

Response to the Request for Information on the National Network of Manufacturing Innovation (NNMI) from Northeast Ohio Partners on the National Additive Manufacturing Innovation Institute (NAMII)

This response to the Request for Information for the National Network of Manufacturing Innovation (NNMI) is from several of the partners in Northeast Ohio who were involved with submission of the successful proposal that resulted in the creation of the National Additive Manufacturing Innovation Institute (NAMII). The organizations involved with or supporting this response include BioDevice Design, Boundary Systems, Case Western Reserve University, JumpStart, Kent State University, Lorain County Community College, M7-Technologies, Manufacturing Advocacy and Growth Network, NorTech, The Ohio Aerospace Institute, RP+M, The Timken Company, the University of Akron, and Youngstown State University. The collaboration of these partners in NAMII is very important to Northeast Ohio. It will add momentum to the efforts to reinvent the regional economy by building off the long history the region has as a strong center of manufacturing in the United States. As such, the following suggestions have been formed drawing on the collective experiences of these partners in the proposal process and in the subsequent development of NAMII following the award.

Broad Agency Announcement (BAA) Process

Use BAA Process as Means to Determine Technical Focus Areas

The determination of which technologies to focus on within NNMI is perhaps the most critical set of decisions. In the case of NAMII, the decision of the technical focus of the institute (additive manufacturing) was determined prior to the BAA process, and this was an effective approach for the first pilot institute. For subsequent institutes, the sponsoring agencies should give strong consideration to using the BAA process as the means to determine which technologies are most appropriate. That is, with the list of technological focus areas identified in the President's Council of Advisors on Science and Technology (PCAST) as a guideline¹, the BAA should call for proposing teams to make their case as to why their team should host an institute (similar to the BAA process for NAMII) and why their proposed technical focus should be a part of NNMI. This approach would more effectively utilize open market and competitive principles to determine which technical areas are most worthy of investment, and it will strengthen the voice of industry in the process.

Develop Alternate Plans to Build NNMI Incrementally

Although full approval and funding would allow for optimal planning and development of the network of institutes, the federal budgeting process may not allow for that eventuality. Therefore, plans should be established that would allow for the development of NNMI whether funding is obtained through full appropriation or through incremental funding. The network

¹http://www.whitehouse.gov/sites/default/files/microsites/ostp/amp_final_report_annex_1_technology_development_july_update.pdf

could be built through incremental funding, using approaches similar to that used to fund NAMII, i.e. drawing on resource streams within existing agency that could be re-programmed. Emphasis on network nodes more aligned to geographic needs for manufacturing, such as industry clusters and/or presence of a substantial manufacturing base, would facilitate such an approach.

Further, a separate approach to the selection of technology focus areas should be based on whether the full network is funded under a single appropriation or whether each institute is funded under incremental appropriations. For example, if full funding is obtained up front for the additional 14 institutes, higher priority might be given to bringing institutes on line that are non-complementary to those already in the network, which would mitigate some of the risk inherent in building the full network. If, on the other hand, funding is secured more incrementally, greater consideration should be given to developing synergies between the new institutes and those already in the network, e.g., bringing an advanced materials institute online next to complement NAMII. This approach would maximize the value that existing institutes can bring to the manufacturing sector and minimize the risk to those institutes in the event that all of the institutes are not funded.

Technologies with Broad Impact

Balance Broad Impact with Technical Focus

The list of technical focus areas identified in the PCAST report is effective in establishing some boundaries on the technical focus of the institutes. The challenge for subsequent institutes will be to strike the right balance between technical focus and broad impact. If the technical focus of the institute is too narrow, impact and interest will be limited. If it is too broad, synergies across partner organizations within the institutes might be limited. As an example, Additive Manufacturing strikes an appropriate balance of these two objectives, but Advanced Materials Design, Synthesis and Process (for example) may be too broad for a single institute. For example, it could be more appropriate to have one institute focused on polymers/plastics with another focused on metals. The sponsoring agencies should give ample consideration to this dimension and develop a template for determining whether the technical focus is too broad or too narrow, and provide guidelines on this dimension in the BAA process.

