ANNEX 25

NATIONAL NETWORK FOR MANUCTURING INNOVATION:

Overview

Background

In order to develop the steps to operationalize the activities outlined by AMP 1.0, the NNMI Working Group has engaged stakeholders on all levels in informal settings and in more formal dialog. These proposed recommendations include and consider these suggestions, as well as reinforce many of the activities currently being undertaken by the Advanced Manufacturing National Program Office (AMNPO).

Scope of Work

We have conducted one-on-one discussions, group discussions, have engaged stakeholders at AMP Regional Meetings, have reached out to existing Institutes as well as other AMP Working Groups and have invited external participation in our deliberations. We have also considered the input of experts who have generously offered their insights as well as the previous work product from within and outside of the Administration.

Key Findings

In order to help ensure existing and near term Institutes have what they need to be successful, we have focused on fundamental concepts and recommendations that will position the NNMI to realize its full potential in supporting/growing U.S. manufacturing, innovation, and the supply chain, ultimately growing regional economies and creating jobs. We have captured our recommendations in six Letter Reports that address the following areas which we believe are keys to the NNMI's success:

1. Internal and External Communications
2. The NNMI Narrative
3. Network Governance & Operations - Key Considerations
4. Network Governance & Operations – Organization & Structure
5. Intellectual Property
6. Technology Area Identification

Recommendations

For details on the recommendations, please refer to the above mentioned Letter Reports (following). A brief description of what is included in each Letter Report is as follows:

1. ***Internal & External Communications***: The focus is to provide guidance on how to better ensure individual Institute effectiveness and operations as well as overall Network effectiveness by increasing the stakeholder's ability to leverage the network model. Recommendations include mechanisms to help to provide consistent messaging on the value of the NNMI, a communications plan, and assistance with both internal and external communication processes.

2. ***Narrative***: The Narrative is intended to provide context for the NNMI and to provide an organized flow of main talking points to help communicate the value proposition. The Narrative is a general messaging guideline to better ensure consistent messaging and clarity with regard to the value of the NNMI to stakeholders and ultimately build participation and support.

3. ***Governance & Network Operations – Key Considerations***: In developing the governance and operational structure of the Network, there were several important considerations that warranted attention. Prime considerations included:
   - The Benefits of the Network – the value of the Network to the Institutes and external stakeholders;
   - Diversity – ensuring that all perspectives are represented so as to ensure the needs of all stakeholders are met as intended;
   - Balancing Network Consistency with Institute Autonomy – ensuring that institutes have the autonomy required to meet their individual charges while allowing for a reasonable level of consistency in operational protocols throughout the network, thereby leveraging the collective strength and streamlining operations;
   - What the Network is…and Isn't – helping to clarify the roles of the Network and set expectations;
   - Workforce Development – ensuring that the NNMI is leveraged to better ensure education is demand driven;
   - Metrics – providing general guidance on how to develop proper metrics;
   - Leveraging the Manufacturing Extension Partnership (MEP) – helping to ensure that the MEP becomes a major "tool in the NNMI toolbox";
   - Network Expansion – Provide general guidance and suggestions on how to promote greater collaboration.

4. ***Governance & Network Operations – Organization & Structure***: A key to ensuring that the NNMI (Network) remains connected to those it is intended to serve and meets its intended purpose is to institutionalize a structure that includes representatives from all stakeholders in its governance and in various advisory groups. The proposed structure provides guidance on how to strike a balance between industry, government and academia and ensure all perspectives "have a seat at the table."

5. ***Intellectual Property Management***: In addition to providing a summary of key best practices, the Letter Report on this topic provides general guidance on how to best manage IP so as to promote collaboration and best facilitate innovation within the NNMI setting.

Recommendations address issues related to areas such as Background IP, Data Rights, Publications, Government Rights and Revenue Models.

6. ***Technology Area Identification***: Rather than debate various technology areas that may make sense to pursue at this time, the approach outlined herein is to provide guidance on how to choose technology areas to pursue via the NNMI at any time in the future. This complements the approach and findings of AMP2.0 Working Team 1, which described a process of manufacturing technology area prioritization in Appendix 1 of the full report. Included in Annex 31 is a series of questions intended to help identify where investments should be made via Institute technology focus areas. Key considerations in developing these questions include ensuring that:
   - The process is outcome driven;
   - The investment will engage a diverse landscape of stakeholders;
   - There is reasonable evidence that the proposal has the potential to generate economic value, such that the technology has a path to commercialization, will attract investment, will advance national security and help to sustain competitiveness;
   - The required supply chain either exists or can be developed (includes considerations on how to grow the required supply chain);
   - That the necessary workforce exists or can be developed.

ANNEX 26

NATIONAL NETWORK FOR MANUCTURING INNOVATION:

Internal and External Communications

Background

The NNMI is intended to be a tool that will provide U.S. manufacturing with a competitive advantage when it comes to leveraging our national collective strength to innovate. The goal of the **Communication Process** is two-fold: (1) to improve operational effectiveness and ensure the continuous improvement of the individual NNMI institutes and the Network as a whole and (2) communicate the value proposition of the NNMI, thereby engaging new members and leveraging the Network's collective strength. A key attribute of the NNMI needs to be its ease of use; it must provide connectivity and a vehicle to collaborate that would otherwise be hard to obtain. The communications process, in its entirety, helps to ensure that the Network functions as intended, and that it becomes widely known as a preferred collaborative platform to more easily and cost effectively innovate.

The communication process is an all-important tool to ensure that operational performance is maximized through a continuous improvement process that is linked to the needs of the "Manufacturing Community" as defined in the narrative below. "Operational performance" should not be construed as the effectiveness of only the individual centers, but rather each center's individual effectiveness as well as part of the network as a whole. One of the key attributes of the NNMI that makes it stand out from typical regional hub collaborations is that the regional centers are linked through a national network. Fully leveraging this Network and providing mechanisms for the manufacturing community to take advantage of the Network as a combined, national asset is imperative.

It is also important to ensure alignment between what is communicated externally by stakeholders and the greater manufacturing community and what is actually happening operationally with the Network and individual institutes, as well as future potential centers at lower and higher stages of manufacturing technology readiness. As the public learns about the NNMI and expectations are formed, it is important that the Network is actually developing and performing as intended…and as communicated. This is particularly important in the initial stages of NNMI development; it is at this time that the "light of scrutiny shines brightest" and the eyes of the public and manufacturing community are most focused on whether the NNMI is meeting its expectations. Simply put, when any new initiative is launched, one does not have a "second chance to make a first impression," and recovering from a perception of being misled from the onset is very difficult to overcome.

In order to best ensure that operational performance is what it should be within the centers and the network, communicate the value proposition of the NNMI and to appropriately set external expectations, our evaluation and subsequent proposals are grouped into two succinctly different but interrelated areas: internal and external communications.

Internal Communications

The internal communication process is intended to simplify the connectivity required to ensure that individual centers, as well as the Network as a whole, are operating as intended. Regular, focused communication should not detract from center operations while providing:

1. That each applicant, to become a center (and all participants in the collaborative application), fully understands their responsibilities as related to communication from the onset, beginning with their initial application/submission;
2. A more formal mechanism or framework to communicate and continually improve, leveraging the collective strength of the centers;
3. A vehicle for centers to reflect on their performance as related to activities aligned with and leveraging the strength of the Network;
4. Information that can be used in the development of the metrics required to evaluate the overall effectiveness of each center.

It is important to recognize the need to ensure that a recommended communications process is not too cumbersome or time consuming and doesn't detract from the time needed by the NNMI institutes to focus on their main deliverables. This is especially important in the agency funded NNMI institutes where agencies have a large investment and specific deliverables which need to be met that are aligned with their more focused missions.

The recommended internal communications process is not intended to cover in detail all aspects of communication within the institutes and Network, but rather a simple yet formal umbrella structure that will ensure that the NNMI participants focus dedicated time on a regular basis toward four primary areas:

1. Each institute's individual effectiveness;
2. How federal agency-funded institutes and non-agency funded institutes can support/leverage each other;
3. Each institute's effectiveness as part of/a contributor to the Network;
4. The effectiveness of the Network functioning as a whole.

Analysis of past and current effective practices, areas of opportunity and improvement, how to better leverage the Network to meet the needs of the manufacturing community and regularly sharing thoughts and experiences between institutes will ensure that the NNMI stays on its intended course as designed and maximize its ability to continuously improve. In addition, measuring the effectiveness of the institutes requires an ability to gauge their performance as related to the entire Network; this communications process lends itself well to providing data and information to be used in the development of performance metrics and subsequent center evaluation processes.

Individual Institute Effectiveness - Improving Institute Operations

Institute "Diaries"

Capturing operational best practices, incremental improvements, and areas of opportunity/needed change is an important part of the growth cycle. In any fledgling operation or start-up, limited staff, training and development, budgetary constraints, etc., often means that every waking hour is focused on "bailing the boat". Some are better at capturing what is working and what is not, essentially taking the time to reflect each day and keep an institute "diary" than others.

Formalizing a process to collect this valuable data in real time is an important part of the improvement process. It is important to note that this process should not be cumbersome; it should be simple, user friendly, and standardized so that there is consistency between Institutes. The process may manifest itself as a very brief daily or weekly on-line summary categorized into three basic areas:

1. Institute operations: weekly learnings (what works well/needed improvements);
2. Interactions with other institutes/the Network (how the center has interacted with other institutes/leveraged the Network);
3. Forward thinking recommendations to improve the Network operations as a whole;
4. Contributing to the Network's "clearing house" of activities, so all members can see what is going on within the Network and institutes at all times (drives more collaboration and promotes the greater value of Network/membership);
5. Cataloging "wins"…especially early wins, to share with the greater manufacturing community and general public.

It is proposed that a simple, standardized reporting mechanism (e-form) be developed by the Institutes via a Network facilitated process on a Network-wide call so as to ensure user friendliness. These reports should be made available in real time for each Institutes to see via a Network website with access limited to the institutes/Network participants and others who are deemed appropriate. The AMNPO-hosted "Manufacturing Portal" (www.manufacturing.gov) provides a vehicle to meet Network needs; however, it is recommended that the portal be evaluated on a regular basis by the users to ensure that it is user friendly and best meets the needs of the Network and its institutes.

