

Response to Request for Information Regarding National Network of Manufacturing Institutes (NNMI)

If the United States wishes to more consistently “bridge the gap” to transform basic scientific discoveries into useful technologies and on into commercializable products that can be manufactured at scale (or manufacturing processes that can be implemented at scale), it needs to provide a much stronger institutional platform through which industry and universities can enter into public-private partnerships to conduct applied (or “translational”) research and development (R&D) activity. Like other countries (such as Germany and Japan), the United States needs to provide an institutional structure that can bring together cutting-edge research in an industrially relevant way across a number of sectors and technologies (such as advanced machining, optics, photonics, nanotechnology, robotics, advanced materials and surfaces, wireless technologies, and many others) by providing a platform for joint pre-competitive research, prototype manufacturing, education and training, and pre-production and cooperative technology transfer arrangements with companies

To be sure, the United States does have a few such sector- or technology-oriented centers scattered throughout the country that specialize in R&D, prototyping, and training and education around specific technologies. A strong example is the Commonwealth Center for Advanced Manufacturing (CCAM) in Virginia, a public-private partnership focused on advanced aerospace and aviation R&D and education. In Minnesota, Saugus 2 is trying to form a cooperative research institute for the U.S. foundry industry (developing castings from molten metals) that seeks to reinvent manufacturing processes with the goal of recapitalizing the American foundry industry with new advanced manufacturing processes and facilities. Other such centers include the National Textile Center at North Carolina State University and the Northern Iowa Metal Casting Center. Many governors, including both Republicans and Democrats, have supported similar kinds of institutes. Yet, historically, these institutes have tended to both be under-funded (relative to their return on investment) and isolated in scope to their state and region and therefore not easily replicable or scalable across the nation.

What the United States has lacked is an integrated and well-funded national network of industry-led, sector- or technology-based centers performing advanced product and process R&D. The Obama Administration has proposed to address this by creating a National Network of Manufacturing Institutes (NNMI) that would bring together industry, universities, community colleges, federal agencies, and states to accelerate innovation by investing in industrially relevant manufacturing technologies with broad applications. The network would help bridge the gap between basic research and product development, provide shared assets to help companies (including small- to medium-sized enterprises, or SMEs) gain access to cutting-edge capabilities and equipment, and create a compelling environment in which to educate and train students and workers in advanced manufacturing skills. Each institute would serve as a hub of manufacturing and engineering excellence and have a well-defined technology focus. The institutes would address industrially relevant manufacturing challenges on a large scale and provide the capabilities and facilities required to reduce the cost and risk of commercializing new technologies. The following responds to questions raised in the National Institute for Standards and Technology’s Request for Information about the NNMI proposal as issued in the *Federal Register* (77 FR 26509) in May 2012.

Manufacturing Institute Structure, Governance, Operations, and Measurement

For the National Network of Manufacturing Institutes effort to succeed, it's vitally important that the individual institutes comprising the Network be initially brought forward by industry consortia (ideally in partnership with universities), which would then be competitively selected. In other words, the government should not be pre-selecting the technology or sector focus areas for the manufacturing institutes, but rather industry should bring manufacturing institute proposals to the table. All technologies or sectors where a clear case can be made for enhancing the productivity and/or competitiveness of establishments in U.S. manufacturing industries should be viewed as candidates for a manufacturing institute. If there are more manufacturing institute proposals than funds are available to support them and the proposals are equal on other merits, the criteria should be designed to select those technology areas that have the widest possible beneficial impact on U.S. manufacturing establishments in terms of boosting their productivity and supporting their ability to produce higher value-added products.

However, while the Obama Administration proposal called for the creation of 15 individual manufacturing institutes, this should only be seen as a general target and not as a hard cap on the maximum number of institutes. Rather, the realized number of institutes should be responsive to the needs of industry. Given the scope of the challenge to U.S. manufacturing (as ITIF documents in *Worse than the Great Depression: What Experts are Missing About American Manufacturing Decline*) and the diversity of manufacturing technologies and sectors across a country as large as the United States, it's important not to pre-judge the size, scope, or number of the manufacturing institutes. Indeed, industry may come up with a diversity of proposals for the manufacturing institutes, including some in industries which are much more dominated by SMEs (e.g., the foundry industry or the jewelry industry), that are equally compelling, and in such cases the country might be better off with two smaller manufacturing institutes than one larger manufacturing institute (given of course that the proposal envisions the necessary scale in terms of number of industry participants, researchers, etc.).

Moreover, the selection of manufacturing institutes should not be biased toward particular advanced manufacturing industries or biased for or against manufacturing products vs. manufacturing processes. Innovation in manufacturing can come in a variety of different forms, from institutes with a variety of different size structures, and from technologies at varying degrees of maturity. It's important that the selection process for the manufacturing institutes be open, agnostic, and above all responsive to the needs of industry.

The National Network of Manufacturing Institutes approach will only thrive if industry has skin in the game, and therefore it's imperative that at least 50 percent of the initial start-up cost—as well as at least 50 percent of the ongoing operational cost of each institute—be borne by industry. In starting up each individual manufacturing institute, the federal government should bear approximately 35 percent of the initiation cost, while state and local governments in the region in which the institute is located should bear approximately 15 percent of the cost.

