Tool Building: Manufacturing Communities Ecosystem Metrics (MCEM) Project Statement

Executive Summary:

There are upwards of 250,000 manufacturers operating in the United States, and each relies on a network of public and private stakeholders: a "manufacturing ecosystem". Manufacturing ecosystem stakeholders seek to maximize the impact and effectiveness of manufacturing (and manufacturing adjacent) investments made in their region. To adopt a more effective strategic approach, develop smarter interventions, and maximize the value added to manufacturing ecosystems and their parent regions as a whole, decision makers need ways to understand the industrial and institutional composition, interactions, and outputs of their manufacturing ecosystem.

Addressing this need, the Manufacturing Community Ecosystem Metrics (MCEM) Tool and Playbook is being developed by AMCC in partnership with NIST MEP and other stakeholders, structured around six key regional systems that comprise a manufacturing ecosystem: Workforce and Training, Research and Innovation, Infrastructure and Site Development, Supply Chain Support, Trade and International Investment, and Operational Improvement and Capital Access. This Tool, once developed, aims to provide actionable information to regional stakeholders to identify and understand critical components, relationships, and interventions within their manufacturing ecosystems. The Playbook will serve a guide on how regional stakeholders can use the Tool.

Fundamentally, this project is an effort to describe, in detail, the major component parts of thriving regional manufacturing communities, and work towards a definition of what constitutes a "thriving" manufacturing ecosystem. Through a co-created, open-source approach, the Tool aims to offer a common language to align diverse stakeholders with varying interests, enabling collective actions that strengthen manufacturing communities.

Recent steps of the project involve organizing efforts around the six designated criteria areas, conducting regional workshops with trial end user groups, and engaging national stakeholders across federal agencies to support the Tool and Playbook development process. The current project team has completed a "beta-protocol" for developing the tool and visualizing information, which the team is working on turning into a functional prototype. The project seeks additional participation from regions and ecosystems, as well as support from designers, researchers, and developers to realize the first version of the Tool.

AMCC's mission is to create and strengthen an alliance of communities with regional economic development initiatives underway dedicated to achieving sustainability through economic growth, improved environmental performance, and inclusive well-paid job creation supporting initiatives to create new opportunities and equity within a revitalized American manufacturing base.As a result of the 2021 American Rescue Plan, the U.S. Department of Commerce's Economic Development Administration recently selected AMCC to continue its work to strengthen the cornerstone of American progress; manufacturing in key industries in regions across the nation.

AMCC and the MCEM Tool team are ready to accelerate progress, and create an increasingly comprehensive and improving self-assessment MCEM Tool and Playbook regions can use across the nation, one that empowers stakeholders with the insight and know-how to produce more predictive outcomes for regional manufacturing ecosystems.

Introduction: The Goals of the MCEM Tool

Manufacturing has a strong and positive ripple effect on local and regional economic development. Recent economic trends, coupled with an influx of federal investments into American manufacturing, have led to a boom in public and private spending on manufacturing across many defense and economically critical industries, especially in place-based initiatives aimed at more strategic deployment of those investments.[1] Based on a consistent feedback from regional manufacturing community consortia leaders and other recent reports[2], public and private stakeholders who make up these regional communities want to build and maintain thriving manufacturing ecosystems that maximize the impact of federal and other manufacturing related investments; thus they need a tool and playbook that can help them elucidate the major component parts, relationships, and interventions that drive success in their regional manufacturing sector.

That is why AMCC, NIST MEP and many other stakeholders have begun this MCEM tool building process organized around 6 key pillars (1. Workforce and Training; 2. Research and Innovation; 3. Infrastructure and Site Development; 4. Supply Chain Support; 5. Trade and International Investment; and 6. Operational Improvement and Capital Access) of a thriving regional manufacturing ecosystem. This future self assessment Tool, accompanied by a set of procedures, analyses and use cases (or "Playbook") on how the Tool can be used, will provide regional stakeholders with better actionable information to align regional stakeholder interests and incentives. The MCEM Tool seeks to enable communities to design and implement interventions that strengthen each pillar of their manufacturing ecosystem, benefiting manufacturers and manufacturing communities as a whole. With use over time and improving open-source data collection and management, the MCEM Tool will not only help each individual community identify, self assess, and leverage their unique assets more productively, it will also likely reveal increasingly better best practices to improve manufacturing ecosystems across the nation.