Monthly Network Calls

In order to learn from the experiences of each institute and leverage the collective strength of the Network to improve overall operations and ensure activities best meet the needs of the manufacturing community, there should be monthly Network-wide calls between all institute directors, key operational staff, and the "Central Office" as defined below. These calls should be structured and focused on individual institute operations and include the following agenda items:

1. A brief report out from each institute to include:
   a. What has worked well;
   b. What institutes would recommend changing (for new institutes, this includes the application process and initial activities associated with start-up);
   c. General discussions on institute operational issues and communication
   d. More forward thinking opportunities/recommendations for change

In summary, these monthly calls should be focused on quick report outs and information sharing between institutes, providing regularly scheduled time for the directors to share their thoughts with each other to assist them with the operational aspects of their institutes. Think of it as a "support group" for institute directors, with street level, frank, discussions intended to leverage the collective experiences of the institutes to improve their operations and the operation of the Network.

Network Effectiveness – Improving Institute Effectiveness as a Contributor To/In Leveraging the Network

<u>Quarterly Meetings</u>

While the monthly calls are focused on institute operations, it is equally important to focus on growing and fully leveraging the Network asset. Without dedicating time to think about how to maximize the potential of the national Network, it is too easy for individual institutes to focus on their daily operations and meeting the daily challenges they face, as they should. As is the case with maximizing the effectiveness of any organization, time taken away from daily "fire fights" to focus on how to improve more global capabilities and better leverage the larger collective will pay future dividends greater than the initial investment in time.

In order to ensure that the Network's institutes take time on a regular basis to discuss their activities in the context of the Network and to focus on how to best utilize the Network structure, there should be quarterly meetings/calls dedicated to Network related discussions. Like the monthly calls, these meetings should include all institute directors and key operational staff, as well as officials from the Advanced Manufacturing National Program Office assigned to assist with the NNMI (if there is an independent "Central Office," they should be included). These meetings should be hosted by the institutes on location, rotated between institutes, and include the following agenda items:

1. A brief report out from each NNMI institute to include:
   a. How each institute has leveraged the Network
   b. How the Network has helped with regard to the institute's more focused mission;
2. How to improve Network operation/functions
3. Open discussion on how to better leverage the Network and use it to encourage greater participation from the manufacturing community (how to increase participation through greater Network access, etc.)
4. How to improve Network communication and interaction between institutes
5. General recommendations on how to improve the Network structure so it best meets the needs of the manufacturing community
6. How to develop and fully leverage the Network web portal (manufacturing.gov)

In addition, the Network's "Central Office" should host and facilitate calls between Network members every six months. This will provide a vehicle for member companies to learn about the greater Network's activities, discuss concerns and areas of opportunity…and in general provide an added benefit of Network membership by offering a method to increase transparency and collaboration in a way that would otherwise be difficult.

<u>Annual Reports – Transparency</u>

In order to best ensure institutes remain focused on the effectiveness of not only their individual operations but the Network as a whole and that their activities remain aligned with the needs of the manufacturing community, there needs to be some level of accountability and transparency. In

order to ensure that institutes remain cognizant of the overall goal of providing a national network of manufacturing innovation as a collaborative platform to meet the needs of the supply chain, providing an annual report with a consistent format is recommended. It is suggested that this report be made available to the Network and its members (based on level of membership) via the Network portal and include, but not be limited to, the following information in a templated format summarizing activities including:

a. Clients served;
b. Membership numbers (and levels);
c. Advancements made (general summaries that can be publically shared);
d. How the institute has contributed to/interacted with/leveraged the Network;
e. General status of institute performance against projections;
f. Sustainability trajectory;
g. How the institute has interacted with education and provided opportunities for experiential learning,

In addition and in order to drive continuous improvement, the "Central Office" should develop consistent metrics to evaluate the effectiveness of each institute, the Network as a whole and gauge member satisfaction.

Central Office

In order to ensure that 1) the necessary communication takes place that is required to maximize performance and 2) the institutes interact as a/leverage the Network to best meet the needs of the manufacturing community as designed, a central manufacturing office should be established. It is recommended that this office has the role of Network administration (including operation and maintenance of the Network portal), facilitation, performance tracking to ensure consistency, continuity and effectiveness of the institutes/Network, etc. While it could work under other offices within the Department of Commerce or the National Economic Council, it is recommended that a "Central Office" be housed within the Advanced Manufacturing National Program Office with a primary focus dedicated to this purpose.

Communications/IT and Organizational Development Support

Dedicated expertise in communications, information technology (IT) and organizational development (OD) should be established within the "Central Office."   If the "Central Office" is created within AMNPO, then the most logical construct would be to create a "Director of Communications" role to support the NNMI and its institutes (see "Additional Communications Assistance" below for more detail). In addition to the more detailed explanation of the role provided below, this person would be responsible for facilitating communications between institutes and government agencies, better ensuring alignment and full utilization of all assets. Agencies need to know what the Network brings to the table and the need to take full advantage of the assets it provides, and the Network/institute's need to better understand the needs of the Agencies and how they may leverage them as well.

In order to ensure that IT capabilities are fully leveraged, a person with required expertise should also be employed. A primary responsibility would be to ensure that the Network's site (manufacturing.gov, or whatever is ultimately used as the Network's main communication portal) serves as both an internal and external communications tool, is user friendly and is continually improved based on the feedback of the stakeholders. If the Communications Director has the needed expertise in IT, it may be possible to have her or him cover both roles.

Given the need to stand up the institutes and Network in a manner so as to ensure effectiveness from the onset, an organizational development expert should be employed. The person filling the role should not only be an OD expert (expert in theory), but also have practical experience in a manufacturing environment. This applied skill will be important in interacting with individuals and teams who are engineers and from the manufacturing community. One will not be effective unless she or he "speaks the language" and understands the needs of the stakeholders.

External Communications

<u>Introduction</u>

In order to ensure broader alignment with the manufacturing community nationwide, it is recommended that various advisory boards be established and made up of individuals from organizations that represent segments of the manufacturing community (see the NNMI Annex 29 on "Governance & Network Operation – Organization and Structure"). These would include representatives from groups such as manufacturing and supply chain associations, all levels of education, economic development entities, regional manufacturing collaboratives and support groups, etc. It is important to have a vehicle to ensure that the Network is meeting the needs of the broader manufacturing community and remains true to its original intent. It is equally important that all stakeholders are aligned and leveraged in the communication process to ensure timely delivery of consistent messaging and direction as well as ensuring input from all stakeholders can be efficiently channeled, considered and help to continually improve the Network. In addition, by institutionalizing this communication process, the model will ensure that the three primary stakeholder groups, industry, academia and government, are fully engaged in an ongoing two-way communication process, which lends itself well to an informed governance body.

Organizations/associations with connections to or which represent broader manufacturing sectors (and various levels) and those who provide unique assets and connectivity to the manufacturing community should be considered. These organizations should be part of the internal and external communication processes, be leveraged in Network operations, be engaged on an advisory capacity and potentially as representatives on the Network governance board. These organizations are valuable tools in helping the manufacturing community to understand that the institutes are not self-interested when speaking about the value of the NNMI.   It is important to help the manufacturing community realize that what may seem like self-promotion on the part of the institutes is in fact the voice of expertise speaking about the true value of the NNMI…and that

the more industry, academia and government agencies utilize and participate in the Network, the more effective it will be.

<u>Using the Membership Structure to Increase Network Participation and Enhance Communication</u>

In addition to providing a vehicle to grow participation, a Network membership structure can be used as a tool to enhance the communication process. It may seem obvious that making the benefits of much broader connectivity to the national Network, its regional institutes and greater membership base will drive membership growth; however, it isn't that simple. As is the case in marketing anything, many times it takes providing incentives to make the target take a closer look before they are able to understand the full benefit of the product or offering. An additional level of membership that provides greater visibility in the Network's activities and information on benefits seems to be a viable approach.

It is recommended that the membership structure include incentives for broader participation in the Network and a means to encourage leveraging the entire network as well as individual institutes. It is understood that stakeholders within a region or industry sector are more likely to invest time and capital in institute activities that they see as more closely aligned with their business priorities; however we have found through discussions with the manufacturing community that there is not a good understanding of what the Network as a whole can really offer. While manufacturers and supply chain participants may be vigilant and know obvious connections between individual institute activities and their priorities, they "don't know what they don't know." If the NNMI Network were to be able to more efficiently and effectively communicate the overall value of the Network and broader, individual institute activities…and provide transparency and easy access to the national Network as a whole, members/potential members may learn that there are other benefits and activities which may offer an advantage*. It is worth noting that it has been repeatedly mentioned by stakeholders that they see a benefit in making connections that they may not otherwise easily make…or even know they should be attempting to make.*

A tiered membership that encourages broader participation and involvement in some degree with the national Network is recommended. While some may argue that all memberships should include some level of Network-wide access, a more cost effective, individual membership may continue to make sense for some and serve a purpose to get participants "in the door," at which time they can learn about the NNMI and the greater benefits of a Network level membership.

Membership may include levels that range from basic, project-based memberships at individual institutes ("plug and play" for a given purpose and duration), individual institute memberships with more general access, higher level memberships with much broader access, "tag along" memberships where larger companies can invite supply chain partners to participate at no cost to them (or cost share), and a more general, broad Network level membership which would a more broad membership that would provide a vehicle for entities to have visibility into Network wide activities, more general trends and development in the supply chain, including MEP activities. This

Network membership could be used as a vehicle to build greater collaboration and encourage more Institute memberships.

An additional consideration is that a balance needs to be struck between the level of transparency that exists externally vs. the exclusive ability of members to access information. The more that can be shared with the general public, the more the general public and more specifically, the manufacturing community, will be inclined to participate; the more existing members feel that they have access to information that others outside of the Network do not have access to, the greater value they will see in membership. A balance needs to be struck between these diametrically opposed perspectives.

In addition, there should be a separate membership for educational institutions to become involved in the Network. One of the benefits of the NNMI is to enhance capabilities when it comes to experiential learning and to better ensure that education is demand driven. The institutes provide unique opportunities for all levels and types of learning opportunities and a vehicle to engage students from all levels. In order to maximize this potential, the Network needs to more formally engage education. An education membership may include various opportunities: experiential opportunities for individual school districts to become exposed to today's manufacturing and for younger students to become more excited about careers in manufacturing; trade school and community college memberships could be focused more on adults and veterans; and university memberships that are designed for more focused, advanced learning and R&D. In addition, educational collaborations could be promoted through the use of a separate membership specifically for education coalitions that encourage all levels of education to work together with the supply chain to develop joint programs that address the needs of a broad population and consider the entire educational continuum and various career pathways.

