

RFI on NNMI

The NIST-hosted AMNPO is specifically interested in receiving input pertaining to one or more of the following questions:

Technologies with Broad Impact

1. What criteria should be used to select technology focus areas?
 - Select topics with technology readiness levels (TRL) in the range of 4-8, that have quantifiable high impact on competitiveness and security, and that have manufacturing readiness levels (MRL) that are low (1-4).
 - Select topics that have the potential to impact many different kinds of products that are important; an example from the past is semiconductor devices; a contemporary example might be light weight structural materials, or smart control systems.
 - Select topics that have the potential to transform an existing industry segment in ways that are not possible with conventional technology; examples might be technologies that enable "custom fit clothes on demand" or that enable "factory built, assembled on site custom homes."
 - Select topics that have the potential to create a completely new industry; an example might be personalized medicine, which depends on mapping a person's DNA and then custom designing drugs, gene therapies, or maybe even devices to enhance/extend life.
2. What technology focus areas that meet these criteria would you be willing to co-invest in?
 - Technology impact and readiness are both key factors when determining areas for all stakeholder investment.
 - Systemic pre-competitive technologies and for proprietary technologies that have impact on a broad range of industry sectors possess a time-to-market resulting in real impact on stakeholder's product weight, power and cost.
 - The "willingness to invest" test at a university needs clarity. In many cases such willingness is an indication that Federal investment may not be needed to achieve readiness. It's exactly those high potential but (perceived) high-risk technologies that are the best candidates for Federal investment.
3. What measures could demonstrate that Institute technology activities assist U.S. manufacturing?
 - Manufacturing Readiness Level (MRL) advancements in selected technology areas. Documented individual stakeholder value propositions and the resultant validation of outcome gained for resources invested.

- Scope includes both material and process as technologies but also includes the MRL integrating threads (modeling, design, properties, supply sources, policies, regulations, etc.) that result in business readiness. Addressing all aspects of readiness is required for accelerating and achieving impact.
 - A good indicator of success for an individual NNMI Institute would be the number of spin out companies or licensing agreements to commercialize. If the Institute leads an innovation that results in an MRL of 7 or higher, then it would be natural for the Institute to spin out a company to commercialize--or partner with somebody to commercialize.
4. What measures could assess the performance and impact of Institutes?
- Intellectual property created (e.g., patents), licensing agreements, and companies launched or precipitated.
 - The Institute, when strongly linked with US research universities, represents potential change agents that can lead the US research university to have greater (and measurable) societal impact.
 - University affiliated institutes with a strong translational mission can influence the US research university to become measurably (by growth) more innovation savvy and innovation productive.

Institute Structure and Governance

5. What business models would be effective for the Institutes to manage business decisions?
- The NNMI concept requires creating a business model that shifts the culture in universities towards regional development engagement. A 3-5 year launch grant is not going to achieve such a business model. It takes a sustained investment to produce an organizational reorientation. The government NNMI business model needs to include the government role in both the initial launch phase and the sustainment of the operating phase. The business model for industry needs to go well beyond the “buying a seat on an Institute board to get a share of the Federal funds” approach.
 - The business model for a University focused on taking ideas to innovations would include (1) an incentive structure that recognizes the value stream of going from idea creation to manufacturing innovation, and (2) a faculty that includes members interested in taking an idea collaboratively to application.
 - Some of these questions have been addressed in the implementation of the Canadian Network of Centers of Excellence (NCE) structure. There exist policy evaluations on the effectiveness of different structures and governance models.
6. What governance models would be effective for the Institutes to manage governance decisions?
- The governance model for Institute decision-making has analytical and culture components. Assuring the alignment of Institute intents, incentives and strategies

is foundational to the successful life-cycle governance of a multi-stakeholder Institute. For example, today the primary university incentive is on idea generation and not on idea deployment. This narrow focus cuts across the entire lifecycle of the professoriate. For a University based Institute (or even for University participation), University involvement in decision making would require an “entrepreneurial” professor to remain affiliated with the university while at the same time have a leadership role with a company that will commercialize a new technology.

