

**ASSEMBLING THE FACTS:
EXAMINING THE PROPOSED
NATIONAL NETWORK FOR
MANUFACTURING INNOVATION**

HEARING
BEFORE THE
SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION
COMMITTEE ON SCIENCE, SPACE, AND
TECHNOLOGY
HOUSE OF REPRESENTATIVES
ONE HUNDRED TWELFTH CONGRESS

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THURSDAY, MAY 31, 2012

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THURSDAY, MAY 31, 2012

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:03 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Benjamin Quayle [Chairman of the Subcommittee] presiding.

RALPH M. HALL, TEXAS
CHAIRMAN

EDDIE BERNICE JOHNSON, TEXAS
RANKING MEMBER

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

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Subcommittee on Technology and Innovation Hearing

*Assembling the Facts:
Examining the Proposed National Network for Manufacturing
Innovation*

Thursday, May 31, 2012
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Witness

Dr. Patrick Gallagher, Under Secretary of Commerce for Standards and Technology and Director, National Institute of Standards and Technology

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON TECHNOLOGY AND INNOVATION

HEARING CHARTER

*Assembling the Facts:
Examining the Proposed National Network for Manufacturing Innovation*

Thursday, May 31, 2012

10:00 a.m. – 12:00 p.m.

2318 Rayburn House Office Building

I. Purpose

On Thursday, May 31, 2012, the Committee on Science, Space, and Technology Subcommittee on Technology and Innovation will hold a hearing to examine the proposed National Network for Manufacturing Innovation (NNMI). The Administration requested \$1 billion in mandatory spending for the NNMI in the fiscal year 2013 budget request for the National Institute of Standards and Technology (NIST). The NNMI is designed to promote the development of manufacturing technologies with broad applications through collaboration between the Federal Government and public and private sector stakeholders.

II. Witness

Dr. Patrick Gallagher, Under Secretary of Commerce for Standards and Technology and Director, National Institute of Standards and Technology

III. Background

Manufacturing has been a significant part of American productivity since the industrial revolution. Although not as dominant as in the past, manufacturing's share of gross domestic product remains around 11 percent, and manufacturing output has risen by 13 percent in the last several years. Nevertheless, manufacturing employment has faltered¹. Many recent reports have cited declines in manufacturing employment as an indicator of surrendering leadership to other nations, but others suggest that declines are overblown and job losses can, in part, be attributed to increases in productivity². Also, some of the manufacturing that moved to other countries in the early part of the decade may be returning to the U.S. due to increasingly competitive labor rates overseas as well as other factors^{3,4}.

¹ Federal Reserve Board Industrial Production Indexes; <http://www.federalreserve.gov/releases/g17/Current/default.htm>; Bureau of Labor Statistics' monthly Current Employment Statistics database, <http://www.bls.gov/data/>.

² Council on Competitiveness Report, Make: An American Manufacturing Movement, December 2011, <http://www.compete.org/publications/detail/2064/make/>

³ Made in America, Again, August 2011, Boston Consulting Group.

Manufacturing has changed and continues to change, making comparative data difficult to obtain and analyze. Because the future of manufacturing is likely to focus on more personalized, single-production widgets as opposed to mass manufacturing, the number of jobs in this sector may continue to be relatively high-skilled but will drop in overall number of jobs⁵.

Because manufacturing is research and development intensive⁶ and often tied to new innovations, any decline in the domestic manufacturing sector raises concerns that changes may ultimately limit the capacity for American innovation.

Though most stakeholders agree that manufacturing continues to be an important part of our economy, the opinions on the appropriate prescription to maintain or strengthen the manufacturing sector are diverse. Efforts to maintain manufacturing leadership have largely focused on “advanced manufacturing”, or manufacturing processes and products resulting from new technologies.

Across the globe, many nations have developed specific manufacturing strategies that guide both government investment and private sector focus in manufacturing. In order to keep the U.S. competitive and ensure that new technologies are created domestically, some advocate that the U.S. should have a defined manufacturing strategy^{7,8}.

Administration Efforts in Advanced Manufacturing

The President’s advisors have recently elevated manufacturing policy as a priority in improving the national economy^{9,10,11}. In response to their recommendations, the President created an Advanced Manufacturing Partnership (AMP) and a National Program Office for Advanced Manufacturing (AMNPO), housed at the Department of Commerce’s National Institute for Standards and Technology (NIST).

The AMP was launched by the President in June, 2011 to bring together industry, universities, and the Federal Government to invest in emerging technologies that have the potential to create high quality manufacturing jobs and to enhance the United States’ global competitiveness. The mission of the AMP is to identify opportunities for investments in research and development,

⁴ Manufacturing’s Secret Shift: Gaining Competitive Advantage by Getting Closer to the Customer; March 2011, Accenture

⁵ Economist special report: Manufacturing and Innovation, Solid print, <http://www.economist.com/node/21552892>

⁶ OECD Science, Technology and R&D Statistics <http://www.oecd-ilibrary.org/content/data/data-00183-en>

⁷ New America Foundation report, Value Added: America’s Manufacturing Future, April 2012,

http://newamerica.net/publications/policy/value_added_americas_manufacturing_future

⁸ ITIF The Case for a National Manufacturing Strategy, April 2011, <http://www.itif.org/files/2011-national-manufacturing-strategy.pdf>

⁹ The President’s Council of Advisors on Science and Technology (PCAST), Report to the President on Ensuring American Leadership in Advanced Manufacturing, June 2011.

¹⁰ National Science and Technology Council, A National Strategic Plan for Advanced Manufacturing, Feb. 2012.

¹¹ The President’s Jobs Council Report to the President: Road Map to Renewal, 2011 Year-end report.

precompetitive collaboration, and shared facilities and infrastructure that have the potential to transform advanced manufacturing in the United States.

The AMNPO is an interagency office designed to further coordinate federal advanced manufacturing activities. The office builds links through establishing technology and innovation partnerships involving U.S. manufacturers, universities, state and local governments, and other organizations. The AMNPO (hosted at NIST) is staffed by representatives from the Departments of Commerce, Energy, and Defense; the National Science Foundation; and other agencies as well as fellows from industry.

The National Network for Manufacturing Innovation (NNMI)

The President's FY13 budget request included a proposal for a one-time mandatory fund of \$1 billion to establish a public-private partnership to revitalize U.S. manufacturing. In remarks given on March 9, 2012, President Obama described the NNMI as a network of institutes for manufacturing innovation around the country. According to background information provided by the Administration, the goal of the institutes is to "bring together industry, universities and community colleges, federal agencies, and regional and state organizations to accelerate innovation by investing in industrially relevant manufacturing technologies with broad applications, and to support manufacturing technology commercialization by bridging the gap between the laboratory and the market."¹² The NNMI also includes an emphasis on education and workforce development in advanced manufacturing skills. Up to 15 institutes are proposed across the country, with the federal support to last 5-7 years.

The NNMI is intended to close the gap between research and development activities and the deployment of technological innovations in domestic production of goods. The Administration envisions the NNMI to be the foundation of a U.S. innovation infrastructure of linked regional hubs of manufacturing excellence. Each institute is to be competitively selected, cost-shared, and each would concentrate on a particular area of technology development.

The focus of the NNMI lies squarely in the applied research region, after basic research has been conducted but prior to full commercialization of a technology. Technologies for further development by the NNMI are targeted at Manufacturing or Technology Readiness Levels of 4-7¹³ according to Administration background documents.

The NNMI is a collaboration involving the Departments of Commerce, Defense, Energy, the National Science Foundation, and possibly other federal partners. The AMNPO, housed at NIST, is the interagency body tasked with coordinating federal resources and programs related to manufacturing, including the NNMI. On May 4, the AMNPO published a Request for Information (RFI) on how each institute and the NNMI as a whole will integrate capabilities and facilities required to reduce the cost and risk of commercializing new technologies¹⁴. In addition

¹² National Network for Manufacturing Innovation <http://www.manufacturing.gov/amp/nnmi.html>

¹³ DOD Manufacturing Readiness Levels; <http://www.dodmri.com/>

¹⁴ NIST Request for Information on Proposed New Program: National Network for Manufacturing Innovation (NNMI), <http://www.gpo.gov/fdsys/pkg/FR-2012-05-04/pdf/2012-10809.pdf>

to the RFI, the AMNPO is holding a series of workshops across the country during the remainder of fiscal year 2012 to facilitate input from stakeholders, and to identify a set of technology focus areas for the institutes. The RFI and workshops are intended to address design and governance issues, and the management of the NNMI as a whole.

Each institute will have a focus area, which could be an advanced material, a manufacturing process, an enabling technology, or an industry sector. Institutes will be selected based upon criteria such as technology focus, research, development, and demonstration plan, impacts, partner resource and investments, and self sustainability.