Use National –Scale Criteria for Selecting Appropriate Technical Focus Areas

The following criteria should be given the highest consideration in selecting the technical focus areas of the institutes:

- The U.S. has strong prospects for long-term competitive advantage in the technical focus area
- The U.S. has a significant strategic interest (e.g., national security, energy independence) in development of associated technologies,

- Federal investment is meaningful and proportionately significant in the context of the applicable fields for the technology (e.g., \$30M investment in a market where \$50B or \$10M of technology development is taking place globally would not be meaningful)
- A market gap is identified (e.g., insufficient investment in corrosion led to the Development of the Corrosion Program at the University of Akron) that can be addressed through federal intervention

Emphasize Cross-cutting Technology-Focused Institutes Rather than Industry-Focused Institutes

The RFI proposes examples of areas that could be the focus of the institutes. These include manufacturing processes, advanced materials, an enabling technology, and an industry sector. Cross-cutting technologies (i.e., manufacturing processes, advanced materials, enabling technologies) that are not tied to any specific industry should be emphasized, rather than industry sectors (e.g., automotive, biomedical). Additive manufacturing, energy storage, nanotechnology, and flexible electronics are also good examples of cross-cutting technologies in that each of these could have significant impact across a variety of industries. An institute focused on specific industry sectors might end up competing with the efforts of existing organizations.

Institute Structure and Governance

Promote Equitable Participation through Tiered Participation Fees

It is very easy for larger players (companies, universities, politically strong organizations) to influence the agenda and structure of an Institute. To maintain vision and fulfill expectations of helping develop a new wave of manufacturers that is not specific to a handful of companies, equitable participation is required. This should be emphasized throughout NNMI, through the availability of various levels of membership, various mechanisms for input, and various opportunities for engagement.

Encourage Independent Third Party Leadership

Having an independent third party engaged to manage the government negotiations and the operations of an institute is a highly valued mechanism to ensuring the vision and goals of the institutes. In the case of the NAMII, the leadership of the National Center for Defense Manufacturing and Machining enabled the team to better negotiate across state-specific political issues, rise above academic competition, and address issues of fairness. It is critically important, however, that such an intermediary operates with integrity and transparency for the good of the institute, rather than building up its own operations and importance at the expense of partners.

Implement Roadmapping as a Core Business Process

The roadmapping process should be a core business process of each institute, and should be standardized for all institutes. The process should include an annual or biannual review. The roadmapping process for any institute should include a look backward at the history of development of the technology focus area. This should include a review of prior technical

developments that may not have been viable economically when initially discovered but could be viable going forward because of different economic circumstances (e.g., change in energy costs).

Facilitate Engagement of other Proposal Teams Post-Award

With the engagement of the submitting team, consideration should be given to sharing information about assets that were included in non-winning proposals with the winning proposal team. Some of these ideas may well be worth incorporating into the institute roadmapping process.

Emphasize Institutes as a National (Rather than Regional) Resource

Feedback was given to the NAMII team that its proposal was strong because it emphasized NAMII as a national resource that would leverage regional strengths, rather than a regional resource with limited national reach. This consideration should be emphasized to proposing teams during the proposal process and should be a key criterion for selection.

Use Competitive Processes to Drive Funding Allocations

To help ensure that the best ideas, partnerships, and solutions are implemented, institutes should build budgets and operations around competitive situations that are peer and industry reviewed. During the development of NAMII, most of the funding was intentionally left unallocated in favor of designing and implementing competitive funding processes after the award. This was done to enable collaboration in the development of new ideas in a way that would not have happened if all institute funding had been earmarked in the proposal.

Develop Systems to Encourage Collaboration across Institutes and Prevent Scope Creep

Management systems should be put into place across the network that will encourage appropriate collaboration between institutes and protect against scope creep of individual institutes.

Establish Common Intellectual Property Policies that Allow Some Flexibility

A set of common intellectual property policies should be established for the network of institutes. These could include policies that ensure that institute-funded intellectual property is made available as widely as possible and that industrial partners are able to benefit from intellectual property developed on their own that is complementary to that developed in partnership with the institute. Also, each institute should be afforded the flexibility to tailor its intellectual property policies to meet the unique needs of the markets in which the technologies are implemented. For example, an institute focused on a specific set of manufacturing processes may need to develop a unique approach for managing trade secrets as well as patentable inventions.

Implement Commercialization and Change Management Capacity

Institutes should make tools and capacity available in the areas of change management and commercialization support, specifically for small and medium sized enterprises (SMEs). They

would be able to realize greater benefit from the institute's technology capabilities if support also were available in these areas.

