Technologies with Broad Impact

1. What criteria should be used to select technology focus areas?

While regional impact adds focus to local economic development and facilitates traditional (classroom-based), workforce development approaches broad impact is best realized by investment in technology areas that will provide a national resource and firmly position the institute's long-term sustainability. Technologies which impact manufacturing in vertical supply chains and horizontally across industrial sectors are best positioned to improve domestic competitive advantage and garner the necessary industrial support to sustain the institute.

2. What technology focus areas that meet these criteria would you be willing to co-invest in?

Enabling technologies that can be used to quantify improvements in structural performance; assure quality and reliability of next generation materials, components, and systems; and assess the variability of manufacturing processes to enable process improvement and control. Among the technologies needed are new sensor developments for extreme and harsh environments (e.g., higher temperatures, corrosive/acidic/caustic conditions, offshore/deepwater, on-process); materials assessment methodologies and implementation strategies; precompetitive opportunities to complete pilot studies using experimental and simulation tools that derisk those methodologies; and education/training tools that can be easily accessed online but can lead to recognized and reputable credentials (degrees, certificates, etc.). Technologies developed by the institute should impact multiple industrial sectors to broaden their economic impact.

3. What measures could demonstrate that Institute technology activities assist U.S. manufacturing?

Are industrial partners producing next generation products which have improved quality and higher reliability as a result of the improved tools from the institute? Is market share established for first generation materials/components/systems (MCS) and/or expanded for next generation MCS of the industrial partners? Is there a 360 degree impact, i.e., suppliers and customers for multiple industrial sectors implement solutions from the institute? For example, the ability to optimize a new sensor (and understanding/modeling of associated measurement phenomena) that can be implemented by a composite fabricator leading to higher quality components delivered to an aerospace customer, an automotive customer, and a wind blade manufacturer which improves safety, fuel efficiency and reliability would be a 360 degree impact.

4. What measures could assess the performance and impact of Institutes?

Repeat interactions (satisfied clients return); students enter the focus area of the institute and are still actively engaged in manufacturing at early mid-career; curricula is implemented at multiple institutes (research universities and community colleges) to support engineering functions and factory floor operations. Does the institute produce a strategic plan and roadmap for its focus technology which provides a national vision? Is there an increase in the

numbers of products exported, global company subsidiaries in the US, and/or new or expansion of companies in the US.

Institute Structure and Governance

5. What *business models* would be effective for the Institutes to manage business decisions?

Public-private partnership that leverages the investment of government and industry. Initial investment of 2 to 1, federal to non-federal that transitions to a 1 to 2 over ten years. As with the Fraunhofer Institute model, continued federal investment that provides baseline support and rewards entrepreneurial institutes for critical technologies will ensure domestic competitive advantage is sustained. The model selected should promote technology transfer from research to commercialization while promoting healthy interactions between academic researchers and industrial partners for the development of technologies relevant to their particular industrial constraints. A balanced mixture of industrial (small, medium, large) and academic representatives should aid in steering the Institute's activities towards the established goal and in promoting efforts that will accomplish the directions set by the roadmap.

6. What *governance models* would be effective for the Institutes to manage governance decisions?

A flexible structure that includes membership opportunities that give preferred access to sponsors but also allows open access thru structured, proprietary projects that include a premium fee for non-members. The NSF IUCRC structure which includes shared governance of precompetitive projects and provides input to a national strategy and technology roadmap. A separate executive board that includes federal, state and industrial members to support operation strategies.

7. What membership and participation structure would be effective for the Institutes, such as financial and intellectual property obligations, access and licensing?

Common, published IP policy which recognizes co-investment and provides revenue back to the institute for sustainment. With a pre-published policy, faster negotiation of projects should result. Multi-year, multi-project agreements which only require a single negotiation for focused, proprietary projects. Single focus industry institutes have generated solutions that could benefit broader manufacturing sectors.

8. How should a network of Institutes optimally operate?

Referrals across institutes should be encouraged and seamless. Provide opportunities for joint projects and provide opportunities (eg workshops) leadership and PI interactions to consider common "grand challenge" needs..

9. What measures could assess effectiveness of Network structure and governance?

Duration of the relationship with clients, sustained investment by industry. Increase in jobs creation and improvements in the US economy including measures of amount of yearly

exports impacted by the institute.