Legislation to authorize the NNMI has not been introduced.

NNMI Pilot Institute in Fiscal Year 2012

This information-gathering effort for the NNMI is proceeding in parallel with steps to establish a pilot institute for manufacturing innovation during the current fiscal year (FY12). This pilot institute will focus on a specific manufacturing process known as “additive manufacturing”, and it is intended to serve as a proof-of-concept for the proposed network of institutes to be funded starting in FY13.

The pilot institute will involve an initial federal investment of approximately \$45 million, and will draw on existing resources and authorities of the Departments of Defense (Office of Manufacturing and Industrial Base Policy), Energy (Advanced Manufacturing Office), Commerce (NIST), NSF (Engineering Directorate and Advanced Technological Education program) and, potentially, other civilian agencies. A broad agency announcement of solicitation for the “Additive Manufacturing Innovation Institute” pilot was released by the Department of Defense on May 8, 2012¹⁵ with anticipated funding of \$18.8 million in FY12. Proposals are due June 14, 2012. At this time it is unclear if the other federal agencies participating in the pilot will also release fiscal year 2012 solicitations for their contributions to the pilot.

Issues for Examination

Since the NIST fiscal year 2013 budget hearing in early March, the Administration has moved forward with establishing the pilot institute as well as the planning process for the greater NNMI. At the time of the hearing, Under Secretary Gallagher was unable to provide substantial details about the program. This hearing will seek to learn more about the proposed network and status of FY12 activities related to the pilot institute.

Goals of Program and Focus Areas

As described, the NNMI is an ambitious endeavor bringing together all types of companies, educational institutions, and non-profit entities as partners to advance manufacturing. Will the

¹⁵https://www.fbo.gov/?s=opportunity&mode=form&tab=core&id=2bbada5cae4ab97438dc3f57fed050d0&_cview=0

institutes be stretched too thin to attempt to partner with so many different entities and achieve results in a relatively short period of time? How will success of an institute be defined?

The intention of the Administration is to have each institute focused on a particular manufacturing process, technology, or material. This may favor one area over another and inadvertently provide an unfair advantage or attention to one area that is not justified by market forces. Is it appropriate for each institute to pick a certain subject area?

Funding

The proposed NNMI represents a new, \$1 billion program. Though subject to PAYGO, it is unclear what revenues would be used to offset the mandatory funding, and when legislation authorizing the NNMI will be available to Congress.

The amount of funding going toward the pilot institute from participating agencies in fiscal year 2012 as well as what other activities those funds will be diverted from to support the NNMI pilot is also unclear. Finally, is it uncertain how both the pilot and the proposed institutes will demonstrate a path towards becoming financially self-sustaining within five years from initiation when federal funds will no longer support the NNMI.

Duplication

The Administration has devoted significant resources to manufacturing activities at many different federal agencies. How will it ensure that the NNMI will not duplicate other efforts underway in the Federal Government to support advanced manufacturing?

Federal Role

The goals of the NNMI, while diverse, appear to focus on advancing certain types of technology through applied research and demonstration. Though still considered "pre-competitive" in nature, some question whether government support at this point in the innovation process alters normal market forces which would determine the best available technology and processes instead. Does the NNMI overstep the role of government and wade into areas which would be more appropriately handled by the private sector?

Chairman QUAYLE. The Subcommittee on Technology and Innovation will come to order.

Good morning. Welcome to today's hearing entitled "Assembling the Facts: Examining the Proposed National Network for Manufacturing Innovation."

In front of you are packets containing the written testimony, biographies and Truth in Testimony disclosures for today's witness. I will now recognize myself for five minutes for an opening statement.

U.S. manufacturing's global market share has held steady at around 20 percent for nearly the last 30 years and still represents the largest manufacturing sector in the world. In my home State of Arizona, manufacturing contributes approximately \$20 billion to our economy. Almost 60 percent of all U.S. exports are in manufactured goods. Though there are some areas in decline, contrary to popular belief, the manufacturing sector is far from vanishing. Technology has the potential to continue dramatically changing the sector. Both the skills needed by workers, and the number of workers necessary could look very different from the assembly lines of the past. Innovative processes such as additive manufacturing, which enable low-volume, adaptable production, are transforming the future of manufacturing.

We don't make it easy for manufacturers in the United States. While all of our major global competitors have been lowering their corporate tax rates, ours has been essentially unchanged for the past 20 years, and is now the highest in the industrialized world. Rising costs in health care, environmental compliance, and litigation all discourage manufacturing from thriving domestically. According to the Manufacturing Institute, "U.S. industry is faced with the highest pollution abatement costs compared to its major trading partners, even higher than the so-called green economies of Western Europe."

In the first three years of the Obama Administration, the Federal Government has imposed 106 new regulations with annual costs of more than \$46 billion. When we are discussing manufacturing and innovation, the conversation is really about the conditions that create a better business environment. Yet rather than focusing on these issues, the Administration has again chosen to create a new \$1 billion dollar program, the details of which have yet to be provided to Congress.

Today we will examine the proposed National Network for Manufacturing Innovation. The proposed network would create up to 15 centers around the country focused on different areas of advanced manufacturing. During the current fiscal year, the Administration has also moved forward with a pilot institute, supported by up to \$45 million in fiscal year 2012 funds from multiple agencies, including three within this Committee's jurisdiction: NIST, NSF, and the Department of Energy.

I firmly believe that manufacturing is important to our economy and innovation, but I am troubled by the continued reliance on politically driven research and development. I think that the best thing we can do to help domestic manufacturers is to trust our markets and reduce the costs of doing business in the United States. I look forward to hearing more about the proposed NNMI,

and I hope that today's conversation helps to provide more detail for Members of this Subcommittee as to why the Administration believes this initiative is necessary.

We thank Under Secretary Gallagher for being here today and we look forward to your testimony.

[The prepared statement of Mr. Quayle follows:]

PREPARED STATEMENT OF SUBCOMMITTEE CHAIRMAN BENJAMIN QUAYLE

Good morning. I would like to welcome everyone to today's hearing.

U.S. manufacturing's global market share has held steady at around 20 percent for nearly the last 30 years and still represents the largest manufacturing sector in the world. In my home state of Arizona, manufacturing contributes approximately \$20 billion to our economy. Almost 60 percent of all U.S. exports are in manufactured goods. Though there are some areas in decline, contrary to popular belief, the manufacturing sector is far from vanishing. Technology has the potential to continue dramatically changing the sector—both the skills needed by workers and the number of workers necessary could look very different from the assembly lines of manufacturing's past. Innovative processes such as additive manufacturing, which enables low-volume, adaptable production, is transforming the future of manufacturing.

We don't make it easy for manufacturers in the United States. While all of our major global competitors have been lowering their corporate tax rates, ours has been essentially unchanged for the past 20 years. Rising costs in health care, environmental compliance and torts all discourage manufacturing from thriving domestically. According to the Manufacturing Institute, "U.S. industry is faced with the highest pollution abatement costs compared to its major trading partners—even higher than the so-called 'green economies' of Western Europe." In the first three years of the Obama Administration, the Federal Government has imposed 106 new major regulations with annual costs of more than \$46 billion. When we are discussing manufacturing and innovation, the conversation is really about the conditions that create a better business environment. Yet, rather than focusing on these issues, the Administration has again chosen to create a new, \$1 billion dollar program, the details of which have yet to be provided to Congress.

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We thank Under Secretary Gallagher for being here today and we look forward to your testimony.

Chairman QUAYLE. I want to now recognize the Ranking Member, Ms. Edwards, for her opening statement.

Ms. EDWARDS. Thank you, Mr. Chairman, and thank you so much for holding today's hearing to examine the proposed National Network for Manufacturing Innovation. I would like to thank Dr. Gallagher—it is good to see you again—for being here this morning and for your leadership both at NIST and as part of the Administration's current efforts to revitalize American manufacturing.

Although we have heard time and time again in this Committee about the crucial link between economic growth and a vibrant U.S. manufacturing sector, I think it bears repeating. American manufacturing employs more than 11 million Americans in high-paying jobs. As recently as 2010, manufacturing contributed \$1.7 trillion

to the Nation's economy and accounted for 60 percent of all U.S. exports. Manufacturers account for nearly two-thirds of U.S. investment in research and development. And for every manufacturing job we create, we add five additional jobs along the supply chain. And for every dollar in manufacturing value added, we create \$1.40 in new value in other sectors.

Advanced manufacturing is also expected to create even more jobs. In fact, a study by the Milken Institute has shown that every job created in electronic computer manufacturing generated an additional 15 jobs. And, finally, innovation in U.S. manufacturing enables our companies to develop new technologies and new products and helps keep the United States competitive. Simply put, "Made in America" equals American jobs and a strong economy.

