

To: The White House Office of Science and Technology Policy

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Subject: Response to Notice of Request for Information Document Number 2021-21644

Thank you for the opportunity to provide input on ways to improve government coordination, and on long-term guidance for Federal programs and activities in support of United States manufacturing competitiveness, including: Advanced manufacturing research and development that will create jobs, grow the economy across multiple industrial sectors, strengthen national security, enhance sustainability, contribute to climate change challenges, and improve health care.

The American Manufacturing Communities Collaborative (AMCC) is a national non-profit network formed by volunteers in 2018 from the 24 regional and federally designated manufacturing community stakeholders in the Investing in Manufacturing Communities Partnership initiative that operated from 2013 to 2015. AMCC has built a growing network of active manufacturing communities that help each other perform better and inform decision makers on the merits of creating new designated manufacturing community and related programs like IMCP such as the existing Defense Manufacturing Community Support Program, the Economic Development Administration's ARPA Build Back Better challenge, and the prospective USICA Tech Hub designation program.

What follows are general inputs on ways to improve government coordination, and on long-term guidance for Federal programs and activities in support of United States manufacturing competitiveness. After the general inputs are some additional responses to RFI questions 1-10. Because of resource constraints, these responses are by no means comprehensive.

General Input Item #1: Tether the Strategic Plan to Sustainable Development

A starting point for any National Strategic Plan for Advanced Manufacturing should include a recognition that manufacturing is the cornerstone of not only the economy but, more broadly, of sustainable development in America. Sustainable development is the best normative framework for progress that science has yet to reveal because it includes not only traditional elements of market driven economic progress but also measures of equity and environmental progress as well. An advanced manufacturing strategy untethered to what produces sustainable development more broadly is much more likely to overlook issues of diversity, equity, inclusion, environmental sustainability, and other factors essential to sound integrated decision-making by manufacturing ecosystem stakeholders. The strategic plan should therefore make clear that producing sustainable development in America is the goal, that advanced manufacturing is the cornerstone to reaching that goal, and that better integrated decisions by manufacturing ecosystem stakeholders are an essential means to reaching that goal.

General Input Item #2: Address Regional Incapacities for Sustained Collaborations

As revealed in AMCC's 2021 strategic planning process that brought in stakeholder insights from a broad range of manufacturing ecosystem stakeholders, America needs a stronger and less siloed manufacturing ecosystem that can help our manufacturers, especially in distressed regions, produce critical goods that effectively compete with manufacturers from autocratic nations that force their manufacturers to quickly apply new technologies and pivot to changing economic circumstances. To succeed in this international competition, America's decentralized manufacturing ecosystem decision makers need more help in understanding our complex manufacturing ecosystem, their role in it, and how, by tapping into our diverse resources of people and place, they can make the changes necessary to thrive. That is, we need stable, expanding, vital networks that regularly bring diverse manufacturing stakeholders together to apply the best science, tools, and tactics to bridge gaps toward making and remaking the systemic changes the market driven American manufacturing sector needs.

Since progress in advanced manufacturing must depend upon the collective input and impact of a more diverse and inclusive set of regional players, one area that an advanced manufacturing strategy must address is the overwhelming band-width challenges regional stakeholders have in understanding the range of federal and often state and private interventions that exist so that those interventions can be leveraged to produce more collective impact progress by and for manufacturers than siloed efforts can generate on their own. Regional leaders often lack systems leadership skills necessary to produce sustainable development through advanced manufacturing.

As such, America's advanced manufacturing strategy should call for programs, technical assistance, research, and investments that continuously enable diverse and inclusive advanced manufacturing public and private collaborations. The strategy should harness insights from behavioral science to produce better outcomes for the American people as described in Obama Administration's September 15, 2015 Executive Order. Necessarily, the strategy should include systems leadership training for manufacturing ecosystem stakeholders so that federal agency and other interventions can be integrated more productively at the regional level.

General Input Item #3: Develop and Apply Manufacturing Community Ecosystem Metrics to Better Inform the Efficacy of Interventions

Since 2014, many of AMCC's principals have actively engaged directly with local manufacturing communities through surrogates who formed under the IMCP initiative described here and on the AMCC website. These sources describe AMCC's knowledge of the history, culture, and landscape of member manufacturing community stakeholders, knowledge grounded in the development and use of the 6 IMCP designation criteria crafted with the National Economic Council: the 6 key components of a thriving manufacturing community ecosystem. AMCC's new project with NIST to build a set of peer reviewable manufacturing community ecosystem metrics starting from these 6 key components should be a part of the strategy. The strategy should include putting an initial set of metrics into action in various manufacturing communities across the country and communicating clearly and consistently about the activities so as to create an ever improving set of useable metrics.

