.

The project team developed a set of tools designed to address some of the partnerships' main challenges and identify opportunities for building the partnership for sustainability. We gathered the tools in a toolkit for use by other MEP/University partnerships. The toolkit is available on the APLU website and includes the following tools:

- The **MEP-IHE PARTNERSHIP ASSESSMENT TOOL** offers existing partnerships between instituions of higher education (IHEs) and MEPs a method for assessing the strength of their existing partnership based on characteristics of effective partnerships.
- The **SETTING GOALS FOR IMPROVING YOUR PARTNERSHIP TOOL** helps partnerships that have identified weaknesses in their current partnership develop a timeline, indicators, and responsibility assignments for improving their current partnership.
- The **FORCE FIELD ANALYSIS TOOL** prompts partnerships to describe a future state, including qualities of the ideal partnership as well as positive outcomes for SMMs, and the drivers and barriers to reaching that future state.
- The **GOAL AND METRICS ALIGNMENT TOOL** prompts participants to identify each partner's goals for the project or partnership.
- The **ENGAGEMENT FUNNEL TOOL** prompts participants to consider issues in choosing partner SMMs.
- The **WORKFORCE NEEDS AND ASSETS TOOL** focuses on the key workforce development needs related to technology adoption.
- The **ASSET AND OPPORTUNITY MAPPING TOOL** prompts partnerships to list both university and MEP assets that can be brought to bear in responding to the "framing question" of "how might we increase the competitiveness of manufacturers in our region by helping them to adopt new technologies?"
- The **FUNDING AND PARTNERSHIP SUSTAINABILITY TOOL** prompts partners to think about potential sources of funding and ongoing revenue that can support the partnership over the long term.

The toolkit also contains links to other resources that assist MEP-IHE partnerships in developing stronger relationships to benefit SMMs.

We suggest that the NIST MEP National Network encourage each MEP Center to use the toolkit that accompanies this report to develop stronger partnerships with regional colleges and universities to the benefit of SMMs and to encourage MEP Centers to share their strategies for cultivating these partnerships. They might also consider offering additional resources to MEPs and their partners to develop and structure these partnerships with a deliverable of a partnership report that includes agreed-to partnership principles and a completed set of tools, including, at a minimum, the **GOAL AND METRICS ALIGNMENT TOOL**,

and the **ENGAGEMENT FUNNEL TOOL**, as described in the toolkit. From our experience, it is very important to put time up front into structuring the partnership prior to launching a project with an SMM.

Finally, the MEP network might consider how it might develop a national partnership network between MEP Centers, community colleges, universities, and workforce boards to ensure that at a regional level, appropriate training on Industry 4.0 technologies is developed and offered to high school students, post-secondary education students, as well as incumbent SMM workers.