

**From:** Ashok Mukherjee [<mailto:ashokm@modria-inc.com>]  
**Sent:** Thursday, October 25, 2012 1:42 AM  
**To:** nnmi\_comments  
**Subject:** NNMI Comments

This RFI comment addresses a key aspect of Advanced Manufacturing, as identified by the Advanced Manufacturing Steering Committee/PCAST,<sup>[1]</sup> that of using and coordinating information, automation, computation, software, sensing and networking to plan and control manufacturing activities. For the purpose of this comment, we term all these elements collectively as manufacturing decision-support technologies.

### **The Challenge**

Sophisticated advanced manufacturing technology (e.g., additive manufacturing, advanced robotics) will give manufacturers new abilities to produce complex, unique products using advanced processes. To be commercially successful, the day-to-day production using these advanced processes needs to be coordinated profitably. Well coordinated production typically requires thorough information about several aspects of the relevant supply chain. While ever more ways of sensing and capturing information specific to each product and process are being devised, our ability to put that information to use, through today's manufacturing decision-support technologies is more generic rather than specific to each manufacturer. Therefore, advanced manufacturing technology, with its game-changing ability to manufacture low-volume, low-cost products for specific customers, and create sustainable new manufacturing jobs in the US, risk losing its technological advantage and employment potential due to inadequate operational decision-support technologies to effectively commercialize the advanced manufacturing technology.

The problem gets even more serious for SMEs, who create a large share of new jobs, as they typically cannot afford sophisticated systems. The challenge is to develop appropriate next-generation advanced manufacturing decision-support technologies that can help manufacturers manage their advanced processes and production exactly as they need to, not how the systems dictate. Further, such systems need to be made affordable to SME manufacturers.

### **Solution Approach**

Creating systems to coordinate all elements of decision-making for advanced manufacturing will require a new approach to manufacturing decision-support technology development. First, we recognize that novel system capabilities to use and coordinate information in ways specific to a manufacturer's requirements cannot come from today's technology and therefore, next-generation technologies are needed. Next, we note that developing and implementing these next generation technologies in a way that allows US SME manufacturers benefit from Advanced Manufacturing will need a coordinated effort that draws upon multiple stakeholders.

There are four major constituents to make this crucial aspect of advanced manufacturing successful through an operationally sustainable initiative.

- SME manufacturers who are going forward with advanced hard manufacturing technology but do not have the exposure to appropriate manufacturing decision-support technology and the resources to own it.
- Large manufacturers, wholesalers, distributors and retailers who buy from the SMEs, and who would benefit from the new operational effectiveness that will come to the SMEs from the advanced technology. These companies typically have used decision-support systems to their benefit and have been aware of the wastage in their supply chains due to their SME suppliers not having such systems. Thus, the value proposition to them will be clear – that the IMI will be able to bring about a sea change by enabling their SME suppliers to use new technology commercially, and thus eliminate significant wastage of material, energy and other resources throughout their supply chains.
- Universities and entrepreneurial firms and to some extent, larger vendors, where research and development on next-generation decision, information and automation technologies is taking place. An IMI with the appropriate charter can evidently play the important role of providing a mechanism that can help appropriately select the platform technologies and match them with manufacturers' requirements.
- State governments that see the job growth potential. An estimated 2 million jobs will be supported by an IMI with this charter, directly and indirectly.

The IMI will also be operationally self-sufficient through a business model involving fee-based subscription services for its advanced manufacturing decision-support technology. There will be different subscription structures for large businesses and SMEs, but economies of both scale and scope will be harnessed to offer an attractively priced Service to both these constituents, as well as making the IMI financially self-sufficient.

---

[i] Report to the President on Capturing Domestic Competitive Advantage in Advanced Manufacturing, President's Council of Advisors on Science and Technology (PCAST), Advanced Manufacturing Partnership Steering Committee, July 2012

**From:** Ashok Mukherjee [<mailto:ashokm@modria-inc.com>]  
**Sent:** Thursday, October 25, 2012 1:44 AM  
**To:** nnmi\_comments  
**Subject:** NNMI Comments

This RFI comment addresses a key aspect of Advanced Manufacturing, as identified by the Advanced Manufacturing Steering Committee/PCAST in their report to the President,<sup>[i]</sup> that of establishing a national advanced manufacturing strategy (Item #1 in the said report).

### **The Challenge:**

Determining a manufacturing strategy at the national level in a free-enterprise economy is a vital yet difficult task. Without a strategy, it is hard to know what to emphasize and invest in and why. Yet, strategists must ensure that any prioritization also respects the will of a free market and the risks of operating in a dynamic environment. Once a set of technologies or areas get strategic priority, resources will be invested in those and initiatives taken. However, the longer-term success and viability of the chosen set of technologies will depend on the flexibility of the outcome to changing conditions of economy, global trade, innovations in complementary or competing technologies, etc. This dual need to excel in current choices and remain open and adaptive to future changes underlines the challenge in both strategy content and process.

An additional challenge in establishing a national advanced manufacturing strategy is the absence of a contemporary framework. Most of the acclaimed thought leadership work in manufacturing strategy was done between about mid 1980s to early 2000s. It is perhaps a reflection of the US receding from its leading global position in manufacturing over the last decade or so. As we embark on advanced manufacturing, the technologies, both hard and soft, challenge many of the assumptions – economic, technological, and behavioral – of the established frameworks for developing manufacturing strategy. While the resulting gap is understood by several practitioners and academicians, no comprehensive alternative framework has been developed.

### **Solution Approach:**

Establishing a national advanced manufacturing strategy calls for new thought leadership. Structurally, work of this nature can either be part of an IMI with an appropriate charter, or perhaps, can be taken up at the AMNPO level. This item will be unlike most others in the list of NNMI activities, in that it does not require large investments and workforce training, etc. Yet, establishing a clear and consistent national advanced manufacturing strategy is vital to the very success of the AMNPO charter.

In terms of execution, this type of effort, involving technological, economic, behavioral, and policy perspectives will involve a team comprising policy-makers, industry leaders and academic manufacturing strategy experts. Strategy work often suffers from the risk of lacking rigor, and what the AMNPO will need to ensure is that both the content and process of the national advanced manufacturing strategy is the outcome of an appropriately rigorous exercise in

manufacturing strategy, grounded in the reality of the new economy. One way to do that will be for the team to combine fresh ideas and perspectives emanating from advanced manufacturing technologies with the basic tenets of manufacturing strategy that have been developed, understood and successfully applied for over thirty years. This way, we will successfully develop a contemporary framework the lack of which is a big obstacle in trying to establish a manufacturing strategy in the age of advanced technologies.

---

[\[i\]](#) Report to the President on Capturing Domestic Competitive Advantage in Advanced Manufacturing, President's Council of Advisors on Science and Technology (PCAST), Advanced Manufacturing Partnership Steering Committee, July 2012