External Communications Components

In order to fully leverage the NNMI concept and maximize the potential of the Network, it is imperative that all stakeholders understand the workings of the model and the value proposition…on their terms. Ensuring that the NNMI is aligned with and meets the needs of manufacturers and the supply chain is only half of the battle; it has to be communicated in a way such that they can easily understand both the "what" and "how" of NNMI activities. Communicating the value proposition is the only way to build participation and support from the greater community.

In order to accomplish this goal, the process was divided up into three components:

1. The Narrative;
2. The Communication Plan, and;
3. The Execution Strategy.

The narrative is intended to help ensure more consistent description of the value proposition to various stakeholders by providing an over-arching message as a guide for various discussions, allowing the messenger to pull from it and tailor her or his message for a particular audience. The

communication plan is simply an organized, reasoned method to deliver the narrative, and the execution strategy provides a means to actual implementation of the communication plan.

The Communication Plan

<u>Influence Mapping</u>

In order to effectively disseminate the narrative and best communicate the value proposition to the manufacturing community, it is proposed to use a multi-pronged approach. This approach identifies targets within the greater manufacturing community and general public based on their ability to influence, priorities targets and their ability to influence them, as well as ease of delivery ("low hanging fruit"), and by engaging "influencers" from various levels and spheres who are identified via regional influence mapping exercises. These "influencers" include respected individuals who are thought leaders, industry representatives and analysts, academics, and government officials, etc., from national, regional and local levels, who could be effective in delivering the NNMI message . Groups representing and interacting with the manufacturing community should also be identified and considered in delivering the Narrative. These groups of influencers may include industry associations, economic development entities, MEPs, educational institutions, etc. Once the influencers from each sphere and level of influence are identified, determining whether they are already supportive, would most likely be supportive, may not be supportive at this time or are "nay sayers," is the next step. This will help to determine the priority of the target based on the need for them to better understand the value of the NNMI, and the amount of time/resources that will have to be invested to engage or convert them.

<u>*Identifying Targets*</u>

It is important to develop a strategic, comprehensive approach to disseminate the narrative and communicate the value of the NNMI to those whose influence may help to advance the Network. Congressional support, private sector participation and Agency collaboration are all examples of what is required for the NNMI to reach its full potential. Targets should be identified based on their value in building support. Entities or individuals who have more control over potential support or membership either directly (responsible for decisions) or indirectly (as influencers) should be prioritized as targets based on their level of importance or influence. These targets should be identified by those involved currently on the regional, state and national level. This method, however should give way to more of an organized approach as individual Institutes are brought online. As the Network grows, each Institute and their regional stakeholders should go through an influence mapping exercise to determine who potential targets are from their perspective.

<u>Message Delivery</u>

The value of the NNMI will be communicated by the dissemination of the Narrative throughout the manufacturing community, which includes government agencies. Once the influencers and target audiences have been identified and prioritized, an evaluation of how best to communicate the Narrative needs to be undertaken, taking into consideration how each target is most effectively motivated and then employing the use of the Narrative to best articulate the value of the NNMI (as a

Network) to that specific target. Determining who is best to influence a specific target is the first step, after which the delivery method is decided upon. Consideration must also be given to available assets within the target market (or those who carries sway with that target). For example, if a particular media/press outlet or person of influence is a natural ally, than due consideration must be given to leveraging that asset...and developing a strategy that best fits that vehicle. Op-eds or editorials from sources that are informed by the Narrative and who understand the value the NNMI to the manufacturing community would be natural first steps.

Identifying and leveraging regional and/or national events in which the NNMI and/regional institutes can have a presence (i.e., a booth/signage/information) provide another opportunity to share the Narrative...as does various speaking engagements and panel discussions.   Regional stakeholders identifying and "bolting on" to existing events in this manner makes efficient use of resources to disseminate the NNMI message. Events such as supplier/supply chain events, industry and educational seminars and conferences, NNMI regional meetings, economic development meetings, events centered around National Manufacturing Day, etc., all provide opportunities to share the NNMI Narrative, either by a presence with a booth, speaker roles, panel participation and/or well-positioned op-eds or earned media.

Assistance with Communication

It is also recognized that that most Institutes and those in the manufacturing community may lack certain communication-related capabilities. For example, building visibility and support via assistance with drafting and placement of op-eds, lining up editorial board meetings and general execution of the communication plan may require specialized help with related experience. They may also lack the ability to fully leverage earned media.   Using the media/press to inform the public is a great opportunity to create excitement and a better understanding of the greater value and workings of the NNMI, weaving the Narrative into every announcement or story so that the messaging is consistent. These opportunities also provide intrinsic value such as a way to excite the public...especially younger students and parents, about the exciting careers and the truths about today's manufacturing.

Some examples of earned media opportunities include:

1. Institutes coming online and reaching various milestones
2. Institute open houses
3. Institute participation in regional and national events
4. Member announcements and milestones for the greater manufacturing community
5. Announcements related to technology development or commercialization of technologies developed through NNMI collaborations
6. Education/workforce development announcements

It is too important to leave these communication processes to ad-hoc activities based on the band-width and/or capabilities of individual institutes and markets.   It is therefore recommended that the Central Office establish an internal communications role to support the Network/the Institutes, as well as the Network consider retaining an external communications consultant/firm that would

be at the disposal of the Network and individual Institutes as needed. This consultant/agency would be funded out of Network funds/memberships, as well as have an ability to provide additional extended services to Institutes on a fee-for-service basis. This approach of dedicated internal and external resources would provide needed support in both areas that are appropriate for the Administration to lend support as well as areas that are best handled by external consultants, such as assistance with the development and placement of op-eds, etc.

Some of these tasks include but are not limited to:

1. Communications-related training and facilitation
2. Media/speaker training
3. Ensuring stakeholders understand their roles
4. Initial facilitation of the influence mapping and target identification processes (and "train the trainer" so that the process becomes institutionalized)
5. Working with institutes and the Network to ensure they fully leverage earned media opportunities (and learn to do so on their own)
6. The dissemination of the Narrative and Communications Plan
7. The execution of communication related strategies
8. Internal communication process development and execution (aligned within the Network)

As stated above, funding for the external resource(s) could be covered via funds raised through Network memberships. This can be sustained due in part to the fact that memberships will increase as the communication/"marketing" process becomes more effective via the employment of the said resource(s). In addition, as the Network begins to be self-sustaining and as part of a transitional model sometime in the future, the role of the "Central Office" and communication asset within that office should be evaluated (at that time) with a decision made by the stakeholders to either keep the role within the Administration's "Central Office," or transition the function, entirely or in part, to a private model.

Execution Strategy

Once there is a clearly articulated narrative and a communications plan in place, the implementation of that plan will depend on the ability to execute. As in any such initiative, the approach should be organized and have a focus of not only initial implementation, but also on helping to ensure the process is institutionalized. This is accomplished by using the internal communication process to disseminate the plan/protocols and in doing so, train stakeholders to ensure that they develop independent capabilities over time. It is recommended that an internal and external communication summary, which includes various undertakings and engagement, be part of each institute's reporting process.

In summary, it is proposed that the steps of the Execution Strategy should include:

1. Determine the facilitative approach and how to manage internal and external Network communications (via engaging/developing internal and/or external expertise);
2. Clearly articulate the facilitative roles of the Network, Institutes and all stakeholders;

3. Communicate roles and Narrative to the facilitators above (and internal/external Communications Plan/Execution Strategy, as appropriate);
4. Conduct influence mapping, initially using existing assets, transitioning to more formal plan as more Institutes come online;
5. Develop a matrix of individuals/groups according to spheres and levels that either need to better understand the value of the NNMI or are potential "messengers";
6. Identify and prioritize targets via a facilitated, templated process, initially with existing assets and transitioning to a more formal process as more Institutes come online;
7. Evaluate various means to disseminate the message (Narrative) and determine the best approaches based on the target, need, and available assets:
    a. Op-eds…and from whom
    b. Speaking engagements & participation in events
        i. Open houses
        ii. Economic development forums
        iii. Educational seminars
        iv. Regional and national meetings/conferences
        v. Etc.
    c. Upcoming earned media opportunities
    d. Engaging "ambassadors" on an ongoing basis by providing the Narrative so they can make sharing information and supporting the NNMI part of their regular routine

Conclusion

The AMP2.0 NNMI Working Team has developed the framework above as a recommended approach to address both internal and external communications processes for the NNMI. In moving forward, it is recommended that the AMPNPO, or "Central Office," as defined herein, has the overall responsibility for managing the process, ensuring that the message, its delivery and related communication processes are consistent, that there is alignment between Institutes and Network capabilities improve overtime. This will ultimately prove instrumental in ensuring that the value of the NNMI becomes widely known and accepted, and that the Network grows and functions as intended.

ANNEX 27

NATIONAL NETWORK FOR MANUCTURING INNOVATION:

Narrative

Background

The **NNMI Narrative** is intended to provide context for the NNMI "story" and include an organized flow of main talking points that, together, help to communicate the value proposition. It is not intended to be a lengthy, comprehensive, detailed document that covers all aspects of the NNMI which is provided to the public, but rather a collective of main themes and talking points that tell the NNMI "story." The narrative will:

1. Help ensure that all "messengers" and "ambassadors" are aligned when delivering the message,
2. Provide a general storyline with a series of talking points, anyone of which can be "tweaked" or expanded by speakers upon based on the audience and
3. Provide a foundation/direction for op-eds and other such opportunities to communicate through the media.

The narrative is not "etched in stone," but rather a living document, allowing additions and improvements over time. In summary, it provides a general messaging guideline to better ensure consistent messaging and clarity with regard to the value of the NNMI to stakeholders and ultimately build participation and support.

The narrative below is broken down into several components:

1. Opening/problem statement – As discussed, it is intended to go right to the heart of the issues the target audiences face (start-ups, SMEs, large/multinational manufacturers and Agencies). It is intended to plainly acknowledge those issues...simply and directly.
2. Frame U.S. potential – Outline assets available to U.S. manufacturers and leave a sense that we could be much better off if there was a vehicle to better access them.
3. Bring forth the concept of a "Manufacturing Community" - Speak to the concept and strengths in engaging the entire manufacturing community (the entire supply chain including all size manufacturers, education/academia, national labs, govt. Agencies, etc.).
4. Outline the NNMI concept - How it provides a unique vehicle to leverage the collective strength of the manufacturing community to address the needs of US manufacturers.
5. Summary/close – Take the opportunity to tie the concepts into a small, tidy package while closing with making an emotional connection via the use of a patriotic theme.

Scope of Work

Problem Statement

Most of those astute in understanding the U.S. economy have come to the conclusion that maintaining a strong advanced manufacturing base and leadership in innovation are key to growing and sustaining the U.S. economy and creating jobs. Today's manufacturers in the U.S. face a host of challenges when attempting to compete in the global marketplace. Years of off-shoring have dismantled the domestic supply chain in many industries. With the growing use of technology, the availability of workers with the necessary skills is no longer a given.