This Tool will not only be valuable to public and private stakeholders who make up these regional communities[3], but also serve other constituent stakeholders as well as out-of-area domestic manufacturers and suppliers and those providing catalytic interventions like investors and federal government agencies. This project takes inspiration from the US Cluster Mapping project, and will allow for both regional and cluster representations of manufacturing ecosystem activity, where specific nodes of activity define the manufacturing ecosystem cluster. The project looks to partner with and/or leverage federal investments under way in the development of related tools. For example, EDA is helping to develop the Economic Development Capacity Index (EDCI) which brings together 53 indicators across five major capacity areas: Financial, Human Capital, Industry Composition, Infrastructure, Institutions and Partnerships.

Tasks and Objectives: How will the MCEM Tool help stakeholders achieve objectives?

The MCEM Tool will be an online platform that incorporates an evolving, open-access set of open-source metrics for public and private manufacturing community stakeholders. The ongoing tasks involved in developing this tool are outlined below. Tasks 1 and 2 are well-underway, and the MCEM tool seeks additional participation from regions and manufacturing ecosystems, as well as support from designers,

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[1] Such as DOD's DMCSP, EDA's BBBRC, Good Jobs Challenge and Tech Hubs, NSF Engines etc.
[2] AMCC Roadshow visits
[3] manufacturing firms, universities, economic development organizations, amongst others

researchers, and developers to realize the first version of the MCEM Tool. The Tool will also require a Playbook that will help stakeholders use the MCEM Tool to help a wide range of uses.

1. Identify the major ecosystem stakeholders, project activities, and programs (the component parts) within each regional manufacturing ecosystem
2. Identify how best to measure each of those component parts and the ecosystem as a whole
3. Identify gaps in how to measure the component parts and the ecosystem as a whole
4. Identify best practices for producing better measures and target outcomes across manufacturing ecosystems

Following the completion of these tasks and the initial prototype of the tool, the MCEM tool will work with regions to implement the tool and:

5. Identify unique regional assets to leverage, and how to measure the value of such assets.
6. Identify targets and interventions most likely to improve performance of the component parts and the ecosystem as a whole.

The MCEM stakeholder group recently created the chart below to help the project and stakeholders visualize the type of metrics we hope will help regional and other stakeholders measure the strength of their manufacturing ecosystem and improve their interventions.
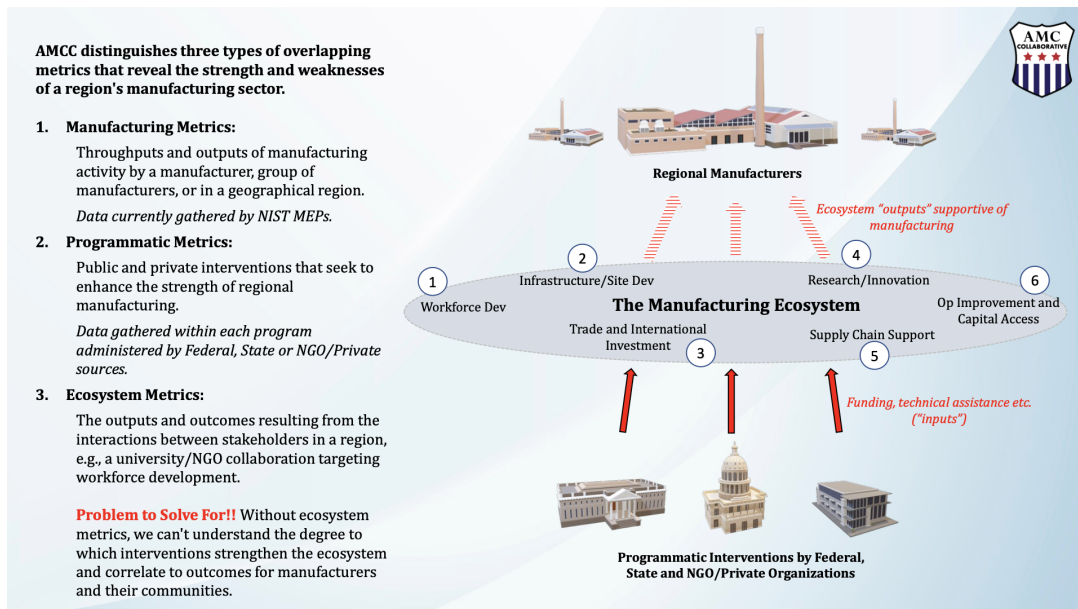

Figure 1: AMCC image identifying the six components of regional manufacturing ecosystem stakeholders and how those components relate to two other overlapping types of metrics.