Response to Question 1: Which emerging science and technology areas will be key to the next generation of advanced manufacturing for global competitiveness, sustainability, and environmental challenges?

In terms of technology areas we recommend a focus on technologies within the six industrial base sectors identified in Executive Order 14017 100 Day report ; 1) the defense industrial base, 2) public health and biological preparedness industrial base, 3) information and communications technology industrial base, 4) energy sector industrial base, 5) transportation industrial base, and 6) agricultural commodities and food production base.

As to specific physical sciences and technologies within those six industrial base sectors, we recommend that the strategy include the manufacturing technologies identified by each of the Manufacturing USA Institutes.

We also recommend including promising technologies and/or processes that will help address the climate crisis for reducing carbon, methane, and other GHG emissions, especially in key manufacturing industries of cement, steel, energy, agriculture, forestry, chemicals, new and existing buildings, and transportation.

So as to more quickly enable the application of every key advanced manufacturing technology, emerging areas of social science should be included in the strategy. As such, we recommend including elements of complex systems science, such as in the areas of sustainable development, systems leadership, and behavioral science.

Response to Question 2: What should be the near-term and long-term technology development R&D priorities for advanced manufacturing, the anticipated time frame for achieving the objectives, and the metrics in assessing progress toward the objectives?

Because of the overwhelming evidence of national harm, and because of the huge leadership, economic, and sustainable development opportunities, the highest near term and long term technology R&D priorities should be those technologies that address threats of national security, pandemics, and climate change.

In addition to promising R&D technologies in those three areas, the R&D must also include how the successful application of these technologies depends upon collaborations by various stakeholders in the advanced manufacturing ecosystem. Without research on how interventions within the manufacturing ecosystem can more predictably produce key market ready technologies, many efforts to research and develop those technologies will likely not be applied and therefore wasted.

As an example of a source that underscores R&D necessary for national security, we refer to DOD's 2018 report on strengthening the defense industrial base. As an example of a source that can inform

the sound application of scientific R&D necessary for preparing for pandemics we refer to the 2021 working paper Strengthening Manufacturing Innovation Ecosystems Working Paper. That paper, co-authored by Liz Reynolds who is now on the National Economic Council, outlines how investments in Massachusetts' manufacturing ecosystem enabled the state's strong pandemic response. As an example of a source that can inform R&D necessary on climate change, we refer to sources in the Legal Pathways to Deep Decarbonization to include the 2021 National Academy of Science report that identifies key technological goals and R&D necessary to achieve them.

Because of the complexity of these challenges, we need a robust response that taps into the talents of all Americans throughout America. Therefore, every part of the strategy should include actions that increase diversity, equity, and inclusion of people from all races, origins, and backgrounds, with a specific intent to do so in an expanding set of regions across the country.

Response to Question 3: What are examples of technological, market, or business challenges that may best be addressed by public-private partnerships, and are likely to attract both participation and primary funding from industry?

As described in earlier responses, the IMCP/AMCC experience provides many and varied examples of how public private partnerships address manufacturing challenges and attract participation and private funding. The partnerships that tend to have success are those with regional leaders who have some understanding of the complex systems challenges and are communicating those understandings to regional stakeholders in building a coherent strategy with partner outputs that are most likely to produce key regional outcomes.

Successful partnerships most likely to consistently attract participation and funding are those that have enough know-how and capacity to at least do three things: 1) make a written commitment to work together toward measurable objectives that advance sustainable development in a particular manufacturing area, 2) conduct a regional SWOT analysis to inform the crafting of interventions most likely to produce predictable positive outcomes, and 3) form a multi-year plan that partners agree to implement by a date certain. Among many benefits, these kinds of partnerships can serve as an important feedback loop to help inform future federal and other interventions.

The trust among manufacturers and stakeholders in these partnerships is an especially important element in helping the small and medium sized manufacturers adopt new tools and tactics for increased competitiveness.

Response to Question 4: How can Federal agencies and federally funded R&D centers supporting advanced manufacturing R&D facilitate the transfer of research results, intellectual property, and technology into commercialization and manufacturing for the benefit of society and ensure sustainability, national security, and economic security?