Start-ups and small- and mid-sized U.S. manufacturers face unique issues. It is difficult for them to meet the technical and standards requirements from OEMs and/or upper-tier supply chain customers. They may struggle to obtain operating capital to advance from proof of concept through manufacturing process development, lacking access to the equipment they need to demonstrate manufacturing feasibility and in finding and applying the right methodologies and tools to help bring new products and process technologies to commercial scale. Finding and retaining the necessary expertise to direct product and process development, as well as making connections to otherwise develop markets and build their business, are also an issue.

Larger, more established manufacturers and multi-nationals face different but equally formidable roadblocks to competiveness. They need to develop closer partnerships with the supply chain, engaging SMEs in the development of needed process and product technology to support their business. They have an increasing need to collaborate on both pre-competitive R&D and the technology born from those earlier collaborations.

Government agencies are constantly under pressure to engage commercial assets and academia to develop technologies required to drive programs. Under existing models they rely on individual sources or regional consortia models to advance their goals. Establishing a national manufacturing ecosystem anchored by a secure network of U.S. based collaborative institutes focused on individually and collectively making inroads in game-changing innovation would be ideal, however has not been a reality.

The Potential

The good news is that the U.S. has very strong, foundational assets upon which to solve these challenges for start-ups, SMEs and large manufacturers. Some of these assets include our ability to innovate through partnerships with universities and national labs, and direct lines from "labs to fabs" (R&D labs to fabricators) for quick learning cycle times. The U.S. is also blessed with dynamic financial markets, an entrepreneurial culture, and great natural resources… water, gas, oil and power…and the required infrastructure to deliver it to the end user. In addition, the U.S. provides some of the world's best protections for securing intellectual property.

If you are a start-up or mid-sized business owner, you are probably not focused on big picture items such as relationships with universities or national labs, or the development of big infrastructure. You are most likely more interested in addressing immediate business challenges. While you may know that access to innovation will help make you be more competitive and better meet the needs of potential customers, you are most likely focused on more practical needs that can be met through specific, real time actions. You may realize that the education system needs to be improved to provide talent to advance your business, but with your limited time and resources, you are unsure what practical actions will allow you to access the R&D talent you need. If there are cost-effective, "bite-sized" items you can undertake to "keep the lights on" and grow your business, you may be willing to pursue them.

If you are a large manufacturer or multi-national, you may have a better perspective when it comes to the "big picture," but all corporations, large and small, make decisions based on the bottom line, often times limiting their ability to engage on "big picture" collaborative initiatives. Larger manufacturers acknowledge that pre-competitive collaborative activities may be necessary, but before they commit, the activities must align with their priorities and R&D portfolio.

If you are a long-established company of any size, you may have felt the brunt of the shrinking economy and aging facilities and infrastructure. Most of your focus and financial resources may be spent on meeting immediate customer needs, leaving little or nothing for investment in much needed process and/or product technology advancements, employee training or business development. You may know that this will not sustain your business over the long term, but you don't have the independent resources to invest in the future.

The great diversity and strength of U.S. ingenuity means that placing companies that reside along the continuum from young start-ups through mid-sized to long-established multi-nationals can result in an environment that exploits the potentials of each contributor and yield results that no one could anticipate from any one or small subset of contributors. It's from interdisciplinary, diverse thinkers which behave according to the different cultures of companies associated with size or dexterity that game-changing innovation can arise.

The Manufacturing Community

It has become increasingly apparent that leveraging collective assets should be an integral part of a competitive manufacturing business model. Collaboration is especially important given the high cost of developing new technologies and products; it is no longer practical for most companies to "go it alone" through the entire development cycle. The longer one can delay independent activities along the product/process development continuum, the more competitive a manufacturer can be. In addition, pre-competitive collaborative efforts can help to develop the capabilities of supply chain partners and train future employees.

There are numerous examples of pre-competitive collaborative models and "hubs" in existence today, all with their own strengths for meeting various needs. These models have shown that the most effective way to fully leverage the collective investment of stakeholders is to address as many of the common needs of the manufacturing sector as possible while also addressing the specific needs of individual businesses. The best vehicle to enable this hybrid approach is to establish regional institutes, tied together in an overall network, driven by the private sector and made available to all stakeholders to fully leverage the collective asset. This concept is at the heart of the NNMI.

This "Manufacturing Community" approach is especially valuable in these current times of global competiveness and tight capital. "Foundational" knowledge created through the hubs could be actively disseminated to the community at large. That is, research results and developmental phase common assets which do not compromise one's proprietary position or the competitive advantage

of individual businesses could be placed in the public domain, leading to strengthening and growing the manufacturing sector and the economy through the creation of jobs throughout the greater manufacturing community.

The heart of the manufacturing community would be a network led and driven by the private sector. This would ensure it addresses real and immediate business needs, ranging from the issues start-ups and SMEs face, to bridging the "missing middle," strengthening the supply chain, and providing a cost-effective safe-haven for small and large companies to advance their interests and to maintain an edge in innovation. This environment would balance the needs for open, community-wide collaborations, dedication to the public domain of results that can benefit industry as a whole, and the protection of proprietary activity for competitive advantage. Such a network could be a fertile environment for pre-competitive collaborations between SMEs, larger manufacturers, universities, and government labs/agencies. Engaging the entire manufacturing community is the best way to develop the needed workforce, provide ways for the supply chain to model solutions, and for all stakeholders to work together to develop game changing technologies.

Building a National Network of Manufacturing Innovation

A network of regional, collaborative institutes could collectively address the immediate needs of individual stakeholders and provide a safe, collaborative environment to develop game-changing strategies and technologies and provide business development opportunities. These institutes, and more importantly the network as a whole, would provide a powerful platform for U.S. manufacturers to compete in the global marketplace and help to grow the economy through job creation proportionate to the growth of the manufacturing sector and supply chain. The National Network of Manufacturing Innovation (NNMI) is intended to be such a platform, providing much greater access to broader, cross-cutting innovation and collaborations through a national network of institutes than would be the case in a model anchored with an individual institute.

The original concept for the NNMI was born in the private sector in partnership with the Administration. Manufacturers and academia, serving in an advisory capacity to the Administration and charged to make recommendations on how to grow the economy, determined that growing the manufacturing base was a priority. One of their recommendations was the NNMI. While the Administration agreed to facilitate the discussions, provide the framework and co-fund the initial institutes through seed funding, it was understood that the Network would not work as envisioned unless it moved to a model completely driven by the private sector. The intention is to have the Network co-funded by Congress, with matching private sector investment. Congress is currently considering legislation to authorize and fund the NNMI.

The NNMI (Network) is intended to leverage the collective assets of all stakeholders and participants within the manufacturing community throughout each region and link them nationally. The Network will address challenges that prevent smaller companies from growing, larger companies from competing and breathe new life into long established companies that have been cash-strapped and unable to invest in necessary innovation by providing a collaborative

environment for companies to share burdens associated with developing new processes and technologies and the application of research from all sources. The institutes will help match needs to resources, assist with building productive partnerships, provide access to potential customers and suppliers, enable the development of cross-cutting technologies that are important to a broad base of manufacturers and leverage experienced individuals and a learning environment to better develop the workforce required in today's manufacturing. In addition, while not in and of themselves directly creating substantial numbers of jobs, the institutes will plant the seeds for stronger manufacturing ecosystems throughout the nation and related job creation.

Conclusions

At the heart of this National Network for Manufacturing Innovation is the manufacturing community. This private sector-led initiative will apply the collective assets of the entire manufacturing community to address the challenges facing large and small manufacturers. Growing a more robust supply chain is integral to growing the economy, creating jobs and advancing our national security. Sustaining a strong manufacturing base is key to maintaining our nation's economic vitality and ensuring a bright future for generations to come.

The education system and various structural roadblocks within the current economic system leave segments of the population at a disadvantage when it comes to opportunities. In order for the U.S. to be best positioned to compete in the global marketplace, we need to better excite our youth, engage our population and provide opportunities for all willing individuals to participate. We need to engage all of our human capital in our quest to succeed, regardless of gender, ethnicity or social background. Ensuring that "all brains are on the table" not only best positions the U.S. to succeed in the global economy, but provides a pathway to success for each individual…the possibility for a better life as well as more generally strengthening the nation's social fabric and helping to address many of the concerns related to social in-equality and lack of opportunity. Growing the nation's manufacturing base can provide opportunities for a much broader swath of the population throughout the supply chain and greater manufacturing community.

Based on the proven strengths of other, more regional collaborative models, the NNMI is an integrated, networked approach to leveraging the collective assets of the entire manufacturing community. It will help connect manufacturers to needed capital, markets, expertise, product and process innovation, and the skilled workforce required to succeed in the global economy. The NNMI may not address all of the more fundamental policy issues that could also benefit U.S. manufacturing if they were addressed. However, it has the potential of becoming a building block in the foundation of a U.S. manufacturing resurgence, and will only work if the private sector steps to the plate to lead, support and take full advantage of the Network's assets.

ANNEX 28

NATIONAL NETWORK FOR MANUCTURING INNOVATION:

Governance and Network Operations –

Key Considerations

Background

The NNMI is intended to provide a means to collectively address the immediate needs of individual stakeholders, providing a safe, collaborative, cost-effective environment to develop game-changing strategies and technologies, and provide business development opportunities for members. Individual institutes, and more importantly the network as a whole, will provide a powerful platform for U.S. manufacturers to compete in the global marketplace by providing a means to pool resources in the "de-risking" of technology development while delivering much greater access to wider-ranging, cross-cutting innovation and collaborations. As an array of individual institutes that are tied together nationally, the network will offer much broader capability and benefit. The Network is intended to leverage the collective assets of all stakeholders and participants within the manufacturing community throughout each region and link them nationally.

Key Findings

It is imperative that the NNMI be demand driven, focusing available collaborative resources on areas where there is market pull. In order to better ensure that the focus remains on technology areas and priorities that make sense to the private sector, it is important to engage a diverse group of stakeholders within the greater manufacturing community. By doing so, the Network will address challenges that prevent smaller companies from growing and larger companies from competing, breathing new life into long established companies that have been cash-strapped and unable to invest in necessary innovation. The Network will also provide a collaborative environment for companies to share burdens associated with developing new processes and technologies and the application of research from all sources.