Strategies for Sustainable Institute Operations

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

Public-private partnership that leverages the investment of government and industry. Initial investment of 2 to 1, federal to non-federal that transitions to a 1 to 2 over ten years.

11. What arrangements for co-investment proportions and types could help an Institute become self-sustaining?

Continued federal investment that provides baseline support and rewards entrepreneurial institutes for critical technologies will ensure domestic competitive advantage is sustained. Cost share that includes equipment donation/loan, labor/travel costs during interaction with institute without over-burdensome tracking requirements which disenchant the partners.

12. What measures could assess progress of an Institute towards being self-sustaining?

Growth of nonfederal income and cost share (which provides indication of investment and benefit).

13. What actions or conditions could improve how Institute operations support domestic manufacturing facilities while maintaining consistency with our international obligations?

Encourage US citizen engagement in student and post-doc positions (associates, undergraduate, graduate) including internships with corporate partners and relevant national labs. Maintain a vibrant national strategic plan that has near, mid and long-term goals and roadmap and is readily accessible to the community. Promote the strategic plan and seek collaborative support to move the technology sector of the institute forward.

14. How should Institutes engage other manufacturing related programs and networks?

Pursue cross disciplinary workshops/symposia that address the vertical supply chain as well as across industrial sectors. Establish opportunities for funding support for collaborative projects, similar to the CORBI program of the NSF IUCRC.

15. How should Institutes interact with state and local economic development authorities?

Include state/local representation on operations board. Support business economic development functions. Work with company assistance (eg NIST MEP) and similar state level programs.

16. What measures could assess Institute contributions to long term national security and competitiveness?

Utilization of results by DOD, DHS, security services and contractors. Incorporation of program results in military standards, specifications and handbooks or comparable industry specifications that guide manufacturing of DOD and other agency products. Contributions

that address specific DOD technology roadmap needs (need to consider how classified/non-classified – OUO and export control issues addressed)

Education and Workforce Development

17. How could Institutes support advanced manufacturing workforce development at all educational levels?

Establish internships from high school, 2-year degrees, undergraduate and graduate students with industry partners. Establish two-way personnel exchange programs between institutes and industry, similar to NSF GOALI program. Utilize distance education approaches to deliver state-of-the-art programs that range from refresher training for factory floor personnel to certificates/degrees at the Masters of Engineering level. Web-based simulation tools to convey basic concepts and support routine tasks and calculations. Include success stories on institute website including quantification of the benefit, i.e., client testimonials; success stories that target high school students and promote manufacturing careers and more detailed success stories that inform the industrial client base.

18. How could Institutes ensure that advanced manufacturing workforce development activities address industry needs?

Promote benefits of manufacturing and satisfaction that comes with "producing substance" locally. Establish effective feedback processes with industrial clients (e.g., IUCRC life forms).

19. How could Institutes and the NNMI leverage and complement other education and workforce development programs?

E-mentoring volunteers to capture the retiring workforce knowledge base and convey that to entry level manufacturing employees.

Provide web-based listing of education/training options in technology focus of the institute and links to opportunities at sister institutes.

20. What measures could assess Institute performance and impact on education and workforce development?

Entries into the field in technology focus of the institute. Development and use of new curricula, including collaborative integration at multiple locations (university, community colleges).

21. How might institutes integrate R&D activities and education to best prepare the current and future workforce?

Incorporate case studies from the R&D program into the classroom including data analysis, decision making, risk assessment and return on investment so that the student learns to consider implementation of new approaches as part of the education process. Provide topics for senior design and other BS level projects. Incorporate national strategic plan needs into the education curricula so that students leave prepared for today's technology as well as informed about their continuing education requirements.

Above prepared by an Iowa State University Team.

POC for additional information

Leonard J. Bond,
Interim Director,Institute for Physical Research and Technology
Director, Center for Nondestructive Evaluation
Professor, Aerospace Engineering

bondlj@iastate.edu
515- 294-1634 (IPRT)
515-294-8152 (CNDE)
FAX: 515-294-7771

Institute for Physical Research and Technology
2156 Gilman Hall
Ames, IA 50011

www.cnde.iastate.edu

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