The success of the American project depends upon its manufacturing cornerstone to be strong and continuously improving. Since our manufacturers' success depends on regional ecosystems of support to thrive, those ecosystem stakeholders and interventions need to be better understood, and measured so that we can form collaborations and interventions that produce increasingly better outcomes.

For more information on the MCEM project and how you and your stakeholders can add value, please contact Matt Bogoshian matt.bogoshian@amccmail.org and Nico Thomas at nico.thomas@nist.gov.

Value Added: How will the MCEM Tool and Playbook add value to existing benchmarking and metric initiatives?

AMCC in collaboration with NIST MEP and other federal actors, has been developing a new, open source [Manufacturing Community Ecosystem Metrics (MCEM) tool](#). The goal for this tool is to allow manufacturing communities the ability to catalog the major stakeholders and interventions in their region, visualize connections, and measure and adapt interventions intended to produce stated sustainable development outcomes along [6 regional manufacturing community ecosystem pillars](#) developed in the IMCP program and used by regions across the country: 1. Workforce and Training; 2. Research and Innovation; 3. Infrastructure and Site Development; 4. Supply Chain Support; 5. Trade and International Investment; and 6. Operational Improvement and Capital Access.

This project seeks to co-create a novel, community based data infrastructure around manufacturing ecosystem health and capacity that can both add value to related efforts and serve as a common language through which manufacturing community stakeholders can align interests and actions. Many ongoing projects provide indicators for regional economic health, such as the Kauffman Foundations Entrepreneurship Index, the US Cluster Mapping Project, Economic Innovation Group's Distressed Communities Index, and the ITIF's New State Economy Index. These existing resources and others like them primarily provide comprehensive assessments of community level economic health that local stakeholders can use to identify regional weaknesses and strengths. Building on this foundation and informed by developments in complex systems science, the MCEM tool seeks to bring together a larger pool of useful public and private open source data within an open-source self-assessment tool that enables manufacturing community stakeholders to better leverage regional assets to build and maintain a thriving manufacturing cluster. The MCEM Tool (once developed) coupled with a Playbook that will serve as a guide for regional self-assessment in using the Tool, will help manufacturing community stakeholders focus their efforts, identify regional collaborators, align incentives across multiple public and private entities, and implement adaptive and dynamic interventions. As manufacturing ecosystems increasingly involve multiple public and private entities (from firms of different sizes, to regional economic development organizations (EDOs,) Manufacturing Extension Partnerships (MEPs), and state governments to name a few), this project seeks to use data and metrics to create a common language that entities with different interests and incentives can use to align activities.

Fundamentally, this project is an effort to describe, in detail, the major component parts of thriving regional manufacturing communities, and work towards a definition of what constitutes a "thriving" manufacturing ecosystem. This project will add value to existing efforts assessing "thriving" or "distressed" communities by helping communities to:

> 1) Identify major components parts of their manufacturing ecosystems;
> 2) Identify the metrics most relevant to strengthen their manufacturing ecosystems; and
> 3) Bridge the gap between descriptive metrics and actionable measures.

Methodology: Task Descriptions

The MCEM group began by organizing its efforts using the [6 designation criteria areas](#) (1. Workforce and Training; 2. Research and Innovation; 3. Infrastructure and Site Development; 4. Supply Chain Support; 5. Trade and International Investment; and 6. Operational Improvement and Capital Access) developed with the National Economic Council as part of a previous Department of Commerce program called the Investing in Manufacturing Communities Partnership (IMCP)[4] program to frame an assessment of what types of metrics and data are available and what metrics and data need to be created. These six criteria areas have proven meaningful for IMCP communities, and those in newer federal programs, to organize their regional development strategies and communicate outcomes resulting from public or private interventions.

Task 1: Identify Core Component Parts of a Manufacturing Ecosystem
In 2023, using the Workforce and Training criteria area of the aforementioned 6 designation criteria areas to establish a proof of concept for use in all 6 criteria areas.This task is informing the project process overall as it seeks to help a few regional stakeholders map the unique sets of institutions, actors, and programs that support manufacturing workforce and training. Through these proof of concepts, the project team is developing methodologies that manufacturing community stakeholders can use to map the key players in their ecosystems leading to a gap analysis that informs their strategic priorities and actions.