7. What membership and participation structure would be effective for the Institutes, such as financial and intellectual property obligations, access and licensing?
 - Joint investment, joint involvement, and joint governance must address the culture and practices of the academic institution, private business/industry, and government at all levels for the Institute to have an impact regionally on jobs as well as nationally and globally in terms of technology innovation and deployment.
 - Issues such as partial ownership of the new technology or conflicts of interest are really thorny, but will have to be worked and well known by the Institute stakeholders.
 - Faculty members (and their related post-docs, GRAs, staff scientists, etc.) will be involved across the life cycle of the Institute as manufacturing readiness levels increase and users begin to move toward commercialization. This means that there will have to be a University Administration enabling effort to adjust existing practices and processes around employment, conflict of interest management, intellectual property management, etc.
8. How should a network of Institutes optimally operate?
 - The NNMI Institutes are to be a focal point for investment in transitioning technology to practice. A key function of the network is to help guide that investment process which will mandate an ongoing process of Institute evaluation and comparison. If some Institute is not really being successful, then that fact should be recognized early, and investment in that institute terminated.
 - The NIST AMNPO should meet regularly with the set of Institute Directors to share “what works and what doesn’t” in a collaborative manner. A yearly National NNMI Conference should be held to extend the reach of the NNMI practices and results across the Country.
9. What measures could assess effectiveness of Network structure and governance?
 - Ultimately, the success of the NNMI is determined by its impact on the domestic economy--did it lead to the production of new products that benefit domestic customers, creating new jobs (domestically)?

Strategies for Sustainable Institute Operations

10. How should initial funding co-investments of the Federal government and others be organized by types and proportions?

- The Federal government should invest appropriately in both the launch and sustainment phases of the Institute. Sustainment phase investments should be linked to products needed by the government and systemic efforts that impact a broad set of sectors but are very high risk. Targeted Federal funding should be at least 25% in sustainment phase; non-federal funding to include state funding, industry funding (both cash and in-kind).
 - Current accepted business models suggest such an Institute will require ongoing public support--much like the Fraunhofer Institutes. The vagaries of the business cycle and the naturally short-term perspective of (American) companies make it virtually impossible to sustain such an enterprise with only private investment. The questions, of course, are: "What's the mix between public and private investment?" And is there a more robust business model?
 - Here's a thought for consideration--the federal investment could essentially be a "pool" and any Institute can dip into the pool, but for every federal dollar it takes out and spends, it has to spend at least 3 dollars from either state or private sources.
11. What arrangements for co-investment proportions and types could help an Institute become self-sustaining?
- Institute's mission should include support of the state's or a region's economic development mission and the Institute should act as a full partner in economic development activities related to the Institute's specific technology areas.
 - Success requires that State governments have a willingness to go "all in" not just in terms of the research institute, but also in terms of "encouraging" either start-up companies, or large corporation investment in the state, along with investment in targeted VoTech programs to provide the workers to fill the domestic jobs.
12. What measures could assess progress of an Institute towards being self-sustaining?
- The key to Institute sustainability is going to be the delivery of results, i.e., is the Institute actually bridging the MRL gap and as a result, enabling the creation of economic activity that impacts domestic job creation.
 - Sustainment progress may be measured by growth in industry resource portion through consortium membership fees, industry research support, and maintenance or growth in base state support.
13. What actions or conditions could improve how Institute operations support domestic manufacturing facilities while maintaining consistency with our international obligations?
- Focus should be on increasing MRL collaboratively with using stakeholders – find the “tipping in” conditions for stakeholder investment. Industrial “tipping in” will result in industrial value and their resource support to the Institute going forward.
 - Whatever is produced in the NNMI Institute is not "containable" domestically. If it's a great innovation, it's going to spread globally.
14. How should Institutes engage other manufacturing related programs and networks?