Through proper engagement, the NNMI will help match needs of all stakeholders to resources, assist with building productive partnerships, provide access to potential customers and suppliers, enable the development of cross-cutting technologies that are important to a broad base of manufacturers and leverage experienced individuals and a learning environment to better develop the workforce required in today's manufacturing. The Network will provide access to a national asset with much broader connectivity and visibility into trends as well as current activities.

Recommendations

The recommendations below, while most importantly addressing the more immediate goal of establishing the NNMI and ensuring it meets its initial charge, will also help to ensure it is institutionalized and remains effective throughout its various transitional states, from the first centers established via Administration/Agency funds that must focus on the mission of the funding agencies, to a longer term, self-sustaining model beyond the initial 5 – 7 year start-up phase.

This letter report focuses on short and mid-term needs with intent of providing necessary guidance to initially stand up Institutes and provide for the success of the NNMI by way of establishing the necessary footing for the centers established over the next 5 – 7 years. It is recommended that a similar private sector advisory panel be convened at a later date so as to develop more future focused recommendations best suited to the model at that time, based on an evaluation of the then

current state and considering the learnings and experiences of the initial centers and first stage of the NNMI.

The key considerations discussed in this letter report are as follows:

- The Benefits of the Network
- Diversity
- Balancing Network Consistency with Institute Autonomy
- What the Network is…and is not
- Workforce Development
- Metrics
- Leveraging the Manufacturing Extension Partnership
- Network Expansion

Benefits of the Network

In evaluating potential governance and advisory structures and functions, it is important to understand what the Network is intended to provide. The list below is a summary of some of the potential benefits of the Network function of the NNMI (the Network function includes governance/advisory groups, Central Office support, etc.):

Network Value to the Institutes (support for Institutes and their operation):

- Ensure inter-Agency coordination/alignment and support
- Assist with broader, inter-Institute and external communication/outreach
    - Meetings, newsletters, workshops, etc.
    - Sharing of best practices & continuous improvement
    - Mechanism for cross fertilization of the Institutes
- Inter-Institute collaboration and sponsorship/funding of inter-institute projects
- Act as a convener/facilitator on a greater regional/national level
- Assist with Institute start-up
    - Protocols/processes, including human resource functions and statutory requirements
    - Staff augmentation/training
    - Communication/marketing/outreach
    - Organizational development
    - Assistance with IT (see recommendations for Central Office IT support)
- Ensure dedicated resources for assistance
- Help to secure financial assistance for a research project that is of interest
- Ensure ongoing relevance and connection to manufacturing community and regional needs
- Institute evaluation – independent feedback on Institute(s) progress and direction
- Coordination of overall advanced manufacturing roadmaps/strategic plans
- Overall advocacy/branding for Network / Advanced Manufacturing

- Convener to discuss standards, regulations, tax policy, etc. that impact Advanced Manufacturing
- Expansion of Network
- Provides history and a set of best practices for the Institutes
- Provides a platform where all of the Institutes can combine their voices and messages on core/central issues to affect policy (i.e.: workforce development, business, tax policies, etc.)

The Value of the Network to the greater Manufacturing Community (external stakeholders)

- More broadly disseminating best practices
- Enabling access to relevant ongoing research results
- Providing broader access to knowledgeable experts in related fields
- Support for the MEPs so they can bring results to local areas, etc.
- Helping to ensure access to new technology info in a range of fields
- Helping to ensure broad based access and collaboration to grow talent base and range of advancements
  - Balance organized, narrower focus of large scale teams with wider base of varied researchers working on a smaller scale (narrower focus may bring in short term funding and solve specific technology issues, but long term sustainability, maintaining innovation leadership in general and growing the greater talent pool requires a broader focus)
- Integrates Institutes via their target areas (ID overlap and dovetail appropriately, and address/avoid overlap among existing institutes) Note: this is instrumental in mitigating completion between institutes in lieu of productive collaboration
- Facilitates identification of mutual opportunities, overlapping interests and work across institutes
- Provides a place/vehicle to facilitate the process to identify the identification of next generation technologies (industry driven engagement), as well as identification of candidate fields for new institutes
- Serves as the voice of the institute community – e.g. on workforce, image of manufacturing, etc.
- Provide the framework for pre-competitive activity and collaborations to companies who would it otherwise be out of reach
- Helps a company develop close working relationships with sources of innovation such as universities, federal labs, agencies and other companies
- Aids in developing partnerships with customers and suppliers
- Makes possible projects where a company does not have all the required skills or technology
- Allows a company to explore areas beyond its core expertise
- Provides a direct or indirect benefit to members from the research done by the institute and other members.

- Provides a platform for public evaluation/endorsement of potential future business direction
  - Outside confirmation of the value of a company's internal research direction.
  - Objective analysis of a company's research plans
- Early contact with future product specifiers/buyers
- Proposal development process for Institute funding aids in the development of a written and reviewed research/development//commercialization plan.
- The discipline required to develop, sell, and carryout a project with institute oversight makes for a better run project
- Helps to build a company's reputation as a technology innovator

Diversity

To ensure various perspectives are considered it is important that the NNMI governance model includes mechanisms to ensure the perspectives of all stakeholders within the manufacturing community are represented (both company (size/type) and individual diversity):

- Diverse enterprises from all aspects of the supply chain (small/medium/large business);
- Ethnic/gender diversity; /minority-owned/women-owned businesses
- Diverse academic institutions (high school, vocational and technical college, under graduate and graduate programs, as well as those serving the minority community and otherwise underserved populations)
- Those who represent Veteran and Disabled populations, first generation college students, etc.
- Geographical diversity
- Government or quasi-government entities at the state/regional/local/Tribal level

It is important to note that mechanisms to ensure the required diversity need to be institutionalized to ensure diversity will remain an integral part of the model regardless of how the governance of the institutes and Network changes over time. It is recommended that the membership of each of the various governance bodies below generally reflect the type of diversity mentioned and that those members are charged with the added role of ensuring due consideration is given to the perspectives and needs of the diverse manufacturing community. A recommended mechanism to increase diversity in manufacturing, with innovative ideas being driven by greater representation from diverse members of the manufacturing is to include a diversity metric within the Technical Merit Review Criteria for each Institute's proposal. Recommended Technical Criteria may include the extent to which each Institute partners with or involves members of underrepresented groups in STEM (i.e. Minority/Tribal/Women; including students and professionals participating in a given academic institution or company).

Balancing Network Consistency with Institute Autonomy

Another important value of the Network model would be its ability to provide participants with a certain level of consistency and continuity while allowing for appropriate levels of institute

autonomy so as to better advance their respective technology goals. While each institute should have substantial autonomy including independent fiduciary boards and operational governance structures, there should also be an overall network operational structure with similar roles governing the Network as well as providing communications support and directional assistance to the institutes. Both institute and Network governance should be composed of various industry representatives, with industry, academia, and government having seats at both tables, thereby preserving their interests.

What the Network Is…and Isn't

Simply put, the Network is the reference used when referring to the collective Institutes (centers). The Network is not a stand-alone entity that governs the individual Institutes, but rather a way to refer to the collaborative asset of national institutes/centers. There is nothing competitive or contrary about the Institutes versus the Network; they are one in the same. As the individual centers are more focused on daily institute operations, an overall network support structure will be needed to help with inter-institute communication, administration, facilitation and overall growth. The main strength of the NNMI is the fact that it is made up of individual centers with enough autonomy to support regional needs while being tied to a national network of regional collaboratives.   The facilitation required to ensure national connectivity and additional administrative support will be provided by a centralized network support office.

A key attribute of the NNMI needs to be its ease of use by industry. The network support function must provide easy connectivity with a vehicle to collaborate that would otherwise be hard to obtain at an Institute level. A communications process, facilitated by the network support office, will help to ensure that the Network functions as intended…and that it becomes widely known as a preferred collaborative platform to more easily and cost effectively innovate. *The mission of the network support office should be to strengthen, support and enable the institutes, being more strategic than tactical in nature.*

Workforce Development

The NNMI is focused on manufacturing industries, helping to develop a more robust supply chain and manufacturing base, *ultimately supporting US economic development and job growth*. To that end, leveraging the NNMI asset to develop the workforce necessary to support manufacturing within a fertile, collaborative environment that provides cost effective, secure access to instrumental product and process innovation to all sized manufacturers will best ensure success. The NNMI provides a unique asset to facilitate experiential learning and consideration should be given to Institutes as regional hubs for workforce and supply chain development activity, ensuring alignment between education and the needs of advanced manufacturing.

Metrics

Optimal function of the Network and Institutes requires a regular evaluation of performance against metrics. While the Institutes have deliverables aligned with program participants, NNMI's overall goal is to help grow the nation's manufacturing base, improving the nation's economy and creating/sustaining the related jobs. Given the need to strike a balance between Institute goals and

the needs of the manufacturing ecosystem, it is important to ensure proper representation in a detailed discussion in developing metrics. Rather than supply specific metrics, it is recommended that of the initial tasks of the NC be the development of the required metrics, and in doing so, includes all of the perspectives of the manufacturing community via the recommended membership. The metrics need to be able to be easily collected and evaluated, leveraging existing sources. The metrics should drive desired behavior within the Institutes, and discourage undesired behavior. Furthermore, as target behaviors will vary over time (e.g., transitioning from start-up to operational mode), metrics should be reviewed on a regular basis to ensure that they are still valid and applicable to their respective Institutes.

Additional Support via the manufacturing Extension Partnership (MEP)

Whenever creating a new organization or entity to address a need, it is important to identify and evaluate existing assets so as to determine how to best leverage them and not "recreate the wheel" within the proposed or new structure. It is especially important in these economic times to take advantage of established constructs that are already funded, are known entities and have existing support, evaluating and leverage current structures and investments to best meet the task at hand.

The MEP is well suited to play a complementary role in support of the NNMI, providing a vehicle for outreach to the manufacturing community and supply chain. The MEP is designed to communicate support and otherwise connect to regional manufacturing supply chains, and as such should not be seen as competitive, but rather complementary and a valuable asset to be leveraged.

As the NNMI is being formed and the MEP is evaluating how best to assist and grow the manufacturing base and related supply chain, we are presented with a unique opportunity in time to best leverage the combined asset. It is recommended that the MEP be provided a seat at the table at both the Network and Institute level and so as to best facilitate productive discussions between the NNMI and MEP and best leverage both assets in what should be the shared goal of innovating, educating and collaborating to grow the supply chain and manufacturing base, ultimately growing regional economies, creating jobs and therefore playing a role in our nation's security.