Task 2: Develop Case Studies to Communicate the Value of using the Tool
Build case studies of what makes up thriving regional manufacturing ecosystems and benchmark these ecosystems against a) stated state objectives, b) stated regional objectives, c) local stakeholders and their initiatives (including MEP centers, EDO's, workforce boards, etc.), and d) the metrics and measures gathered from Task 1. As with Task 1, the MCEM group has begun helping a few manufacturing community regions map out their unique sets of institutions, actors, and programs that support manufacturing workforce and training. As this Task slowly proceeds, more capacity to accelerate these important case studies will better inform the Tool and Playbook development.

Task 3: Develop Best Practices to Create the Playbook
Synthesize a set of best practices from the results of the first two Tasks to help stakeholders understand the benefits of regional ecosystem collaborations to the nature of successful manufacturing ecosystems and what are best mixes of public and private regional stakeholder collaborations and their program and other interventions   that are most likely to produce regionally determined outcomes. Then, outline a Playbook illustrated with use cases and case studies, where possible, describing how an online MCEM Tool could, once it is created, be continuously used and improved to increase collective impact toward common objectives.

Task 4: Iterate on the Playbook and Seek Additional Funding for a Web-Accessible Tool
Iterate with regions and stakeholders on the Playbook outline developed in Task 3, and build a proposal to attract capacity to create and maintain the MCEM Tool and a set of continuously improving open-source manufacturing community ecosystem metrics.

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[4][Investing in Manufacturing Community Partnerships Archived EDA website](#)

Current Progress and Outcomes:
Task 1:
Because of the unprecedented investments in US manufacturing, it is more important than ever to increase the efficiency and effectiveness of investments in manufacturing communities. This project seeks to develop a consistent and increasingly accurate understanding of what constitutes the best interventions to produce thriving manufacturing communities. In early 2022 to open the conversation with a national set of stakeholders, AMCC and NIST MEP co-convened a number of key public data providing agencies and players to discuss addressing that need. In the meeting we discussed how we build an open source roadmap for providing manufacturing community leaders with a set of useful indicators and metrics they can use right away and improve upon over time.

Here is a link to the attendee list, notes, and recording. [AMCC NIST MEP Discussion on Community Metrics](#) After meeting every other week for over a year, a small set of MCEM stakeholders form AMCC, NIST MEP, DOD, DOE, CREC and others, formulated this definition chart to describe three overlapping sets of metrics to focus the work. Since then, a small group of stakeholders have been meeting biweekly to advance the work. Led by NIST MEP and AMCC, these conversations include key federal agencies. As of August 2023, representatives from DOC's EDA, DOD, NSF, DOL and DOE are frequent attendees as well as the Center for Regional Economic Competitiveness (CREC) and Deloitte's Center for Government Insights. AMCC is working to include other key stakeholders in future discussions and invites other public and private stakeholders to join the effort.

Task 2:
As a part of EDA's support for an expanding national manufacturing community of practice, AMCC has been conducting regional workshops with a few groups of regional manufacturing community stakeholders to better understand the nature of their ecosystems. AMCC convened a hybrid virtual/in-person workshop in January 2023 with Utah's manufacturing community stakeholders. Part of those meetings included the first beta test of the ecosystem mapping method for one of the six criteria to inform the process to be developed for use in all six areas of the MCEM tool. As a result of the workshop focused on the workforce and training criteria area for the test, the Utah Manufacturers Association (UMA) agreed to spearhead data collection on the workforce and training module of the MCEM project for their region. The MCEM project team asked UMA to gather data on the following questions:

1. Who are the stakeholders or groups of stakeholders addressing various manufacturing workforce and training activities and sub-activities in your region?
2. What relevant initiatives and programs are they running?
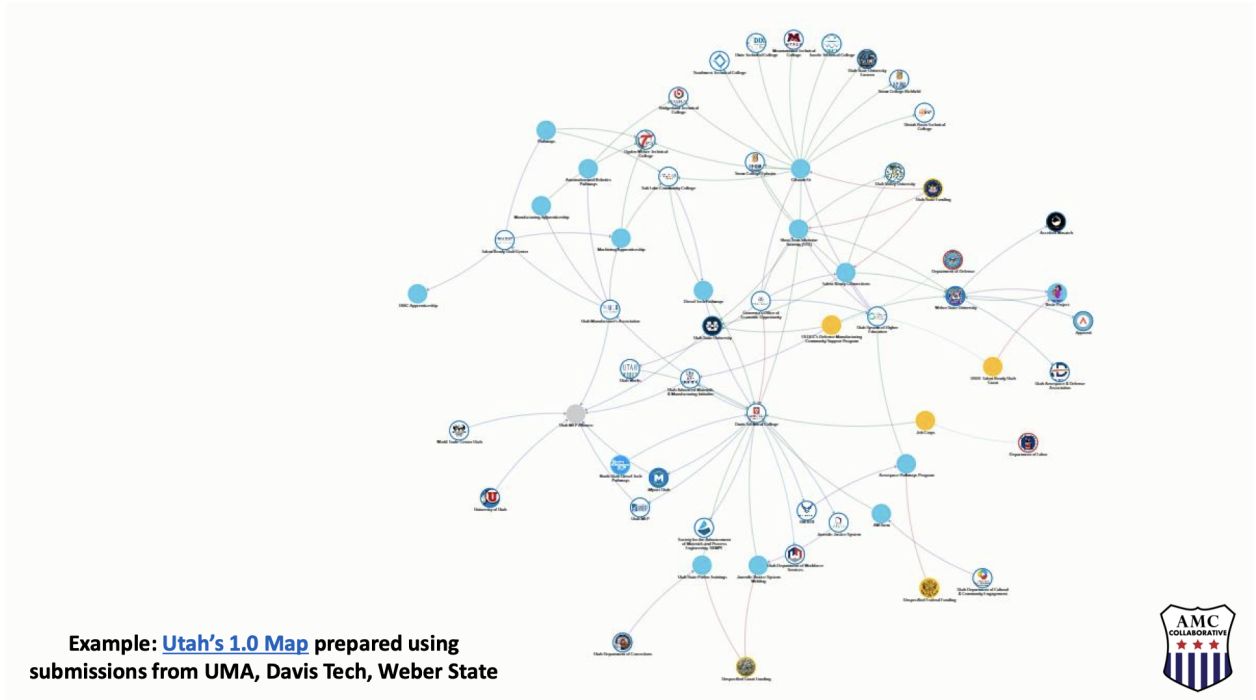3. What key metrics are being used to measure outputs and outcomes?

Figure 2: Version 1.0 of Utah's regional manufacturing workforce and training ecosystem map, identifying the major actors, their connections, and the programs they run. The above interactive Kumu chart is an example of UT's in progress mapping and illustrates a visualization of one initial step of the MCEM tool output for any region.

To complement their efforts, UMA is coordinating with the state of Utah's Department of Workforce Service to gather metrics associated with its regional workforce stakeholders. UMA is also collaborating with higher education representatives from Davis Technical College and Weber State University to identify relevant programs associated with workforce development. On June 1, 2023, AMCC and this working group co-presented activities in a virtual workshop to ~35 Utah stakeholders to demonstrate progress and seek additional participation. The workshop recording can be viewed here.

The workshop was attended by representatives from Utah's workforce ecosystem, including: America Makes, The ARM Institute, Davis Technical College, Granite School District, i5 Service's CONNEX Marketplace, Idaho National Laboratory, Salt Lake Community College, Spectrum Recruiting Solutions, Utah Advanced Materials and Manufacturing Institute, Utah Department of Workforce Services, Utah Governor's Office of Economic Opportunity, Utah Manufacturers Associations, Utah State University's College of Engineering, Utah STEM Action Center, Utah System of Higher Education, and Weber State University.

Using AMCC's regional visits as a conduit for additional beta tests, the MCEM project team is in conversation with stakeholders in Colorado, Connecticut, Illinois, Massachusetts and Mississippi. The project team hopes these regional relationships lead to more tests from various geographic regions that will help the MCEM project team better understand the challenges and complexities that will be required for developing a useful Tool. This initial step for regions to map relevant regional workforce stakeholders and interventions has produced important insights for the regional stakeholders as well as for

the MCEM project team that reveal benefits of applying this assessment step to the other five ecosystem criteria areas. For example, UT stakeholders report that, in collecting the data necessary to map their first and second order workforce partners, they have been spurred to re-engage with other organizations in their workforce ecosystem. Further, trial users have remarked on their prior lack of knowledge that certain programs were available within the early Beta map, reinforcing the project team's hypothesis that the network mapping exercise will stimulate new partnership discoveries and points of collaboration during its construction. Stakeholders in Rhode Island identified increased institutional knowledge as a value of the mapping step in the Tool development process, insofar as the clarity of the mapping exercise helps new hires and other new stakeholders understand the relevant partners and programs operating in their region.