Unfortunately, this Committee has also heard that the United States' competitive edge in manufacturing has slipped. According to the Council on Competitiveness, the United States ranks fourth in global manufacturing competitiveness and is expected to fall to fifth place in five years. Countries such as Korea, Japan and Germany have a larger share of the advanced manufacturing sector than the United States. If we do nothing and settle for the status quo, our position will almost certainly decline further and our economy will continue to struggle.

Thankfully, the Administration has renewed its commitment to American manufacturing and is focused on ensuring that the United States is the global leader in advanced manufacturing. The truth is that the perception of manufacturing as low-skilled, assembly-line work is outdated and no longer applies. The future of manufacturing is in fact advanced manufacturing, a high-tech endeavor that uses sensors, robotics, and cutting-edge modeling and simulation. Biomanufacturing and nanomanufacturing processes are, and will be, conducted by high-skilled and highly trained technicians in lab-like environments.

If we want to create high-paying jobs and help this country keep its competitive edge, then we need to move forward with policies and programs that will expand and support the development of advanced manufacturing. One such proposal, the National Network for Manufacturing Innovation, or NNMI—we are all going to get confused about that—is the topic of today's hearing.

The purpose of the proposed NNMI program is to establish up to 15 public-private manufacturing institutes across the country. These institutes will serve as centers of manufacturing excellence that will accelerate innovation in manufacturing and help transition cutting-edge manufacturing technologies from the lab to the marketplace.

As I understand it, the NNMI is modeled after the successful Fraunhofer Institutes in Germany, and Germany has been able to withstand the global financial crisis in large part due to its focus on innovative technologies as a key driver to economic growth. The Fraunhofer Institutes are widely considered to be a central and key component of the country's effective high-tech strategy.

Based on Germany's success, a number of organizations, including the Council on Competitiveness, the Manufacturing Institute at the National Association of Manufacturers, the President's Council of Advisors on Science and Technology, and the Information Tech-

nology and Innovation Foundation, have all called for the establishment of a similar network of public-private manufacturing centers in the United States to accelerate the development and deployment of advanced manufacturing technologies.

I believe the concept has significant merit, and I am excited by the Administration's proposal. I am eager to learn more today about how NIST and the Administration plan to execute this initiative, and I am specifically interested in learning how the proposed additive manufacturing pilot institute will be structured and how it will be coordinated with the broader network to ensure that lessons learned will be applied. I am also looking forward to learning more about how the interagency partners are working together to make this network a reality.

Certainly, the challenges facing U.S. manufacturers are urgent. The truth is that we simply can't afford to wait. If we are committed to a vibrant manufacturing sector and to improving our competitive position in advanced manufacturing, it is precisely the time for bold ideas and devoted leadership. I look forward to working with Dr. Gallagher, the Chairman, and my colleagues on implementing this initiative and ensuring that it is effective and successful.

Thanks, again, Mr. Chairman, for calling this important oversight hearing, and I yield the balance of my time.

[The prepared statement of Ms. Edwards follows:]

PREPARED STATEMENT OF SUBCOMMITTEE RANKING MEMBER DONNA F. EDWARDS

Thank you, Mr. Chairman, for holding today's hearing to examine the proposed National Network for Manufacturing Innovation. I'd like to thank Dr. Gallagher for being here this morning and for his leadership both at NIST and as part of the Administration's current efforts to revitalize American manufacturing.

Although we've heard time and time again in the Committee about the crucial link between economic growth and a vibrant U.S. manufacturing sector, I think it bears repeating. American manufacturing employs more than 11 million Americans in high-paying jobs; in 2010, manufacturing contributed \$1.7 trillion to the Nation's economy and accounted for 60 percent of all U.S. exports; manufacturers account for nearly two-thirds of U.S. investment in research and development. For every manufacturing job we create, we add five additional jobs along the supply chain. And for every dollar in manufacturing value added, we create \$1.40 in new value in other sectors. Advanced manufacturing is expected to create even more jobs. In fact, a study by the Milken Institute has shown that every job created in electronic computer manufacturing generated an additional 15 jobs. And finally, innovation in U.S. manufacturing enables our companies to develop new technologies and new products and helps keep the U.S. competitive.

Simply put, "Made in America" equals American jobs and a strong economy.

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Thankfully, the Administration has renewed its commitment to American manufacturing and is focused on ensuring that the U.S. is the global leader in advanced manufacturing. The truth is that the perception of manufacturing as low-skilled, assembly line work is outdated and no longer applies. The future of manufacturing is advanced manufacturing, a high-tech endeavor that uses sensors, robotics, and cutting-edge modeling and simulation. Biomanufacturing and nanomanufacturing processes are, and will be, conducted by high-skilled and highly trained technicians in lab-like environments.

If we want to create high-paying jobs and help this country keep its competitive edge, then we need to move forward with policies and programs that will expand and support the development of advanced manufacturing. One such proposal, the National Network for Manufacturing Innovation (or NNMI), is the topic of today's hearing.

The purpose of the proposed NNMI program is to establish up to 15 public-private manufacturing institutes across the country. These institutes will serve as centers of manufacturing excellence that will accelerate innovation in manufacturing and help transition cutting-edge manufacturing technologies from the lab to the marketplace.

As I understand it, the NNMI is modeled after the successful Fraunhofer Institutes in Germany. Germany has been able to withstand the global financial crisis in large part due to its focus on innovative technologies as a key driver to economic growth. The Fraunhofer Institutes are widely considered to be a central and key component of the country's effective high-tech strategy.

Based on Germany's success, a number of organizations—including the Council on Competitiveness, the Manufacturing Institute at the National Association of Manufacturers, the President's Council of Advisors on Science and Technology, and Information Technology and Innovation Foundation—have called for the establishment of a similar network of public-private manufacturing centers in the United States to accelerate the development and deployment of advanced manufacturing technologies.

I believe that NNMI concept has significant merit and am excited by the Administration's proposal. I am eager to learn more today about how NIST and the Administration plan to execute this initiative.

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Certainly, the challenges facing U.S. manufacturers are urgent. The truth is that we simply can't afford to wait. If we are committed to a vibrant manufacturing sector and to improving our competitive position in advanced manufacturing, it is precisely the time for bold ideas and devoted leadership. I look forward to working with Dr. Gallagher, the Chairman, and my colleagues on implementing this initiative and ensuring that it is effective and successful.

Thank you again, Mr. Chairman, for calling this important oversight hearing. I yield back the balance of my time.

Chairman QUAYLE. Thank you, Ms. Edwards.

If there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

At this time I would like to introduce our witness. Dr. Patrick Gallagher is the Under Secretary of Commerce for Standards and Technology and the Director at the National Institute of Standards and Technology. Thanks for being here this morning. As our witness should know, spoken testimony is limited to five minutes. After presenting your spoken testimony, Members of the Committee will have five minutes each to ask questions.

I now recognize our witness, Dr. Patrick Gallagher, for five minutes.

**STATEMENT OF DR. PATRICK GALLAGHER,
UNDER SECRETARY OF COMMERCE FOR
STANDARDS AND TECHNOLOGY AND DIRECTOR,
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY**

Dr. GALLAGHER. Thank you very much, Chairman Quayle and Ranking Member Edwards and Members of the Committee. It is a privilege for me to be here and have the opportunity to talk about the Administration's proposed National Network for Manufacturing

Innovation. I appreciate this opportunity to update you because there has been a lot of progress on implementing the President and Secretary's vision to ensure U.S. basic and applied research and development is optimally leveraged to benefit U.S. industry. Manufacturing matters, Mr. Chairman. As the President has said, an economy built to last demands that we keep doing everything we can to keep strengthening American manufacturing.

"A manufacturing strategy for the 21st century should focus on making the industry sector globally competitive." That is a quote from the American Enterprise Institute, and we agree. A robust manufacturing sector is in everyone's interest and of importance in everyone's district. The Administration and NIST are critical partners in this effort and have been hard at work on this issue.

The stage was set last summer in a report on advanced manufacturing by the President's Council of Advisors on Science and Technology, PCAST, and it reminded us why manufacturing remains essential. Manufacturing that is based on new technologies can provide high-quality, good-paying jobs for American workers. It is critical to our balance of trade. It represents 60 percent of U.S. exports and it drives technological innovation, accounting for some 70 percent of private sector research and development activity in the economy. The report also made it clear that the government should play an important role through the development of an innovation policy as opposed to an industrial policy, and the difference is crucial.