While industry can be expected to bear a greater share of operating costs for the manufacturing institutes over time, the vision should not be that the manufacturing institutes become completely self-sustaining over time. This is not a desirable goal. Moving to a completely “self-sustained by industry model” will force these institutes to essentially do what industry is already doing, which is to become short-term in their project selection and move further down the technology path toward product development activity rather than doing the riskier, earlier stage applied research that it is the goal of the institutes to promote. Even if at a lower share over time, it’s important that there be ongoing federal support for the manufacturing institutes, both to reflect their status as true public private partnerships, to encourage the institutes to continue to engage in riskier applied R&D activities, and to continue the education and training activities which should also be viewed as a core part of the institutes’ mission.

At least initially, at least half of the federal government contribution toward the institutes should be on a “non-project” basis. That is, it should be general support with federal funds as opposed to tasking the institutes with specific assignments (e.g., a Department of Defense contract to an institute to solve a particular manufacturing problem). Initial funding should be institutional support and not predominantly project-based, for that could make the focus of the institutes too narrow. (However, as the institutes evolve, more of the federal government contribution could be targeted toward specific projects.)

As with SEMATECH, the individual manufacturing institutes should be set up as independent entities, specifically as free-standing 501(c)3s. The dominant role of governance over the institutes should be played by industry. The manufacturing institutes should have broad industry membership. At least five firms in a manufacturing industry should comprise the industry consortia backing an institute. However, policymakers should avoid institutes where only a very small number of firms are participating—except in cases when a small number of firms represent a very large share of an industry. (However, a manufacturing industry with over 100 manufacturing enterprises in which, for example, only three companies were participating should not be eligible for an NNMI). Optimal membership structure should include a range of firm sizes. It’s vitally important that SME manufacturers comprise a significant component of the membership structure of many of the manufacturing institutes. This is important because SMEs are often vital links in the supply chain of manufacturing industries and critical suppliers to OEMs (not to mention that SMEs account for the vast majority of American manufacturers). If SMEs are not participating in the manufacturing institutes, an important chance to increase the overall competitiveness, productivity, and innovation potential of key manufacturing sectors is missed.

Foreign enterprises should be eligible to participate in the manufacturing institutes so long as they have significant capacity to absorb and utilize technologies and innovations developed at the institutes in the operations of their establishments in the United States. However, enterprises (or establishments thereof) headquartered in countries that are on the United States Trade Representative’s (USTR’s) Special 301 Watch or Priority Watch Lists—which identify countries that provide inadequate intellectual property (IP) rights protections to U.S. IP rights holders—should not be permitted to participate in any manufacturing institute.

As noted, it’s important that each manufacturing institute work closely with state and local governments and their development authorities. Each institute proposal should assess the local/regional landscape

and identify local universities/colleges and state or local government initiatives/research institutes related to the technology or sector of the manufacturing institute and develop a coordination and partnership plan with those entities.

Also, as noted, each manufacturing institute should receive at least fifteen percent of its budget initially (and at least ten percent on an ongoing basis) from state and local governments (even though the institutes should be seen as national resources). Perhaps the best way for state and local governments to make this contribution is by “buying SME slots” for their SME manufacturers to participate in the activities of the manufacturing institute. For example, state/local governments could provide a \$20,000 voucher their SMEs could use toward participating in the manufacturing institutes. Despite the fact that each institute must be located somewhere (and should receive contributions from state/local governments in that region), it’s critical that the manufacturing institutes be viewed foremost as national resources for manufacturing and engineering excellence in key technologies and sectors. The NNMI approach must foremost be a sectoral one, not a regional one.

It’s critically important that SME manufacturers be involved in the manufacturing institutes. To be funded, each institute should develop a strategy specifying how it plans to interact with the Hollings Manufacturing Extension Partnership (MEP) program as part of a sector- or technology-based partnership. (For example, the pilot additive manufacturing institute should specify how it plans to work with the MEP network to help the SME manufacturers MEP works with in addressing their additive manufacturing challenges). Each manufacturing institute should issue a biannual report discussing how the technological and R&D developments at the manufacturing institute over the past two years impact SMEs, both directly and indirectly, and explaining how they work with SME assistance programs, including the Manufacturing Extension Partnership. Furthermore, as part of their education and training mission, each manufacturing institute should integrate with national manufacturing skills standards programs relevant to their sector or technology, helping to develop relevant skills certification standards and training content.

With regard to measuring and evaluating the manufacturing institutes, the fundamental test of whether the institutes are adding value is whether industry will be willing to continue to put cash on the table to continue to support them. The single most important measure of performance should be seen as robust industry funding. But, to get more specific, the impact of the institutes should be measured by the number of establishments that are using the technologies developed at the institute, in the case of process technologies, or the amount of U.S. value-added, in the case of product technologies. Measures should be developed to document how technologies developed at the institutes impact production capability at manufacturing establishments in the United States. In general, the manufacturing institutes should be evaluated both initially and on an ongoing basis on the extent to which they are committed to deploying technologies developed at the institutes to domestic establishments (as opposed to domestic enterprises) that are in the United States. The performance of the institutes should be evaluated every five years by an external review board to evaluate their impact and outcomes.

No more than a maximum of two manufacturing institutes should be located in any single U.S. state.