As an example of how the MCEM project has been describing the recommended approach for their regional stakeholder and intervention mapping approach, the following illustrations utilize CT's experience as a 2015 federally designated IMCP community.
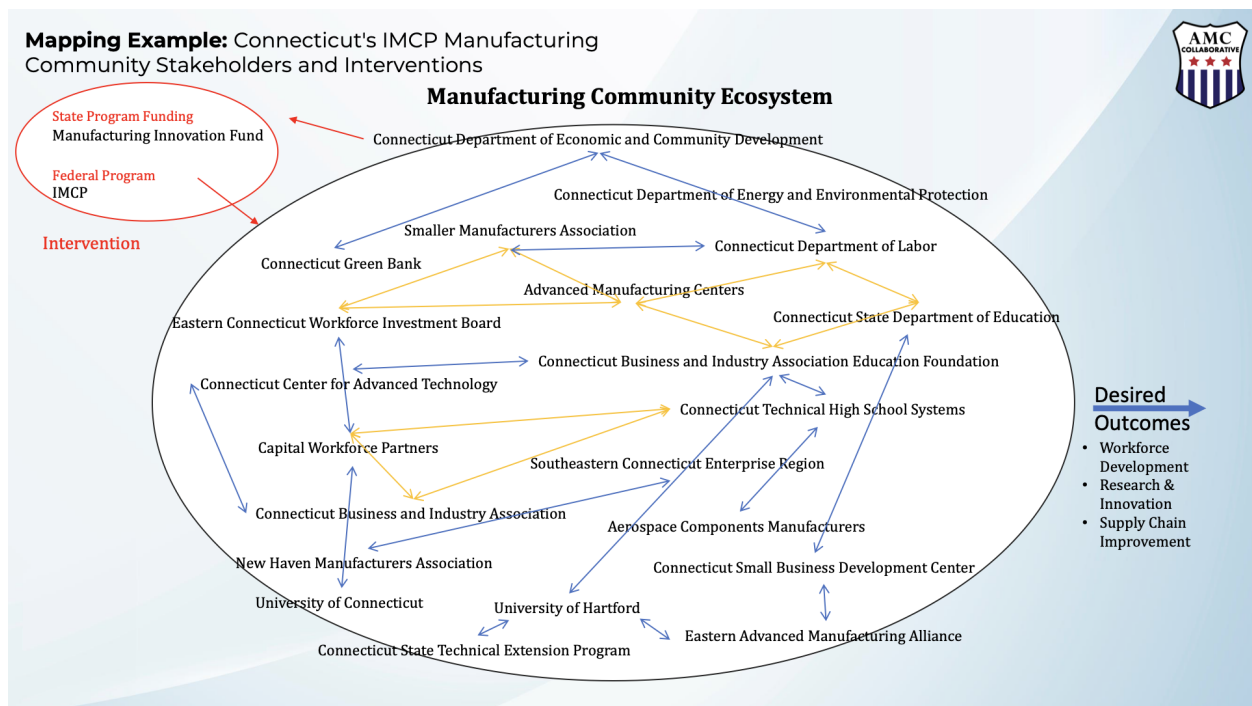

Figure 3: Beta version of Connecticut's manufacturing ecosystem with regards to workforce development; research & innovation; and supply chain improvements. The chart maps both their ecosystem stakeholders and the interventions aimed at improving manufacturing outcomes.The blue and yellow lines do not reflect the full status of regional partnerships, rather serving as a visual representation of partnership "nodes" that have the greatest impact on the capacity of the system to produce desired outcomes.

In conversations with potential beta testers, such as those in UT, AMCC and the MCEM project team has identified early challenges for conducting the beta test to include:

1. Variance in the regions' hierarchy among its consortia of stakeholders;

2. Hesitation by some stakeholders to participate based on past poor experiences with other types of metrics projects;
3. Challenges in transforming a region's pre-existing work and data to inform the MCEM model;
4. Apprehension related to the scope of the project and additional work required to gather the data.
5. Lack of common and available metrics that can form the basis of what is an adequately useful set of regional manufacturing ecosystem metrics, e.g. what are the metrics revealing a strong or weak workforce system within the regional manufacturing ecosystem as a whole?