Given the breadth of manufacturing, the report looked at a broad range of approaches to help sustain and grow the sector. In addition to research and development, the report looked at areas such as taxes, trade, workforce, regulations, small business and education policies and how they either can help or hinder the health of the manufacturing sector.

Another consequence of a focus on manufacturing is the importance of an effective interface between the public and private sectors, and because of this, when the PCAST report was released in June of last year, the President also announced the formation of the Advanced Manufacturing Partnership, whose purpose is to bring together industry, universities and the Federal Government to work together to invest in the emerging technologies that will create high-quality manufacturing jobs and enhance our global competitiveness. To complement the public-private partnership, the Administration also strengthened the interagency coordination on advanced manufacturing, and in that context, NIST was asked to play a key role.

In February, the National Science and Technology Council had an interagency working group on advanced manufacturing and it issued a report that said that the acceleration of innovation for advanced manufacturing requires bridging a number of gaps in the present U.S. innovation system, particularly the gap between research and development activities and the deployment of technological innovations in the domestic production of goods, and other organizations ranging from the Information Technology Innovation Foundation to major U.S. companies such as Dow and GE have each expressed their support of an approach to address these gaps in a strategic and targeted way.

The NNMI is the Administration's approach to meeting the challenges of addressing these gaps. The President's proposed network would create up to 15 Institutes for Manufacturing Innovation, or IMIs, around the country, and these IMIs would bring together industry, universities, community colleges, federal agencies, regional and state organizations all working together to accelerate innovation by investing in industrially relevant manufacturing technologies with broad applications.

The President also announced that the Administration will take immediate steps to launch a pilot demonstrating an Institute for Manufacturing Innovation but based on existing programs within the Department of Defense and potentially also including the Energy and Commerce Departments, NASA and the National Science Foundation. These are two distinct efforts but have an important relationship between them, and I would like to briefly expand on this.

The NNMI program has not yet begun. It will require legislation enacted to fund and carry out this program, and currently the Administration is working under requirements and principles of that legislation to support Congressional efforts on a potential bill. I am looking forward to working with this Committee on that effort.

The principles outline the basic features of the NNMI program that would be established under competitive grants through the program, and we are working on developing these principles with extensive input from our agency partners and from the private sector through a series of regional meetings and through a request for public information and, importantly, through the pilot.

The pilot program that the President announced is a way for us to demonstrate the concept of multiple agencies, industrial, and academic consortia jointly executing a single program. That is the essence of these institutes. And it is really a demonstration effort based entirely on existing programs within the participating agencies. There is much we will learn through the process of standing up an institute with our federal partners and enable us to use those lessons to benefit the eventual design of the NNMI. It is an area that cuts across different agency missions, and each agency brings their own expertise. NIST has been asked to play a critical role in both its interagency capacity and because of its mission.

Mr. Chairman, I want to thank you for the opportunity to testify today and I am looking forward to our discussion.

[The prepared statement of Mr. Gallagher follows:]

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Testimony of

Patrick D. Gallagher, Ph.D.
Under Secretary of Commerce for Standards and
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United States Department of Commerce

Before the
United States House of Representatives
Committee on Science, Space, and Technology
Subcommittee on Technology and Innovation

Assembling the Facts: Examining the Proposed National
Network for Manufacturing Innovation

May 31, 2012

Chairman Quayle, Ranking Member Edwards, and Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss the Administration's National Network for Manufacturing Innovation (NNMI) initiative. As the President has said, "[An] economy built to last demands that we keep doing everything we can to ... keep strengthening American manufacturing."¹ Secretary of Commerce John Bryson amplified that message when he told us that in order to create good paying jobs, we need to help more American businesses "build it here and sell it everywhere." As the Under Secretary of Commerce for Standards and Technology at NIST, I see every day how critical the United States manufacturing base is to our economy.

A report by the National Science and Technology Council, "A National Strategic Plan for Advanced Manufacturing," stated that advanced manufacturing is a matter of fundamental importance to the economic strength and national security of the United States.² The President has articulated a plan to bolster the U.S. manufacturing base, outlining a blueprint for American manufacturing and supporting a number of manufacturing initiatives in the FY 2013 budget, including the NNMI.

National Manufacturing Trends – Manufacturing is Key to a Strong Economy

As President Obama said in his 2012 State of the Union address, "*We have a huge opportunity, at this moment, to bring manufacturing back. But we have to seize it.*" "*The blueprint for an economy built to last,*" he said, "*begins with American manufacturing.*" By itself, if the U.S. manufacturing sector were a country, it would be the 9th largest economy in the world.³ There are nearly 12 million jobs in the manufacturing sector.⁴ These are high-quality jobs.⁵

Manufacturing is also closely tied to our Nation's capacity to innovate. Manufacturing makes a disproportionately large contribution to U.S. innovation, accounting for 70% of private sector research and development (R&D) and developing capabilities that support the next generation of products and processes.⁶ Manufacturing represents 60 percent of U.S. exports and must play a critical role in an expansion of our exports and a move toward more balanced trade.⁷ Manufacturing increases economic activity in other sectors, creates jobs up and down the supply chain, and anchors employment in communities around the country. Until recently, U.S. manufacturing had been losing ground in the face of global competition. China is edging closer to the United States in terms of total volume of manufacturing output, and the United States has slipped below Germany, Korea, and Japan in the rankings of R&D intensity in the manufacturing sector, a critical indicator of future innovation.⁸ More alarming for the long-term health of U.S. innovative capacity is the trade balance in advanced technology manufactured products, many of them invented in the U. S. The trade balance on these products turned negative

¹ Remarks by the President on the Budget, February 12, 2012; ¹ <http://www.whitehouse.gov/the-press-office/2012/02/13/remarks-president-budget>

² The National Science and Technology Council, "A National Strategic Plan of Advanced Manufacturing", 2012.

³ Bureau of Economic Analysis Manufacturing Industry Data Tables 2010

⁴ Bureau of Labor Statistics, April Employment Situation Summary, May 4, 2012, Table B-1.

⁵ NSTC A National Strategic Plan for Advanced Manufacturing February 2012 pg 2.

⁶ National Science Board, *Science and Engineering Indicators 2012*, Appendix Table 4-14 and Table 3-32.

⁷ Bureau of Economic Analysis and Census, *U.S. International Trade in Goods and Services*.

⁸ NSTC A National Strategic Plan for Advanced Manufacturing February 2012 pg 5.

in 2001, and the gap has widened in the decade since (a \$99 billion deficit in 2011 as measured by the U.S. Census Bureau⁹).

The President recognizes that these trends threaten the long-term economic security of the country and is committed to putting in place the programs and policy that will help reverse these trends and strengthen the U.S. manufacturing base in the long term.

Progress is being made. During the past two years, we have begun to see positive signs in American manufacturing, and more companies are making the decision to “in-source” - bringing jobs back and making their products here. The Administration is working in close partnership with community colleges, apprenticeship programs and other training providers to ensure the United States has a technical workforce with the industrially relevant training and experience required by industry.

Even so, we must do more. Today’s challenges require stepping up efforts to enhance and strengthen the Nation’s underlying technical infrastructure, which is integral to our innovation and advanced manufacturing capabilities.

To reap the economic benefits of our ability to innovate, our Nation’s manufacturing sector must be able to renew itself by adopting new technologies and developing new markets. The Nation’s manufacturers must respond quickly and effectively to an ever-changing mix of requirements, risks, and opportunities, such as emerging technologies and markets.

Revitalizing American Manufacturing

Building on the work of the President’s Council of Advisors on Science and Technology (PCAST) and as part of the Administration’s comprehensive effort to secure the future of the Nation’s global competitiveness in advanced manufacturing, the Departments of Commerce, Defense, and Energy worked together to lead an interagency effort under the National Science and Technology Council’s (NSTC) Committee on Technology to assess the patterns and trends in U.S. Advanced Manufacturing. Through this work, it became clear that the acceleration of innovation for advanced manufacturing requires bridging a number of gaps in the present U.S. innovation system, particularly the gap between R&D activities and the deployment of technological innovations in domestic manufacturing production. To guide the Federal government’s efforts to address these gaps, the NSTC developed and made public the “National Strategic Plan for Advanced Manufacturing.”

The strategic plan lays out a robust innovation policy that would help to close these gaps and address the full lifecycle of technology. It also calls for intensive engagement among industry, labor, academia, and government at the national, state, and regional levels. Partnerships among diverse stakeholders, varying by location and objective, are a keystone of the strategy, and part of the requirements to support increased private sector

⁹ The Census Bureau defines Advanced Technology Products using about 500 of some 22,000 commodity classification codes used in reporting U.S. merchandise trade. Each of the 500 codes meets the following three criteria – (1) the code contains products whose technology is from a recognized high technology field, (2) these products represent leading edge technology in that field, and (3) such products constitute a significant part of all items covered in the selected classification code.

investment in both manufacturing technology development and advanced manufacturing production capacity.