In addition, a membership mechanism should be explored by the NC/AMNPO that could facilitate membership in the NNMI (Network). While membership in Institutes provides the opportunity for entities to participate in Institute focused activities, a more broad Network membership may provide a vehicle for entities to have visibility into Network wide activities, more general trends and development in the supply chain, including MEP activities. If developed and marketed appropriately, an NNMI national membership can prove to be a vehicle to engage entities who would otherwise be on the periphery, ultimately leading to more direct involvement in Institutes as well as potentially utilizing the services of the MEP.

It is important to ensure that programmatic footprint of NNMI is broad and considers workforce, small business, and regional clustering, or it will not develop the broad based support it will require to sustain itself into the future. Without institutionalizing a mechanism to ensure broad based representation and involvement, the program bases of the institutes may be too narrow, supported by agencies and/or high tech companies concentrated in just a few states...with institute award

winners having no incentive to advocate for the program, work to ensure longevity or to make sure they meet the intended need over the long term.

While not being focused on advanced technology development and lacking shared facilities, the MEP has an established national network in every state that is tied to the greater manufacturing community and is already seen as a value to especially SMEs. By leveraging this asset, the NNMI will have a ready-made vehicle to help establish linkages, communicate value and ensure that efforts are demand driven…ultimately being more effective and garnering the support of the manufacturing community that will be instrumental in obtaining the necessary political support needed to achieve long term sustainability.

Balancing goals that are tangible to small businesses, such as workforce development and regional economic development, with longer term, harder to measure impacts that resonate with larger manufacturers such as R&D, is something that the NNMI is designed to accomplish. Engaging the MEP, whose value has been recognized by the Administration and Congress, provides a vehicle to better ensure that this balance is maintained. It is recommended that the NC has more detailed discussions on how to ensure that the MEP is integrated in both Institute and Network activities with the intention of fully leveraging this valuable asset. Such integration should be seen as mutually beneficial. The aforementioned governance recommendations and structure is intended to facilitate these discussions.

The MEP is a separate entity with unique ties to the manufacturing community and if leveraged as envisioned, can help stakeholders better understand the value of the Institutes and help increase participation. On the *Network* level, the MEP's role is more in providing input and direction to better ensure the greater needs of the more diverse manufacturing community are met, with the ultimate goal of providing value so regions can grow their economies and create jobs.

That being said, the MEP's involvement on the *Institute* level is more facilitative, focused on networking, communication and assisting with the items required to help the Institutes meet the needs of the manufacturing community as well as specific programs. In this case it makes sense for the MEP to be contracted for specific services, as is the case with the DoE Institute at North Carolina State University as it is providing funding to the MEP Center for liaison with small companies, and for workforce development activities. Contracting such services will better ensure consistent support and is aligned with the current MEP financial model.

Network Expansion

"Broadening the tent" to included parties who have been part of the application process, are already collaborating or would like to join the Network makes sense in that we are stronger by leveraging our greater, collective assets. It is recommended that the proposals below are discussed by the NC and AMNPO and acted upon based on their determination of viability.

Encourage Non-Selected Proposers to Form Institutes

- Encourage the stronger non-selected Institute proposals by industry-state-university groups to consider standing-up their Institute proposals relying on state and industry cost-sharing.
- Develop a set of threshold requirements for such groups to join the NNMI by adopting NNMI formats.
- Consider an alternative selection approach: instead of "winner take all," "winner takes most," with lower federal cost sharing for other strong proposals submitted.

Encourage Participants in Non-Selected Proposals to Join the Network

- Encourage openness by winning Institutes to additional Institute participants in the period after the Institute award
- Discuss offering a comparative membership based on their role and membership model to encourage greater collaboration

Encourage Participation by Non-Institute Entities

- Develop a set of threshold requirements for network participation of additional industry-state-university organizations that could adopt NNMI approaches and formats to gain access to the network.

Finally, while we have worked to ensure alignment in developing these recommendations, it is important to consider the recommendations from the other AMP 2.0 working groups in moving forward. In moving forward with the further consideration and the implementation of these recommendations, the Administration should integrate all working group recommendations and ensure they are fully considered as a whole.

ANNEX 29

NATIONAL NETWORK FOR MANUCTURING INNOVATION:

Governance & Network Operations –

Organization & Structure

Background

In order to ensure that the Network is meeting the needs of the broader manufacturing community and remains true to its original intent, it is it is important to provide methods to engage organizations that represent various segments of the manufacturing community. These include representatives from groups such as manufacturing and supply chain associations, all levels of education, economic development entities, regional manufacturing collaboratives, support groups and state and regional representatives, etc. Organizations/associations with connections to or which represent broader manufacturing sectors (and various levels) and those who provide unique assets and connectivity to the manufacturing community, should be considered. These organizations should be part of the internal and external communication processes, be leveraged in Network operations, be engaged on an advisory capacity and potentially in the Network governance process.

It is equally important that all stakeholders are aligned and leveraged in the communication process to ensure timely delivery of consistent messaging and direction as well as ensuring input from all stakeholders can be efficiently channeled, considered and help to continually improve the Network. Institutionalizing the communication process will ensure that the three primary stakeholder groups, industry, academia and government, are fully engaged in an ongoing two-way communication process, which lends itself well to an informed governance body.

Key Findings

Operations, Advisory Groups and Administration of the Network

A network support office, while providing guidance to better ensure consistency, assist with initial center development and ongoing operational protocols, should have a greater communications / information-sharing role versus "governance" role in the strict sense of the word, providing support and guidance to the institutes while allowing necessary regional autonomy. Network support activities and Institute operations will be informed by a network council and several advisory groups as described below.

The recommended structure and roles provide for multiple levels and methods to engage the diverse stakeholders within the manufacturing community. As an example and as related to identifying appropriate technology areas, in addition to the established solicitation process which allows entities to pose arguments for investments in their preferred technology areas, these recommendations provide multiple vehicles to engage stakeholders, better ensuring a broader base of perspectives are considered, as follows:

- Guidance via the above mentioned technology ID process
- The establishment of a Technology Advisory Board
- The establishment of an Industry Advisory Board
- An establishment of a Network Council, which considers all input

- The Network's role as a regional/national convener, facilitating ongoing engagement of existing collaborative groups and industry representatives to continually evaluate/determine the "technology roadmap" (facilitating external discussions within the institutes)

Operations - Network Formation

It is recommended that the initial membership in the proposed groups (below) is appointed by AMNPO. Thereafter, membership, membership rotation, new member seats, etc., will be determined by the Network Council. *Note: It is important to consider the optimal size of each operational/advisory group so as to ensure efficient and effective operation.*

Network Council (NC)

- o **General focus:** Ensures NNMI continues to meet the needs as intended.
- o **Funding:** Administrative functions funded by the Administration/Congressionally allocated funds via the Central Office; individual members cover their costs to participate.
- o **Membership** includes representation from the following **:**
  - Institutes
  - Manufacturers/supply chain
  - Large manufacturers
  - Long standing (mature) manufacturers
  - SMEs (including start-ups)
  - Academia
  - Agencies
  - Labor
  - Central Office representative
  - NIST/MEP representative
  - State government
  - Additional external collaborative representatives (TBD by Network Council, once established; need to ensure necessary protocols to ensure the Council will be free from problematic outside/foreign interests)
- o **Role:**
  - Main decision making body
  - Review and accept recommendations from Technical Advisory Board (TAB)
  - Review and release findings of TAB
  - Meets twice annually, or as needed (more early on)
  - Reviews activities of Central Office, performance of Institutes; makes recommendations to better support Institutes/meet needs on manufacturing community
  - Evaluate Network to ensure it is meeting its initial charge
  - Evaluates methods to ensure diverse representation and ways to grow/sustain the Network

- Ensures collaboration/fully leveraging the MEP and other established regional assets
- Ensures an ongoing focus on workforce development and ensuring education is demand driven via leveraging Institute activities and providing experiential learning opportunities
- **Develop and convene at least annually an "Industry Advisory Board" to provide ongoing direction and recommendations on the NNMI to ensure that it continues to meet the need as intended to the NC and AMNPO**
  - This is the general industry advisory body; it could include industry representatives from the recommended Advanced Manufacturing Advisory Consortium discussed in the full report's Recommendation 2.
  - Allows for manufacturing association membership and other representative bodies
  - Could also include regional players/regional meetings (TBD by NC/AMNPO)

Technology Advisory Board (TAB)

- **General focus:** ensure proper technology focus
- **Funding:** Administrative functions funded by the Administration/Congressionally allocated funds via the Central Office; individual members cover their costs to participate.
- **Membership** includes representation from the following (similar representation, but size/actual membership may vary; specialists nominated by NNMI participants and confirmed by the NC):
  - Institutes
  - Manufacturers/supply chain (could include manufacturing associations)
  - NIST/MEP
  - Large manufacturer
  - Long standing (mature) manufacturers
  - SME (including start-ups)
  - Academia
  - Agencies
  - Central Office
- **Role:**
  - Makes recommendations to the NC
  - Reviews Manufacturing Innovation Institutes (MIIs) according to criteria set forth by the agencies and the NC
  - Develops recommendations for new MIIs

- Ensure longer term view by working with Institutes to facilitate engaging Industry on a regular basis to evaluate/adjust technology priorities and roadmap, engaging wider ranging and more diverse stakeholders (**including other collaborative groups**) in discussions
- to identify future activities (recognized as the national leader and convening body to ensure proper focus and support of manufacturing)

Education/Workforce Development Advisory Board (EAB)

- **General focus:** ensure development of workforce required to support manufacturing
- **Funding:** Administrative functions funded by the Administration/Congressionally allocated funds via the Central Office; individual members cover their costs to participate.
- **Membership** includes representation from the following (similar representation, but greater focus on education. Size/actual membership nominated by NNMI participants and confirmed by the NC):
  - Institutes
  - Manufacturers/supply chain
  - NIST/MEP
  - Academia
    - Local school districts
    - Community Colleges
    - Universities
    - Parents
    - Students
  - Agencies
  - Central Office
- **Role:**
  - Ensure centers are leveraged to develop regional workforce
  - Share national best practices, trends, etc.
  - Help institutes develop plans to engage regional educational institutions and businesses and provide experiential learning opportunities
  - Consider recommendations from the AMP 2.0 Workforce Work Group and other entities with proposals help develop the required workforce and to ensure that the education is demand driven
  - Engage the MEPs to better align workforce development activities with supply chain needs

Network Support Office (within AMNPO)