AMCC and the MCEM project team are working to understand and help solve these challenges and others but pace of progress is slow. More capacity is needed to accelerate testing progress and create an integrated MCEM Tool and Playbook for communities across the nation as soon as possible. AMCC and its partners recognize current capacity challenges to produce a fully realized Tool and Playbook, and are working to identify additional partners and funding sources to support development, completion, and usage. The two most immediate funding needs identified by the project team include 1) support for additional trials to build out the Playbook used by regional stakeholders to map and analyze their manufacturing ecosystem and 2) development of the Tool as an online dashboard and database that can allow stakeholders to collect data, map and analyze their regions virtually. AMCC and its partners invite outreach from prospective funders and partners to participate in the creation of the MCEM Tool and Playbook.

Tasks 3 & 4 (Forthcoming/ To-do): Create a Playbook and Web-Tool

Parallel to the creation of the initial MCEM prototype framework, this project seeks to develop a "Playbook" of actionable ways to get value out of the MCEM tool. To date, the project team is defining the playbook's structure, and how to maximize its flexibility and applicability to add value to manufacturing community stakeholders' assessment needs. The MCEM playbook will contain a workflow detailing how to use the MCEM Tool and framework to self-assess, identify regional assets, compare against past progress and peers, and both design and implement targeted interventions that lead to more predictive outcomes. As the MCEM team gathers data to inform the tool, the project is also seeking collaboration from regions and industries in developing the Playbook. Broadly, the MCEM playbook involves 4 steps: 1) establish an objective; 2) assess regional assets; 3) define areas to improve; 4) design and implement programs. An example MCEM Playbook workflow might resemble:

1) **Establish Broad Objective:** A manufacturing stakeholder sets an objective: e.g. attract manufacturers in target industries (e.g. semiconductors, robotics, pharmaceuticals, batteries) to establish domestic manufacturing operations in region X.
   ○ Performance Metrics:
      ■ # of announced private investments
      ■ % of private investments that are realized

2) **Assess Regional Assets:** The manufacturing stakeholder uses the MCEM tool to understand their region's relative strengths and weaknesses along the 6 regional manufacturing ecosystem pillars: 1. Workforce and Training; 2. Research and Innovation; 3. Infrastructure and Site Development; 4. Supply Chain Support; 5. Trade and International Investment; and 6. Operational Improvement and Capital Access.

- ○ (2a) Gather Relevant Performance Metrics:
  - ■ Key Industries in region
    - (1) Number of establishments
- ○ (2b) Map Notable Regional Assets across 6 Pillars
  - (1) Influential regional actors (e.g. universities, economic development organizations, etc.) and their established inter-ecosystem partnerships
  - (2) Main programs, interventions and initiatives relevant to objective

3) **Define Improvement Area**s: The manufacturing stakeholder uses the MCEM Tool to conduct a gap analysis comparing their regional assets against their goal/objective, or against the activities of peer regions, gathering ideas for ecosystem initiatives that might be effective. The goal of this step is to identify one or two ecosystem pillars that can be improved through a more targeted intervention or program.
   - ○ Gather Relevant Performance Metrics:
     - ■ Benchmark performance against peer regions
     - ■ Program ideas in regions with similar ecosystem structures
     - ■ Program ideas from regions with similar performance but different ecosystem actors

4) **Design and Implement Programs:** Leveraging the full strength of AMCC's national manufacturing community of practice network as well as any other relevant sources, design target programs that leverage regional assets (from step 2) and fill identified gaps (from step 3).
   - ○ Gather Relevant Performance metrics
     - ■ Program design
     - ■ Program dollars

In addition to the above described processes, the project team is also working on a long-term goal of creating an interactive web-based tool that will be hosted open-source as a resource for economic development. The web-based tool, once produced, will shorten the time required for a region to advance through the steps in the Playbook. Similarly, The MCEM Playbook will be most effective when a region has also provided information to the MCEM Online Tool.

The success of the American project depends upon its manufacturing cornerstone to be strong and continuously improving. Since our manufacturers' success depends on regional ecosystems of support to thrive, those ecosystem stakeholders and interventions need to be better understood, and measured so that we can form collaborations and interventions that produce increasingly better outcomes.

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