The existence of these agency efforts and R&D centers, within the context of a national strategy, must be widely and consistently communicated to the general public and to the networks of regional

stakeholders in each of the mostly siloed 6 IMCP areas referred to above. More robust regional manufacturing ecosystem networks will provide more real time feedback loops as to issues that need a rapid federal response.

Response to Question 5: How would you assess the state of the domestic advanced manufacturing workforce in the U.S? How can Federal agencies and federally funded R&D centers develop, align, and strengthen all levels of advanced manufacturing education, training, and certification programs to ensure a high-quality, equitable, diverse, and inclusive workforce that meets the needs of the sector and drives new advanced manufacturing jobs into the future?

Domestic advanced manufacturing needs to be strengthened to address the key challenges described above. As a part of that, workforce and training is one of the six essential areas that needs to be strengthened for us to have a thriving domestic manufacturing ecosystem. Because multiple federal agency interventions that cover these six essential areas are not integrated at the regional level, regional leaders are often overwhelmed with the complexity and miss opportunities to integrate federal assistance into their activities.

Response to Question 6:How can the Federal government assist in the development of regional public-private partnerships to achieve greater distribution of advanced manufacturing clusters or technology hubs, particularly in underserved regions of the country? What outreach and engagement strategies are most useful in promoting development in underserved regions of the country?

As described above, successful partnerships start by doing at least three things: 1) they make a written commitment to work together toward measurable objectives that advance sustainable development in a particular manufacturing area, 2) they conduct a regional SWOT analysis to inform the crafting of interventions most likely to produce predictable positive outcomes, and 3) they form a multi-year plan that partners agree to implement by a date certain. Among many benefits, these kinds of partnerships can serve as important feedback loops to help inform future federal and other interventions.

Federal government programs like IMCP, DMCSP, the BBB Challenges, and the USICA Tech Hub program need to be adopted and expanded and communicated using understandable metrics that are meaningful to communities, manufacturers, entities within their ecosystem of support, and to peer review researchers.

Response to Question 7:How do we assess the adequacy of the domestic advanced manufacturing supply chain and industrial base? How can Federal agencies assist small and medium sized manufacturing companies to adopt advanced technologies and to develop a robust and resilient manufacturing supply chain? What steps can these agencies take to promote the development and diffusion of technology that augments worker skills (rather than substituting for them), and ensures that manufacturing jobs are good jobs?

The metrics work described above will be a big step forward in being able to assess the adequacy of the domestic advanced manufacturing supply chain and industrial base. Federal agencies can assist small and medium sized manufacturing companies to adopt advanced technologies and to develop a robust and resilient manufacturing supply chain if they become a part of a regional collaborative of manufacturing ecosystem supporters that uses better metrics to prioritize activities. Agencies that create incentives for busy manufacturers to engage will increase the likelihood that technology will augment skills and ensure that jobs are good jobs.

Response to Question 8: Are there useful models (at the international, national, state and/or local level) that should be expanded?

Yes, federal government programs like IMCP, DMCSF, the BBB Challenge, the USICA Tech Hub program need to be adopted, expanded, and communicated using understandable metrics that are meaningful to communities, manufacturers, entities within their ecosystem of support, and to peer review researchers.

Response to Question 9: The current Strategy for American Leadership in Advanced Manufacturing has three top-level goals, each with objectives and priorities: (1) Develop and transition new manufacturing technologies; (2) Educate, train, and connect the manufacturing workforce; and (3) Expand the capabilities of the domestic manufacturing supply chains. Are these goals appropriate for the next 4-5 years? Are there additional top-level goals to consider?

Top level goals should also include:

1. Tether the advanced manufacturing strategic plan to a national sustainable development strategy that includes not only traditional elements of market driven economic progress but also measures of equity and environmental progress.
2. Address regional incapacities for sustained collaborations among stakeholders in all six domains of the manufacturing ecosystem.
3. Develop and apply manufacturing community ecosystem metrics to better inform the efficacy of output interventions most likely to produce strategic outcomes.

Response to Question 10: Is there any additional information related to advanced manufacturing in the United States, not requested above, that you believe should be considered?

One tactical suggestion would be to include manufacturing of critical material into all FEMA preparations and responses so we avoid shortages like those we endured in 2020 at the outset of the pandemic.