- **General focus:** Network administrative functions and support
- **Funding:** Administrative functions funded by the Administration/Congressionally allocated funds
- **Role:**
  - Assist with/establish communication protocols to maximize performance
  - Help the Institutes interact to ensure Network is leveraged to best meet the needs of the manufacturing community
  - Operation and maintenance of the Network portal
  - Assistance with general facilitation
  - Performance tracking to ensure consistency, continuity and effectiveness
  - Support NC, TAB, EAB and Institutes

Staff (provided by/within AMNPO) dedicated to serve the NNMI, including roles specializing in (Note: Representation from the MEP office should be integrated into the Central Office):

- **Communications**
- **IT**
- **Organizational Development/Support**
- **Staff support for NC, TAB, EAB and Institutes**
- **Communications Director** (reports to Director of Manufacturing)
  - Facilitating communications between centers and government agencies (help to ensure alignment and full utilization of all assets both Agency and Network assets)
  - Assist with initial development of centers upon standing them up
    - Communication protocols
    - Communications/media training
- **IT Director** (combined role with or reports to Communications Director)
  - Ensure that the Network's site (Manufacturing.gov, or whatever is ultimately used as the Network's main communication portal) serves as both an internal and external communications tool
  - Help centers establish their IT systems
    - Required security
    - Consistency/continuity between centers (connectivity)
    - "E-form" development
    - Continuous improvement
    - User friendly (for internal and external users)
    - Troubleshooting
- **Organizational Development** (ideally OD, manufacturing and TD experience (theoretical and relevant applied skills))

- Assist with initial development of centers upon standing them up
- Provide direction on organizational structure and roles
- Collect and share best practices
- Assist in continuous improvement and center training
- Help with transitions in centers as the Network matures from its initial state
- Work with the Communications Director to continuously improve internal and external communication skills

- **Staff support for NC, TAB, EAB and Institutes**
  - **Program support for Institutes**
  - **Administrative support for NC, TAB, EAB**

Conclusions

When allocating resources to support the recommendations above, funding and potential Congressionally-allocated resources need to be considered, as well as actual needs of Institutes. In addition, a means to offer additional assistance/support if needed should be considered.

ANNEX 30

NATIONAL NETWORK FOR MANUCTURING INNOVATION:

Intellectual Property Management

Background

It is the intention of the Federal government to develop an intellectual property (IP) policy for the NNMI, published by the AMNPO, consisting of the guidelines and recommended practices related to **IP Ownership, IP Rights, IP Licensing, and Data Control** within Institutes. Individual Institutes will develop, as part of each Institute's Governance and Membership Agreement, their own IP plan which will contain all operational rules for treatment of IP within that specific Institute.

This is a working document of IP policy guidelines for the NNMI including how to address Institute-Developed IP (IDIP), which is defined as IP developed at an Institute using Institute or government funds. Institute funds include any funds that originate from the Institute including those that are generated via IP ownership, membership dues (including any in-kind funding) and contract for research fees. As the objective of the NNMI is to drive innovation into the market with as little friction as possible, the IP policies must emphasize engaging and supporting industry. Clearly, the IP strategy for a large consortium will almost never be the ideal strategy to all parties involved. There will be a constant struggle between the need to balance individual and participating organizations' rights within the context of a consortium providing IP benefits to members. Furthermore, the needs of large enterprises will vary from those of the small-and-medium-sized enterprises (SMEs) as well as academe and the government. Thus, the recommendations presented in this document must be considered a starting point, and the IP strategy for Institutes must continually evolve to meet the demands of current and future partners and technologies.

Recommendations

With respect to IP guidelines for the NNMI, one recommendation is that Institutes should not consider IP as a potential source of revenue for fiscal sustainability. This is considered a necessary and best practice for gaining participation from large and SME manufacturers alike. Organizations have little incentive to participate in a group activity if a central authority such as the non-profit organization were to claim ownership of all IP. Further, IP ownership increases the burden on the Institute to maintain and defend IP. Another recommendation is that an Institute should encourage applied research project team partners to pre-negotiate terms no later than the start of a joint project. In contrast, membership arrangements which provide a royalty-free license (to some or all member entities) for IDIP are not productive or equitable.

Terms to be pre-negotiated should include any restrictions that university partners have on publication of jointly owned IP. To encourage participation from SME partners, another consideration would be for the Institute to promote and encourage proper IP protocols and practices. This would include helping SMEs understand the larger IP landscape as well as to oversee that overly broad patent applications are not unfairly staked out by larger companies.

Proposed recommendations below include:

1. Intellectual Property Management
2. Detailed Communications Plan and Execution Strategy

Summary of Key Best Practices

1. IP should be owned by member(s) employing the Inventor(s)
2. Institute may own IP, but does not seek to own IP. Furthermore, while an Institute may own IP, it may not be in the Institute's best interest to develop a technology transfer office to market or license the IP; rather, this could be left to the other partners that share in the IP ownership.
3. Entities that participate together in a project share IP based on project agreements.
4. Background IP is owned by the supplier of the IP, and no rights are forfeited by bringing that IP into Institute projects, unless IP is used in lieu of membership dues or as a cost share. The owner of any background IP shall allow its use in that specific project by participating partners for the term of and sole purpose of the project. In the event that the parties deem the said background IP may be instrumental in the further use and deployment of the technology, process or product developed via the work of the partners participating in the project, the partners will provide for the continued use of the IP beyond the close of the said project as deemed necessary and agreed upon by the owner of the IP in the initial agreement. Procedure/protocol for valuating IP is needed.

Intellectual Property

1. Should be owned by member employing Inventor; Co-inventors' employers own jointly.
2. Ownership and joint ownership of patents for proprietary projects determined by project agreement.
3. Rights to IDIP are available to a member only for IP developed during the time during which the member is in good standing. This incentivizes early participation and encourages a long-term commitment.
4. Members owning IDIP shall grant the Institute and members-in-good-standing (all membership levels) at the time of creation a limited, non-exclusive, license to use the IDIP for the member's internal procedures, research or development purposes (but not to make, use, or sell products or external processes for commercial purposes). License terms (including royalties) are to be negotiated in good faith in a separate agreement from the membership agreement.
5. Intellectual property developed within the Institute facilities or networked organizations, without federal funds (such as externally contracted research, fee-for-service activities, industry crowd-funded projects, company incubation) need not be shared with other members and is not considered IDIP.

Background IP

1. Background IP remains the property of original owner.
2. Institute/members gain no right to background IP - unless provided as cost share or under agreement with owner.

3. If provided as cost share, then background IP should be treated as IDIP (e.g., IP funded by Institute). In such a case, substantial efforts will be required to develop Institute guidelines for valuing IP.

Data Rights

1. Data are owned by the member(s) generating the data.
2. Pre-existing data remains the property of the original owner.
3. Data that is generated by parties engaged in a project but funded by an Institute will be owned jointly by the members generating the data and the funding Institute unless an agreement stating otherwise is mutually agreed upon by the parties (Note: "funding Institute" is intended to cover times when Institutes may collaborate on a project)
4. Pre-existing & generated data are free to use by all members unless marked proprietary by owner.
5. Protection of proprietary data: All proprietary data must be properly marked. Pre-existing proprietary data are held confidential unless released by owner. Generated data is held confidential for an agreed upon period of time.
6. Usual exclusions: data already in possession, data independently developed, data that become publicly available without breach, data from a third party received without restrictions.

Publications

1. Publication of project results is encouraged but not mandatory. However, publication of jointly owned IP may be delayed in order to preserve a competitive advantage.
2. Project participants should receive copies of draft publications within a reasonable agreed upon timeframe so participants may assess the propriety and patentable nature of the project findings.

Government Rights

1. Government purpose rights (GPRs) are the data rights recommended for any cooperative agreement and for Institutes that are co-funded by the Government.
2. GPRs permit the Government to use, modify, reproduce, release, perform, or display technical data within the Government without restriction and to release or disclose technical data outside for Government purposes (not for competition).
3. GPRs expire in 5 years, unless otherwise negotiated, and converts to unlimited rights, which can be used for competitions.

Revenue Models

1. Institutes should be encouraged to generate their revenue and profit models through contract-based research and fee-based services that support and enable companies to

develop and commercialize technologies, rather than establishing or having ownership in commercial based entities that leverage the research and development.

2. Institutes should provide preferential licensing and royalty treatment or exclusive rights to US-based companies that commit to have U.S.-based manufacturing operations and key supply chain partners. Parts of the licensing and contract arrangements will specify the licensing and development to be restricted to U.S.-based companies.

ANNEX 31

NATIONAL NETWORK FOR MANUCTURING INNOVATION:

Technology Focus Area Identification for Institutes

Background

The **identification of technology focus areas for institutes** is critical to the NNMI. Due to the rapidly changing technology landscape, the process of determining and prioritizing key technologies for institutes within the Network must be continuous. This document presents the results of the discussions among AMP 2.0 Working Team-3 regarding Technology Area identification (ID). Note that his discussion is distinct from but complements the analysis and approach developed by Working Team-1 to analyze and prioritize manufacturing technology areas for prioritized federal investment, as outlined in Appendix 1 of the full report, because the focus of the present annex is only on the use of NNMI institutes as a mechanism. This document outlines the process of identifying, scoping, and assessing potential technology focus areas in the future, rather than selecting specific technologies. *It is understood that initial Institutes may have given technology focus areas that are aligned with the priorities and missions of the funding agencies. These recommendations are intended to provide general guidance in determining focus areas when applicable.* Key concepts for the process are presented followed by critical questions that could be used to identify focus technology areas for the NNMI. While the current focus is establishing new institutes and providing a mechanism to help identify initial technology areas, the mentioned criteria may be used as a guideline by the Technology Advisory Board mentioned below as they identify future technology areas for investment.

It is important to note that some of the recommended questions are not directly associated with the target technology, but rather intended to establish if the necessary support required to develop and commercialize the technology is in place. In cases where the necessary support does not exist, it may be premature to invest in the development of a certain technology. Evaluating the support capabilities in areas such as supply chain readiness, infrastructure and or the availability of the required workforce provides an added benefit in that if the development of a technology is important to grow the manufacturing base and it is found that the necessary support doesn't exist, then the need to develop and implement a strategy to put in place the needed support will have been identified.

Key Findings

Considerations for Technology Identification

This section presents critical ideas that the team identified during its discussion. While this is not an exhaustive listing, the following points were raised by all participating sectors in the discussion.

Therefore, it is recommended that the following five concepts be considered during the technology identification process.