This new advanced manufacturing plan provides a solid foundation on which to erect a Federal policy that will enable the United States to fulfill Commerce Secretary John Bryson's vision to "build it here, and sell it everywhere."

The Administration is taking steps to enhance the integration and coordination of manufacturing policy and programs across the Federal government through organizational efforts such as:

- *The White House Office of Manufacturing Policy.* To improve the coordination of manufacturing policy across the Federal government, President Obama announced on December 12, 2011¹⁰ that Commerce Secretary John Bryson and National Economic Council Director Gene Sperling would co-chair the White House Office of Manufacturing Policy. That office has begun to convene cabinet-level meetings to implement and coordinate priority manufacturing initiatives.
- *The Advanced Manufacturing Partnership (AMP).* Launched in June 2011¹¹, AMP identifies opportunities for industry, academia, and government to collaborate in order to accelerate the development and deployment of emerging technologies with the potential to transform and reinvigorate advanced manufacturing in the United States. The AMP Steering Committee, working through the PCAST framework, is bringing together leading experts from industry and academia, including CEOs of major manufacturing firms and presidents of leading universities, who are working to develop recommendations for catalyzing manufacturing innovation in the United States. Those recommendations are expected very soon.
- *The Advanced Manufacturing National Program Office (AM-NPO).* To effectively coordinate resources targeting advanced manufacturing across the Federal government, NIST is hosting the Advanced Manufacturing National Program Office (AM-NPO). The AM-NPO is intended to strengthen interactions with the private sector, to enable the private-public partnerships that are fundamental to improving the U.S. manufacturing sector's competitiveness and innovation, and to link these partnerships to relevant Federal resources. A critical aspect of the AM-NPO is its "whole of government approach." A diverse staff, consisting of representatives from Federal government agencies including the Department of Energy (DOE), the Department of Defense (DOD), the Department of Education (ED), NASA, the National Science Foundation (NSF), and NIST, as well as fellows from industry and academia, will coordinate activities across agencies that have a stake in advanced manufacturing. The AM-NPO will also work closely with the NSTC to coordinate policy.

¹⁰ <http://www.whitehouse.gov/the-press-office/2011/12/12/president-obama-names-commerce-secretary-john-bryson-nec-chair-gene-sper>

¹¹ <http://www.whitehouse.gov/the-press-office/2011/06/24/president-obama-launches-advanced-manufacturing-partnership>

National Network for Manufacturing Innovation

A centerpiece of the President's efforts to strengthen U.S. manufacturing is the establishment of the National Network for Manufacturing Innovation (NNMI). In his remarks on March 9, 2012 in Virginia, the President announced his proposal to create the NNMI made up of a number of Institutes for Manufacturing Innovation (IMIs) around the country.

The IMIs are designed to bring together industry, universities and community colleges, federal agencies, such as the Departments of Commerce, Defense, Energy, and the National Science Foundation, and U.S. state, tribal and local governments to accelerate manufacturing innovation. Specifically, the Institutes will invest in industrially-relevant manufacturing technologies with broad applications to bridge the gap between basic research and product development, provide shared assets to help companies – particularly small and medium-size manufacturing enterprises – access cutting-edge capabilities and equipment, and create an unparalleled environment to educate and train students and workers in advanced manufacturing skills. Each Institute will serve as a regional hub of manufacturing excellence, providing the innovation infrastructure to support regional manufacturing and ensuring that our manufacturing sector is a key pillar in an economy that is built to last.

This model has been successfully deployed in other countries and would address a gap in the U.S. manufacturing innovation infrastructure. We look forward to working with Congress on the legislation related to the establishment of this initiative.

To facilitate input from key stakeholders, the participating agencies, led by NIST, have issued a Request for Information specific to the NNMI and have begun a series of workshops across the country to gain insight from academia, industry, other public sector agencies at the state and local level, and private citizens on some of the technical issues regarding the design and structure of a National Network of such Institutes. The first one was held in April at Rensselaer Polytechnic Institute in Troy, NY, with the second scheduled on July 9th in the Cleveland area. Others are still to be scheduled.

This consultative process for the NNMI will have similarities to the consultative process for the pilot Institute (which I will discuss in a minute) but will be broader in scope. Through these outreach efforts, the U.S. Government will seek to identify a wide-ranging set of technology focus areas for the IMIs. The RFI and workshops also will explore institutional design and governance issues, such as the ownership and handling of intellectual property generated by the NNMI and management of the NNMI as a whole to amplify the impact of its member Institutes. All of these elements, if constructed and organized well, will greatly enhance the contribution that these Institutes can make to U.S. manufacturing competitiveness.

Key Principles of the NNMI

In parallel with the RFI and public workshops, an interagency team has been working to define a series of high-level principles that will help guide the programmatic design of the NNMI, focusing especially on the activities and governance of the IMIs and the process of setting up the Institutes in the first place. They are specifically set forth in the following description:

Activities and Governance of the IMIs:

As currently envisioned, each Institute would integrate capabilities and facilities required to address cross-cutting manufacturing challenges that have the potential to retain or expand industrial production in the U.S. on an economically rational basis. IMI activities are envisioned to include: applied research and development and demonstration projects that reduce the cost and risk of commercializing new technologies or solve generic industrial problems, education and training at all levels, development of innovative methodologies and practices for supply chain integration, and engagement with small and medium-size manufacturing enterprises (SMEs).

As currently envisioned, the IMIs would optimally involve a core team of two or more companies, and have significant industrial involvement in the agenda setting of the IMI and direct participation by industry scientists and technologists in IMI projects.

Institute Formation

An inter-agency program management team would be responsible for defining the NNMI and IMIs' organizational design, managing an open, competitive selection process and executing the awards process.

The inter-agency team would define the selection criteria, and identify criteria to add or modify as a result of input received from the public input process, including the RFI noted above.

The Administration anticipates that awards would be in the form of grants, contracts, and cooperative agreements, and could be executed in multiple rounds of awards. Awardees would be expected to show how the federal investment stimulates co-investment from the organizations and institutions making up the partnership entity or from other non-federal sources. Subsequent federal support would be contingent on demonstrating co-investment and progress to sustainable operations as well as progress toward and impact on NNMI goals. IMIs are expected to become financially sustainable within seven years.

Pilot Institute

The NNMI is an exciting opportunity to catalyze our companies, large and small, to work synergistically with one another and with academic and other partners to advance technological innovation at a pace much faster than any one company could on its own. While the process of engaging with industry, academia and other potential stakeholders, and working with Congress, takes time, the President challenged a group of agencies to

do what we could to work together within existing resources and within existing authorities to demonstrate the NNMI concept. To that end, at a March 9th event in Virginia, the President announced the impending creation of a collaborative interagency effort. In April, an interagency team led by the Department of Defense announced that the collaborative effort would focus on additive manufacturing. Additive manufacturing (including “3-D printing”) is a game-changing set of technologies with enormous implications for national security, energy and resource use, and process and product innovation in many sectors of the manufacturing economy.

The technology focus of the pilot was selected in part based on a determined national security need to field unique specialty parts, on-demand, in relatively low volumes. While several agencies already support programs in the area of “additive manufacturing”¹², the pilot affords the opportunity to bring agencies together to make a concerted push towards developing manufacturing tools that will both address an essential national security need and potentially revolutionize the way we mass-customize products.

Broadly speaking, the Department of Defense-led competition is designed to use collaboration among educational and research organizations, and companies – big and small – to convert promising new technology into repeatable manufacturing processes and tools and promote workforce development through unique educational opportunities. This effort will demonstrate the value of problem-solving and asset-building that could also occur on a broader scale with an entire network of Institutes for Manufacturing Innovation.

On May 16, the interagency team hosted an Industry Day to share our ideas about the pilot institute and to answer questions from interested parties. The response was overwhelming – nearly 300 leaders from academia, industry, government, and other organizations attended, prompting us to set up two overflow rooms to handle the crowd. The Industry Day provided an opportunity for networking among potential team partners, and many brought posterboards to show their strengths. We feel confident that we will receive a number of excellent proposals for the pilot institute, again demonstrating the strong demand from industry for the collaborative innovation model envisioned by the President’s NNMI proposal.

Conclusion

The President recognizes that we must do more to enhance innovation in the manufacturing sector, support R&D investments that provide the foundation for new products, processes, and industries, and invest in the cross-cutting technologies that can improve the competitiveness of U.S. manufacturing.