In regard to support for commercialization, an emphasis on TRL alone as the guiding development process may lead to oversights in several areas of commercialization.

Commercialization can be very challenging for manufacturers and SMEs in particular. Specific challenges include the development and execution of appropriate pricing strategies, market and competitive analysis, and costing analysis. For these reasons, the TRL framework should be complemented with other tools to ensure that these challenges are addressed. MRL tools are an example of potentially complementary capabilities that could be helpful.

With respect to change management, firms of all types and sizes often struggle with finding an appropriate balance between executing on their current business and developing their future business. Tools and capacity should be made available through the institute that can assist SMEs in this area.

Manufacturing Extension Partnership (MEP) centers and affiliates and other resources with similar capabilities could be helpful in delivering services that address needs for commercialization support and change management.

Encourage/Invite Involvement of Manufacturing Extension Partnership Centers and Affiliates
Engagement of SMEs should be emphasized as an important goal for each of the institutes. The Manufacturing Extension Partnership (MEP) centers and affiliates can play a prominent role in helping achieve this. In leveraging MEP capabilities, institute leadership should ensure that the staffing and resources of the MEP organizations are consistent with the requirements and expectations of the institutes. In the event that the MEP's are not sufficiently staffed or resourced, they should advocate for additional support through the institute's budget or other resources such as NIST.

Engage Traditional and Non-traditional Innovators through Entrepreneurial Ecosystems
Institutes should make organizations that comprise their local entrepreneurial ecosystems (e.g. incubators, accelerators, and other economic development organizations focused on supporting entrepreneurs) an integral part of the ecosystem of the institute. These organizations can engage non-traditional innovators, i.e. those that are not currently involved in the targeted focus area of the institute but who could benefit from or contribute to the ecosystem of the institute. They also can provide assistance to current and would-be entrepreneurs that are directly involved in the focus area.

Strategies for Sustainable Institute Operations

Leverage Government/Economic Development for Seed Funding

Federal, state, and local economic development authorities could provide complementary financial resources such as start-up or seed funds for the institutes. Each institute should be given aggressive targets for developing a sustainable financial model that is not overly dependent upon these agencies for financial support for ongoing operations. Continuing engagement and support from local and state government agencies, financial and otherwise, is strongly encouraged in order to ensure alignment with local interest, policies, and regulations.

Use Membership Fees as a Revenue Source

A tiered approach to membership is recommended as a potentially effective strategy for achieving financial sustainability. The number of memberships is a good indicator of customer value creation. If the institute is adding sufficient value, the attraction and maintenance of members should follow; if it is not, then membership levels will suffer. Tiered membership levels should be offered that provide value commensurate with the contributions to the institute and with the ability to pay.

Use of Success Fees/Royalties with SME

SMEs often are risk averse. Accordingly, requiring an up-front cash match from them may be a disincentive to their engagement. Any institute should consider the option for the SMEs to contract for success fees or royalties (in lieu of membership fees and/or match requirements on projects), to be paid by the SME contingent upon their achieving performance-based milestone(s).

Education and Workforce Development

Embed Education and Workforce Development in Institute Processes and Organization

All institutes should embed workforce training and development opportunities as central goals. These goals should include both should be a focus on incumbent worker training and on development of the future workforce, including K-12, community colleges, universities and trade schools. A significant theme of this training and education should be on experiential learning where students and workers get hands-on experience to complement their classroom learning.

Support National Marketing Campaign focused on Promoting Diverse Careers in The Business of Manufacturing

NNMI should develop and support a national marketing campaign that promotes Science Technology, Engineering and Math (STEM) education as a pathway to a variety of career options, including many in the business of manufacturing, whether in disciplines traditionally associated with manufacturing (e.g., engineering, operations) or in non-traditional disciplines such as accounting, humanities, and social sciences.

Support STEM Education and Hands-On Experiences for Youth

All institutes should support STEM education in their regions, whether directly or indirectly related to the manufacturing technologies and that they consider sponsoring "hands-on" activities for youth that promote the value of "making things" for example at workshops at places like Home Depot or Lowes. Also, content/curricula developed by NAMII could be made available for education and outreach programs executed by partners such as programs during the national engineers' week (<http://www.eweek.org/EngineersWeek/EngineersWeek.aspx>).

Conclusion

The Northeast Ohio partners in NAMII appreciate the opportunity to share these suggestions with the NNMI. They will be glad to respond to any questions or requests for more specific information.