- Successful Institutes will operate with a dynamic network of skills and participants. Such non-hierarchical models are conducive to collaboration with other Institutes and initiatives. The approach would be to drive the desired engagement via incentives and measures.
15. How should Institutes interact with state and local economic development authorities?
- State and local economic development efforts need to be a focus of the Institute business model from day 1. This node on the Institute network would be aligned with the technology efforts of the Institute and would 1) continually seek enabling opportunities for achieving the Institute objectives within the region and 2) participate in the Institute Board meetings with a progress, opportunities and challenges report for the Board.
16. What measures could assess Institute contributions to long-term national security and competitiveness?
- The number of adoptions of NNMI Institute enabled products or processes.
 - The Institute would pick the manufacturing readiness initiatives based on 1) technological readiness, and 2) impact on competitiveness, national security, and jobs. A fully capable Institute would have the capability to analyze the projected “impact” of establishing a manufacturing readiness that would be implemented through the industrial base. Furthermore such a capable Institute would have the capability to assess the barriers (e.g. policy and financial) for deploying and achieving the needed outcomes

Education and Workforce Development

17. How could Institutes support “advanced manufacturing” workforce development at all educational levels?
- Developing and managing apprentice programs for senior level and graduating engineers and scientists.
 - Reaching into existing education programs (STEM, Community/Vocational education, and University GRA/intern/CoOp) to match Institute R&D efforts with workforce needs. However, the onus should be put on the STEM education system (and other large National initiatives) to build the bridges to the NNMI, not the other way round.
18. How could Institutes ensure that advanced manufacturing workforce development activities address industry needs?
- The Institute would analyze the manufacturing research level (MRL) status and needs for the focus manufacturing technology and determine the gaps and priorities. The resultant skills "requirements definition" would be used by the Institute to host Regional workshops of industry, education and training providers, etc. to establish awareness in the Community of the need and to define the role of the Institute R&D efforts in creating the regional pipeline of skills for the industrial users of the technology.

- The Institute role would be focused on “hands on” learning by doing.
 - The Institute scope would be incidental, not systemic, to the large scale National workforce development initiative. The Institute’s Regional role is important in that it contributes to establishing specific education and training requirements.
19. How could Institutes and the NNMI leverage and complement other education and workforce development programs?
- Workforce Education and Training will be a node on the Institute’s operating network. The focus of the node would be to establish the education and training requirements related to the advanced manufacturing of the Institute and to collaborate with all other development programs to drive the workforce development to align with the industry needs for the new products. This node would also report to the Institute Board to report on progress, opportunities and challenges.
20. What measures could assess Institute performance and impact on education and workforce development?
- Within the Institute, the measures are straight forward – have the priorities been addressed and the gaps filled for the Workforce “Skills Requirements” plan that is established for each major initiative to advance the MRL of high impact technologies?
 - An appropriate measure is the extent to which content in those curricula can be traced back to the Institute activities. If nothing being taught reflects developments from the Institute, then it's having zero impact.
 - There are existing models working for example in Minnesota, Michigan, Ohio, New York, and Wisconsin. The NNMI challenge is to focus these existing models and their best practices on the emerging innovative products emerging from individual Institutes. The AMNPO at NIST could cover each Institute’s approach at the scheduled review meetings and could have a session sharing best practices at the NNMI National Conference.
21. How might Institutes integrate R&D activities and education to best prepare the current and future workforce?
- At least for Institutes, which are university-based, it will be quite natural for the work in the Institute to find its way into the curriculum. To the extent that the Institute has a significant impact on practice, the work will even show up in the undergraduate curriculum.
 - The Institute’s mission, structure, and business model must include a focus on preparing current and future workforce for the Institute’s high impact initiatives. A workforce focus group will be represented in the Institute structure as a node that is accountable for integrating workforce requirements based on needs and then collaborating with Regional workforce efforts to establish a regional plan for achieving timely workforce skills to support the Institute emerging high impact manufacture of products.