The NNMI is a critical piece of innovation infrastructure that can help U.S.-based manufacturing to remain globally competitive by fostering cutting-edge technological advances, solving problems of interest to a wide range of manufacturing sectors,

¹² Additive manufacturing is defined in ASMT 2792 as a process of joining materials to make objects from three dimensional model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies.

supporting small and medium-size manufacturing enterprises, and strengthening the skills of workers, managers, and entrepreneurs.

I look forward to working with you, Mr. Chairman and members of the Committee, and would be happy to answer any questions.

Chairman QUAYLE. Thank you very much, Dr. Gallagher.

I want to remind Members that Committee rules limit questioning to five minutes. The Chair will at this point open the round of questions and I recognize myself for five minutes.

Dr. Gallagher, I agree with you in terms of the importance of manufacturing to our economy, to our exports, to providing good, high-paying jobs here in the United States, but one of my concerns is, with the focus, especially on a policy basis, addressed specifically to the manufacturing sector, why shouldn't we just be focusing on broader applications, broader policy decisions that affect all businesses? I don't think I am alone in this. I think Christina Romer in a recent article stated that, you know, not seeing any specific market failures within the manufacturing sector, we should be focusing on policy decisions that affect all businesses so they can be successful and they can grow and they can expand.

What do you see that is different that is a special need for the manufacturing sector, especially seeing that we haven't lost out and we have been holding steady in manufacturing since 1980?

Dr. GALLAGHER. So that is a great question, and it is actually central to almost every policy discussion we end up having about manufacturing. In fact, recently Gene Sperling, the President's lead economic advisor within the White House, had a speech about this, talking about the role of government in manufacturing-related activities, and actually made the observation, this is a place where otherwise like-minded economists can even disagree, and I think it comes from—it stems from a natural discomfort in talking about any one sector in the economy and the issue of broad-based policy.

But the PCAST report actually laid out a compelling reason why we need to actually take a look at manufacturing, even if we don't have manufacturing-specific policy solutions. And I agree with you, a big part of this is laying out the general conditions for business of which manufacturing is part of and making sure that in that context we have a business climate, whether that is through taxes, trade, regulations and so forth, is as supportive as possible because these businesses are competing in very robust globally competitive markets, and that is clearly part of the Administration's policy focus as well and it was outlined in the NSTC report.

The interesting thing about manufacturing, though, is it plays a couple of unique roles as a sector. Some of them have been long-standing policy areas. One is how it supports our national defense capabilities and the need for domestic manufacturing capacities in fact entwine with our ability to secure and protect our country. Additionally, the manufacturing sector is rather unique in how it interfaces with our Nation's capacity to innovate. Most of the R&D investments and performance in this country are not done by the Federal Government, they are done by the private sector. And 70 percent of that private sector activity is in manufacturing-based activities, so it plays a disproportionate role. And in fact, that is one of the reasons these public-private partnership issues are automatically brought up in manufacturing, because on one end, as a country, we support through public investments basic research, even applied research. In some areas where there is an overriding mission need, like in defense or energy and others, we go farther. But there has to be an effective transition of this know-how to the pri-

vate sector if it is going to reap the full economic benefit to the country.

Chairman QUAYLE. You bring up some interesting points. In looking at what the Administration did, they devoted a significant amount of resources to manufacturing activities at many different federal agencies. For example, just this week, the Administration announced that the Advanced Manufacturing Jobs and Innovation Accelerator Challenge, which is a multi-agency, \$26 million effort to assist the development and implementation of regionally driven economic development strategies that support advanced manufacturing in cluster developing. So I am trying to figure out what I am missing here, because this sounds really similar to NN—it is difficult, Ms. Edwards—NNMI. So what am I missing? How is this different? Are we having—putting just more redundancy, more overlapping programs that are trying to actually have the same goals and accomplish the same goals?

Dr. GALLAGHER. Only to the extent that there are a number of programs that touch on manufacturing but the programs themselves are quite different. So the interesting thing about manufacturing from a federal policy perspective is that it is a big enough and diverse enough set of activities that it touches federal programs in a number of ways. It will touch workforce, it touches training and education, it touches innovation, it touches economic development, small business support. One of the focus points has been, how do you bring disparate different federal efforts into alignment so that you can have greater synergy, and that was certainly the focus of the announcement this week, to look at a regional manufacturing strategy, another theme that came up as we talked to industries across the country. That is the point of integration. That is where everything comes together. That is where a company and its supply chains and the educational infrastructure and the small business support, the banking industry, the VC funding, everything needs to be in place to have this whole-greater-than-the-sum-of-the-parts effect.

And so the announcement in that context was, how do you bring different programs into alignment so you have that larger effect. The NNMI is basically, very simply, about creating shared R&D infrastructure. It is a place where different companies can work together alongside national lab and university researchers to effectively bridge this gap between one part of the research community that is largely operating on public funding and one set of institutes and a set of organizations that are all private sector funded that are working in different businesses, so that is basically what the NNMI is. It is shared R&D infrastructure.

Chairman QUAYLE. Okay. Thank you very much.

I now recognize Ms. Edwards for five minutes.

Ms. EDWARDS. Thank you very much, Mr. Chairman, and I would note that I guess Dr. Gallagher has been saying NNMI for a long time because you seem—it seems to roll off your tongue.

Before I begin my questions, Mr. Chairman, I would like to ask unanimous consent to include a few items in today's hearing record. The first is a statement from the Council on Competitiveness outlining some of its recommendations for revitalizing manu-

facturing in the United States and expressing support for the National Network for Manufacturing Innovation Proposal.

The second: as you may be aware, late last year the Manufacturing Institute, that is the educational and services arm of the National Association of Manufacturers, and EWI jointly developed a proposal to establish a network of advanced manufacturing application centers across the country, similar actually to what is being proposed in NNMI, and I would like to submit the PowerPoint presentation that was delivered by EWI and the Manufacturing Institute just this past December that clearly articulates the need for these centers and outlines a critical role for the Federal Government in providing support for the network. In fact, in the submission, the manufacturing application centers point specifically to capital equipment and core capabilities funded by the Federal Government, essentially recommending 20 percent of that kind of funding balanced by competitively bid programs, and I would like to note that yesterday, EWI's CEO specifically encouraged its member companies to get behind the Obama Administration's NNMI proposal.

And the third item I would like to introduce for the record is a press release from the Information Technology and Innovation Foundation applauding the NNMI, and in the press release, the foundation's president, Rob Atkinson, claims that the NNMI is "one of the most important steps this or any Administration has taken in recent years to revitalize American manufacturing."

Mr. Chairman, I would like to add those to the record.

Chairman QUAYLE. Without objection.

[The information may be found in Appendix 2.]

Ms. EDWARDS. Thank you.

And then to Dr. Gallagher, in your testimony, as we have heard time and time again, manufacturing is closely tied to competitive and innovative capacity of our Nation. Undoubtedly, manufacturing creates well-paying jobs and is key to our economic growth. What is less clear is what gap or need NIST is trying to fill through the establishment of the National Network for Manufacturing Innovation, and so I wonder if you could describe the need that the network will attempt to address.

Dr. GALLAGHER. Thank you very much. So the gap in the R&D cycle that is being looked at is basically between an area where we are quite comfortable with public investment, largely at universities or national labs, where we are looking at basic or early applied research very clearly pre-competitive and it is performed and funded in very different ways than another sector, which is very late-stage technological development performed by individual companies through their own funds. What we are concerned about is that there is both almost no programs in the middle bridging those two, and the degree of segregation between those two groups of participants has in fact grown wider. It has grown wider by shifts in funding both on the federal side in terms of the balance between applied and basic R&D, and it has also become a larger gap in terms of the nature of what private industry funds. And so the answer appears to be creating a vehicle where companies can leverage each other, in other words, create—pool the risk and address—because we want to move the private sector into the earlier stage

research to begin to perform that, and we also want to put it in a place where the folks doing the early-stage research have access. So you are creating a mixing zone.

So it is really trying to address this very important gap between two different communities, and that is one of the reasons I believe that we are hearing such broad support from across industry, from across academia, and from across all these associations that this type of entity is really quite important.

Ms. EDWARDS. Thank you, Dr. Gallagher, and I wonder if you could share with us (because I think a lot of us have questions about this, given that NIST has historically focused mostly on intramural research): in addition to the funding level that is proposed for the program, it really dwarves NIST's entire current annual budget. Can you explain why NIST is the best equipped to oversee the implementation of the network?

Dr. GALLAGHER. So it is a great question. You know, since prior to the late 1980s NIST research funding was all intramural. You are correct. And the addition of intermural programs largely came in the late 1980s. So NIST does have some experience running these programs. One thing to emphasize, though, is that the NNMI is envisioned as a multi-agency effort. This is really not about giving NIST a unique program. This is designed to support, because manufacturing supports a wide variety of agencies. This ability to act in concert to bring a spectrum of efforts and looking at manufacturing from the Defense Department, from the Energy Department, from NASA, from National Science Foundation and NIST is critically important.