1. *The process needs to be outcome driven.* That is, the team must make recommendations that best ensure alignment with Network activities/institute focus and where the Nation needs to be in the future with respect to specific manufacturing sectors. While there are many factors to consider when determining whether or not an investment should be made (via

the NNMI) in a particular technology focus area, it is important to ensure that the target technology is at the appropriate readiness level so as to best leverage further development within the NNMI. It is understood that the "appropriate readiness level" may vary based on a given technology and/or industry; however, it is safe to say that the range should be from TRL 4-7 and/or MRL 4-8. Determining the suitable level can be accomplished by working backwards from the point of commercialization to where it is most appropriate to make enabling investments and to bridge development gaps. This results in an outcome driven process. It is important to note that the outcome needs to be both technically stated as well as economically stated (e.g., identifying both the technologies that need to be scaled appropriately and the value proposition of the final result for the OEMs, the supply chain SMMs, and the delivery chain). Being outcome driven will also help to narrow the scope of the initial request for proposals (RFPs), providing better insight into the target area and more focused proposals. The current DOE RFP (termed a funding opportunity announcement, or FOA) for an NNMI institute related to advanced composites manufacturing is an example of a more focused topical area that has the potential to support multiple sectors including energy, aerospace, and automotive. Given that specifications and requirements of these different sectors are significantly different, however, there may be substantially different technology deployment strategies at these MRLs and at higher TRL/MRLs, as well as different workforce and supply chain needs.

For cases that will require government funding, explain why technology and manufacturing scale up has not, cannot or will not be successful under purely private, market driven forces. Describe why the market has not/has not been able to react or while market failure is probable and why government investment is necessary. Will the technology development and manufacturing scale up slowly or not at all under purely private, market-driven forces? Does the Technology explicitly enable critical government objectives such asnational security, energy security, food or water security, disease control, and/or trade? Will this area not mature based upon industry-only investment? It should be noted that an acceptable answer to this question is that a specific technology area will mature too slowly to reach critical mass in the U.S. before another part of the globe dominates the area.

2. *The proposal should include how the Institute plans to leverage/engage the diverse landscape of the U.S.* The definition of diversity encompasses a wide spectrum of concepts including classical sectors of culture, gender and race. However, what makes the U.S. so robust and resilient as a nation and culture is the ever changing landscape of its diversity not only in the classical areas, but in areas such as business types (e.g., small, medium and large enterprises), professional societies, educational institutions such as K-12, community colleges, 4-year colleges and research universities, and government at all levels from local, to state, to regional to federal. Thus, when addressing the nation's ability to successfully compete in a future technology area, diversity along many lines must be included in the discussion, including regional diversity.

3. _There should be reasonable evidence that the proposal has the potential to generate economic value, provide national security and sustain competitiveness._ This can be based on considerations that may provide a competitive advantage such as a unique execution approach, market positioning, available assets, regulatory/IP regime, or being first in entering a given market. In cases where first entry into a technology area is a prime consideration, it must be determined if the nation has the ability to successfully compete. This requires an analysis of the market and business case to ensure that the U.S./and or a region/regions within the U.S. can create and/or maintain a competitive position in the global market, considering structural issues such as infrastructure, domestic technology expertise, access to capital, labor and productivity, existing supply chain and workforce capability.

4. _In support of an outcome driven process, it is necessary to ensure that the Nation has the supply chain, can or will sufficiently develop or scale the supply chain in time to support the technology area when it is deployed._ Without the supply chain in place, the technology cannot be scaled and thrive within the nation. Small and mid-sized manufacturers not being aware of trends and opportunities limits their participation and investment. Suppliers don't always know where technology is going, so they don't invest in activities aligned with market trends. In many cases, even with ample awareness, they do not have expertise and resources to participate in the evolution of supply chain capabilities that will be required to commercialize the technology when ready and will need access to market/technical insight and commercialization support. While OEMs dictate needs, the supply chain must be proactive and lead the way so it is prepared to meet the needs of the market through needed product and process innovation. Unfortunately, small and mid-sized manufacturers do not have the capabilities to "stay ahead of the curve." It is incumbent on large manufacturers and the government to ensure supply chain alignment and readiness as other nations are making sizeable investments in this activity.
    a. Sizeable, sustained investments to support small and medium sized manufacturers in the supply chain to better ensure alignment with trends and better support readiness for scale-up will be required to maintain U.S. leadership in innovation and advanced manufacturing.
    b. The NNMI, and more specifically each regional Institute working in concert with the MEP, is uniquely positioned to evaluate supply chain readiness, identify needs and to facilitate activities necessary to ensure required development. The NC should have detailed discussions and develop the model in a way so as to fully leverage each Institute's regional presence and construct their role as a central figure in ensuring regional alignment of manufacturing assets across the full spectrum of the supply chain and better ensure its development. The Network function can augment regional activities by helping to ensure national alignment.

5. _Just as with the supply chain, it is necessary to ensure that the Nation has the workforce capability in place for the technology scale-up and deployment._

Questions to be Asked When Identifying Technology Areas

The following important questions were identified by the team as important questions to ask when identifying technology areas for the NNMI. The questions are loosely broken into four areas. As the numbers of issues raised were significant, each question set was noted as either a primary or secondary consideration.

Commercialization
> Primary Considerations
>> 1. Will the technology attract private and or public (non-federal) investment to commercialize?
>> 2. Is this technology capable of supporting/driving national economic development and national security?
>> 3. What is the time frame for development required for commercial application?
>> 4. What technologies are replaced, added to, improved on, or does it provide a new way of manufacture?
>> 5. Why was the technology not developed by others? (Feasibility, investment, critical capabilities, etc.)?
>> 6. Are the appropriate financial resources available for a successful outcome?
> Secondary Considerations
>> 7. What cost, time and material benefits will this provide? What is the change compared with existing capabilities?
>> 8. Is the technology already part of the nation's portfolio? Can other technologies in the federal portfolio be leveraged? Can existing institutes combine forces on their own or with the new technology institute to solve this challenge?
>> 9. Is this a disruptive technology (in other words, a game changer, key manufacturing component, or product relevant)?

Workforce Development / Local Execution
> Primary Considerations
>> 1. Is there a local source for the necessary manufacturing/equipment labor? (Is there a local skilled labor pool?)
>> 2. Is there a local source for operations, technical and engineering resources and training (e.g., Universities, Technical Trade Institutes, etc.)?
>> 3. Do these institutes/institutions have the appropriate facilities, majors, and degree programs?
>> 4. If the facilities and degrees require updates, are the updates critical to the first manufacturing facility, or would it be reasonable to hire future graduates with updated degrees in +4 to +6 years?
>> 5. Are there local/government funds to train/retrain workers, employees?
> Secondary Considerations
>> 6. Are there online capabilities and courses available?

7. Is there a training program/apprentice program in place to up-skill workers?
8. Does the technology development business plan have consideration training/development costs?

Supply Chain – Infrastructure
Primary Considerations
1. Is this a stand-alone technology? What other technologies, capabilities or infrastructure are necessary to make this commercially viable, or provide a full manufacturing complement, if mission-critical?
2. Are there regional manufacturers and service providers necessary for the development and deployment of the technology t?
3. If suppliers are within the U.S., where are the critical commodity suppliers located, and what is their required time period for standard and expedited delivery?
4. Are there strong existing regional manufacturing networks and intermediaries to leverage (such as the Manufacturing Extension Partnership, or the next generation version as envisioned in the National Academy of Sciences report, or state level organizations such as New York State FuzeHub or Massachusetts Advanced Manufacturing Collaborative) in terms of supply chains?
Secondary Considerations
5. Is there a core supplier base regionally or within two days via land travel?
6. If suppliers are in a foreign country, what is the risk associated with their utilization? What would be the costs in developing these suppliers locally?

Logistics – Infrastructure
Primary Considerations
7. Is the technology dependent upon any specific infrastructure requirements? (power, transportation/ connectivity/ etc.)
8. What are the capabilities of logistics delivery and where are the pickup points – receiving/shipping facilities, rail spurs, etc.? What is the current project growth loading of the existing logistics chain – *e.g.* Will regional growth of natural gas delivery via rail hamper necessary transit?
Secondary Considerations
9. What is the proximity to cargo ports and location to major road links?
10. What is the cargo airport proximity and delivery capability to and from airport
11. What is the location of forwarders / major shipping capabilities / companies?
12. What are the trends in regional/local expansion/contraction and costs of ready energy supplies of coal, natural gas and hydro-derived power, as well as natural gas and electricity?

Conclusions

Of the evaluation criteria mentioned above, the following should be considered priorities:

- Industry pull

- National security/economic interests.
- Cross industry impact by sector and size
- Ability to build on current US competitive advantages

These criteria were in fact used within AMP2.0 to identify Manufacturing Technology Areas (MTAs) of high national priority and detailed analysis, as discussed in Appendix 1 of the full report. In the event that in any case, after a thorough evaluation of potential technology areas for investment, it becomes apparent there is no clear leader, it is recommended that the following criteria be considered in determining the most appropriate technology:

- Time to commercialization
- Value to market
- Competitive advantage to US manufacturing in the global market and the estimated length of time of US advantage
- As part of proposal, applicants should demonstrate through supporting data that the necessary support structures (as mentioned above) exist.
- Employing existing federal mechanisms with the capabilities to evaluate regional support structures should also be considered as part of the evaluation process.

Additional Considerations

The NNMI Working Group's recommendations on Technology Area ID are proposed guidelines and the specifics of each opportunity must be evaluated. The following needs to be considered when moving forward with these recommendations:

- If a given technology is truly transformative in that maturing the technology and its manufacturing readiness could give U.S a first-mover advantage, then the chances are the needed supply chain, workforce and the infrastructure do *not* exist. That does not mean that investment it such technology development would not be justified. In this case, a role of the NNMI may be to develop the knowledge, skills, shared infrastructure and test equipment – also known as the "industrial commons" and the corresponding supply chain – for these emerging technologies. In the event such "industrial commons" already exists, then it should be questioned if there is in fact a market failure that explains why industry alone is not addressing the manufacturing technology development, scale-up, deployment, and commercialization. If not, the technology in question may not be a candidate for an NNMI.

- The development of "platform technology" should be common to all application areas. Such "platform technology" is not translational R&D, but rather applied R&D. Ideally, applied R&D should be funded by the private sector. Translational R&D may be best suited for public-private partnerships to fund, such as via the NNMI. However, note that more extensive discussion of platforms in the context of advanced sensing and controls is discussed in Appendix 1 and in Annexes 1-2 of this full report.

- Generally, the main focus of technology investments should be economic value, with an indirect focus on national security within the context of economic value. Maintaining leadership in innovation and a strong economy are also components of providing for national security. In DoD-funded NNMI institutes, investments focused on technology directly related to national security are appropriate.