That being said, from a clear accountability perspective, it was viewed as, while we will build in strong interagency vehicles to make this work as a multi-agency effort, somebody has to basically be on the hot seat for making sure this is done right; and in particular, since the idea is to have a network, something that links these different entities together so that again there is a whole greater than the sum of the parts, an ability to disseminate best practice. NIST has tremendous experience in networking manufacturing-related activities together. That is really what MEP is, and we have had experience at running these types of programs, and I think the consensus from the interagency community was that it really made the most sense for NIST because of its broad mission to support the competitiveness of U.S. manufacturing was the natural sort of home, but this really is done through a multi-agency effort.

Ms. EDWARDS. Thank you.

My time is expired. Thank you, Mr. Chairman.

Chairman QUAYLE. Thank you, Ms. Edwards.

I now recognize the gentleman from Texas, Mr. Smith, for five minutes.

Mr. SMITH. Thank you, Mr. Chairman.

Dr. Gallagher, first of all, let me thank you for the good work you have been doing, particularly in regard to scientific research and developing standards. I think NIST has done an outstanding job in those areas, and you get the credit.

However, in regard to NNMI, I wish the Administration were more interested in creating jobs the old-fashioned way, which is to

say, either lowering taxes or keep taxes low. That encourages businesses to invest and produce and create jobs that way, and also in reducing the burden of regulations on small business, or any business as far as that goes. As you know, this Administration has broken all kind of records with its proposed regulations, I think over 200 in 2011 alone, each of which would cost businesses over \$100 million, and here we have President Obama twice publicly, I think first in his State of the Union address and the second during an address to a joint session of Congress, talking about the need to reduce the burden of these stifling regulations on businesses. We have heard the words and yet his actions contradict those words. And so like I said, I wish this Administration were more committed to creating jobs by reducing regulations and keeping taxes low.

I hope this NNMI initiative is not just another example of—or a smaller version, for instance, of the stimulus plan, \$800 billion there, which we saw did not work, did not keep unemployment below eight percent, and in fact, even the President admitted there were very few shovel-ready jobs created and very few jobs created as a result.

In this case, you have come out with a one-time-only one-year mandatory spending of \$1 billion. I don't know why we expect this to be any better or to perform any better than other stimulus bills that the Administration has advanced that have not particularly worked. And I think this follows up on a question you were asked earlier. Why is it that we haven't seen any specific legislation, legislative language in regard to the NNMI program? And when are we going to see that language?

Dr. GALLAGHER. Thank you very much. So let me focus on the why is this one time and what is the path forward.

Mr. SMITH. Well, actually if you will answer that last question first, and then you can go back to that. But why haven't we seen language and when are we going to see language specifically proposed by the Administration?

Dr. GALLAGHER. Very good. So the Administration did not intend to send over a ready-to-enact piece of legislation. The reason being for that is we believe that the best vehicle to do this would be to come up with a legislative proposal that can have broad bipartisan support.

Mr. SMITH. Okay. Who is going to write that, or who are the people working on that?

Dr. GALLAGHER. Well, I think we are hoping that that effort would be led from the Hill and that we would work with any interested committees that would be willing to do that including—

Mr. SMITH. Has the Administration approached any Congressional leaders yet, and if so, who have they approached?

Dr. GALLAGHER. The approach—the Administrative strategy has been led by the White House, and I am sure they have had discussion with manufacturing caucus-related groups. I don't have a list of who they have specifically talked to at this point. From my perspective, we have been talking with everyone who has expressed an interest and has wanted to talk about the proposals. And the NIST focus has been to try to outline those parts of the program that would be required to be defined in legislation that would make these institutions function effectively. The issues of how to identify

the costs, the outlays and the offsets is not something within NIST we have been specifically focused on.

Mr. SMITH. Okay. Not specifically focused on worries me a little bit. When you had the Administration propose a new program and you can't say who they talked to in Congress and you can't say specifically where the money is going to come from, that begins to look more and more like a political election-year-eve initiative that is not really serious or is not conceived to be a piece of legislation that will actually pass. Do you understand why we might think that when you can't say who you have approached and you can't give us any specifics?

Dr. GALLAGHER. I can see why, but I have to say, it is my failure to communicate effectively, not a signal of the Administration's intent and priority to this program. I think our goal would be to find a vehicle, a piece of legislation with as broad as support as possible. I don't think this is being done for any political—

Mr. SMITH. I am sure the Congressional leaders would welcome that approach when and if it occurs, and can you tell us again where that likely source of the \$1 billion might be since it is going to be redirected from other programs? What other specific programs will be cut?

Dr. GALLAGHER. So my understanding is that the Administration's 2013 budget has identified a number of potential offsets.

Mr. SMITH. You mentioned that a while ago, but you can't tell us specifically where those offsets are?

Dr. GALLAGHER. No. I think there were several hundred million dollars worth of offsets that were identified, was my understanding, and I at this point could not do that, but I would be happy to follow up with you.

Mr. SMITH. Okay. I hope you will follow up where the specific offsets might occur, what language—surely the Administration's legislative shop has some specific ideas, but until they come up with the specifics, I think I am slightly skeptical about how serious the Administration is.

Thank you, Dr. Gallagher.

Dr. GALLAGHER. Thank you.

Chairman QUAYLE. Thank you, Mr. Smith.

At this point, I would actually like to ask unanimous consent to put into the record the recent article in *USA Today* by Dan Ikenson regarding various policies to help the manufacturing sector and the broad business sector. Without objection, it will be included as part of the record.

[The information may be found in Appendix 2.]

Chairman QUAYLE. I now would like to go to—recognize Ms. Bonamici from Oregon for five minutes.

Ms. BONAMICI. Thank you, Mr. Chair.

Dr. Gallagher, thank you so much for being here today to talk about the importance of manufacturing and the critical role that we can play at the federal level to support innovation in manufacturing. I know last week was Small Business Week, and I spent the district work period touring small businesses across northwest Oregon, and the topic of manufacturing and innovation naturally came up often, as it is directly related to small business job growth and job creation in my district. I was in Astoria, Oregon. I had a

great discussion with a small business that was recently able to start canning their own product, allowing them to sell their product throughout the Northwest. I am proud to share this example with my colleagues here today. There are a number of efforts and opportunities in place that seek to leverage federal resources through partnerships with State and private sector stakeholders to boost manufacturing.

Dr. Gallagher, can you share with us how the proposed National Network for Manufacturing Innovation as part of the comprehensive manufacturing innovation strategy will help small businesses like the one in my district continue to grow?

Dr. GALLAGHER. I am delighted to, and I appreciate your comments and observations about the MEP program in Oregon. That is great to hear.

So there are a couple of overlaps between interactions the existing MEP program and the NNMI. The NNMI, as I said, is really about creating shared research capacity. One of the interesting developments is that we tend to think of industrial R&D as largely based out of big companies. That is not true anymore. The small and midsized manufacturers have become centerpieces of innovation and manufacturing technology, process, new materials, and that is particularly true in emerging technology areas. So one of the things that we envision is that the NNMI, the Institutes created under this program would be specifically designed to foster and incorporate small business participation, small manufacturing participation, and one of the ways that they can provide that outreach is by creating partnerships with the local MEP programs, which are already networks to tens of thousands of local manufacturers from across the country. So you have an existing network that is working with existing small businesses and supporting their competitiveness including looking at, you know, diversification, introduction of new technologies supporting trade, and we are talking about a network of research capacity which brings together companies and academia to work on enabling technology. These two networks, of course, can feed off each other, and that is probably the biggest synergy between these two programs.

In fact, the concept of a network to disseminate not only best practice between the institutes, but to have sort of shared metrics so that as these institutes evolve, you know, they grow and they develop in a way that is most supportive of their goals, something we learn from MEP.

Ms. BONAMICI. Thank you very much. And also we know that in order to maintain a strong manufacturing base in this country, we need to develop advanced manufacturing technologies, processes and materials—but we also need to develop a highly skilled workforce that is capable of filling the high-technology and manufacturing jobs of the future. Can you explain how workforce development will be incorporated into the National Network for Manufacturing Innovation Programs?

Dr. GALLAGHER. Yes, I can. So I think the interaction with workforce, which, as you point out, is one of the key things that comes up when we talk to every manufacturing entity, really has sort of two aspects to it. As a shared R&D infrastructure, you know, and manufacturing employs some 70 percent of the private sector re-

searchers, engineers and scientists in the United States, there is a direct tie with that type of workforce development. This is a venue for bringing in top research talent working on industrially identified and relevant programs and it creates clear pathways to that workforce need.

But the other interaction is a more indirect one, that these institutes are expected to be magnets for co-location for synergies between the manufacturer activity itself and the R&D activities including technical scale-up. So, you know, we envision, you know, technical and vocational training programs including community colleges, that there will be opportunities, the knowledge creation that is happening to these institutes to support broader workforce training programs in these regions that would be around these institutes.

Ms. BONAMICI. Thank you very much.

I yield back.

Chairman QUAYLE. Thank you, Ms. Bonamici.

The Chair now recognizes the gentleman from Illinois, Mr. Hultgren, for five minutes.

Mr. HULTGREN. Thank you, Mr. Chairman. Thank you, Dr. Gallagher.

I am confused about the purpose of the institutes. The Administration Website states that they may conduct basic and applied research, but other documentation suggests that the institutes will focus on applied research in order to scale up new technologies in the United States. This definitely would squarely place such work outside the basic research domain. Which is it?

Dr. GALLAGHER. Both. So the intent is to have—the institute program is designed to stand up and form these institutes where you can have mixed—you can bridge this gap between basic and applied and between much more developmental activities. So the institutes themselves need to support a broad range of research activities. I think one of the key questions you are raising is, where is the federal funding going? The federal funding for those research activities would be done on a project-by-project basis. So it would certainly be appropriate for some project being done maybe at the institute to be supported by federal funding if it was in basic—in appropriate basic or applied window, but if it is really out in an area that is getting closer to technology development for a particular company, we do not envision that to be something that would be publicly funded. In fact, one of the major objectives of these institutes is that they create a venue, a vehicle that is attractive for increasing investment in R&D by companies.

Mr. HULTGREN. Would there be a check on that? Because I really do think at a time like this, when resources are so tight, I am a strong proponent of supporting basic scientific research, but it is really that application where the private sector has shown an ability and a willingness to do it. How are we going to make sure that we are not spending federal dollars in an area that we shouldn't be?

Dr. GALLAGHER. So there are two tensions here. The way I think this will play out in practice is through the actual cooperative agreements that cover project-specific activities, and that is how we will ensure that, you know, federal funding doesn't go for some-

thing that is inappropriate. There is going to be a mixture of activities in these institutes, and that can't be a recipe for inappropriately mixing funding against what it was purposed for.

That being said, you know, you are raising this important issue, which is in tight times, we focus to mission unique, and the government provides basic research, and that is part of what has been driving this strong segregation of participation. So we are fighting—you are exactly right. You don't want inappropriate funding, but you also still need to create a vehicle where that proximity and that technical interaction can continue to occur, and that is kind of the key question.

Mr. HULTGREN. I do wonder, and I can go on to the next point, you know, would we really need such direct support for manufacturing applied research and development? Would it even be necessary, you know, if government intervention was directed instead at reducing general taxes, regulatory burdens that really are hindering American companies? I wonder if there is another way at getting this accomplished rather than some of the direct support?

Dr. GALLAGHER. So I am going to—you know, my take on that would be, there are two issues here. One is, I would agree with you entirely that for manufacturing to be competitive, we have to do all these things. It is not enough to simply have access to good ideas and technology if you can't compete and sell it in a global market. No question. The institutes are a piece of a larger puzzle and the piece that they are after is making sure that the transfer of knowledge is as efficient as possible between the investments we do make as a country in basic and applied research and what we hope to be a commercial use in manufacturing.

That gap is real, and I think even doing things like lowering R&D—increasing the R&D tax credit and things of that type, while it supports efforts by individual companies to enhance and grow their research investments, the missing issue is how to get them to work in longer intermediate-range research where individual companies have been reluctant to make those longer-term commitments, and we believe that by working together in these type of shared research institutes and this type of shared research infrastructure that you facilitate that because they leverage each other's investment, and that is really the idea both behind consortia and behind the call for this type of infrastructure.

Mr. HULTGREN. My time is running low, but if I can try and get one more very specific funding question. Information on the fiscal year 2012 funding for the pilot institute has been unclear as to the total amount of funding available and which agencies are supporting the pilot financially. In some cases, at least \$45 million has been posted while another up to \$45 million. I wonder if you could please clarify briefly the amount that has already or will be spent from fiscal year 2012 funds on the pilot and which agency funds are being used.

Dr. GALLAGHER. So the quickest way for me to give you the full breakdown will be to share a table with you afterwards, which I am happy to do.

Mr. HULTGREN. Thank you.

Dr. GALLAGHER. But it is up to 45. The amount that is part of the joint call, which is part of a joint solicitation that is being car-

ried out by the Defense Department, NSF, NASA and DOE is 30, and then what we have identified is once the institute is established, it would be a likely candidate for additional funds on a competitive basis, and that is where the "up to" comes from, but I think the table will answer your question most succinctly.

Mr. HULTGREN. Okay. Good. Thanks, Dr. Gallagher.

Thank you, Mr. Chairman. I yield back.

Chairman QUAYLE. Thank you, Mr. Hultgren.

The Chair now recognizes the gentleman from Illinois, Mr. Lipinski, for five minutes.

Mr. LIPINSKI. Thank you, Mr. Chairman.

I want to thank Dr. Gallagher for your work and for your testimony. I certainly think the NNMI is a very good and important concept, and I think you have been doing a good job of explaining why that is. I think one of the things that we really have to look at is: we invest a tremendous amount in research. The Federal Government invests a lot in research. And right now, one of the biggest barriers to advanced manufacturing commercialization is that the development of new technologies are sometimes too risky or too long-term for industry to develop on its own, and that is what it sounds like to me what you are aiming at doing here.

I have pushed the Federal Government to develop a national manufacturing strategy. We are actually having a hearing in Energy and Commerce tomorrow on a bill I have to implement a national manufacturing strategy. I have also championed programs like one that just began at the NSF called the Innovation Corps, which helps to teach researchers how to commercialize research that they have had funded already by the Federal Government.

So I think the NNMI certainly can help, but obviously we need to work through these things. I am looking forward to working with you to figure out how exactly we are going to implement the NNMI. It is my understanding from your written testimony that this model has been successfully deployed on other countries. You have looked at that. I know the Fraunhofer Institute in Germany is one example. I know a lot of their funding, much of their funding comes from doing contract research. This is not something that you had mentioned, or at least I hadn't noted it. Do you anticipate that that will be part of this initiative?

Dr. GALLAGHER. I think the answer is yes. You know, the development of a stable business model for these institutes is going to be something that will need to be played out in the solicitation review and award process for this program. We envision this as a one-time investment with the government playing this convening and coordination role and allowing some time for the private sector entities that are going to work together in these institutes to develop the vehicles for a sustainable business model. The way it has played out in many countries is a combination between support to the institute, what I would call base funding to keep the institute's overall functions working, and the research activities that are covered on a project-by-project basis. You can call that contract or grant or cooperative agreement, but there would be, you know, specific funding. And I think that is probably going to be the case here just because of the diversity of types of research that are going to be done there and addressing the need to make sure that federal

funding is used for the purposes of federal funding, and private-sector funding that is brought in is for used for the companies that want to use it for.

So I think you are right. This is a shared infrastructure and there will have to be some base funding of some type, probably through some collective action on the part of the key participants. Whether it is consortia-type program, I don't know. We envision no long-term role for the Federal Government supporting that, and then a collection of project-specific or contract-type work that would cover the different types of research efforts underneath the institute. That seems like a realistic assumption to make on how a possible business model would go. This is, by the way, the subject of questions under the request for information that is ongoing now.

Mr. LIPINSKI. Well, obviously, there are a lot of things that we have to work on. I want to take the last minute to ask one other question.

What can be done as we develop this initiative to ensure that we are not just helping the Chinese to build better iPads? How do we—what steps can we take to make sure that products that are developed from work at the NNMI are commercialized here in America?

Dr. GALLAGHER. So one part of my answer would be, we should build these institutes because to not do it is actually enabling foreign competition to reap the very open and diverse output that we have from our basic and applied research simply because we are not taking steps to nurture that next stage, which is the translation of that know-how and knowledge into the commercial sector. So I would argue right now, we actually do disadvantage ourselves by basically doing one part of it, publishing it wide open and then stopping and not providing vehicles for the efficient translation into companies.

Mr. LIPINSKI. I agree with that, but the iPad was really developed here but now it is all being manufactured overseas.

Dr. GALLAGHER. And so this points to the synergy that happens between the actual manufacturing activity and the innovation. The reason these are physical institutes for research and development around manufacturing is to support and drive this collocation synergy. We would want to see manufacturing and their suppliers and this ecosystem being built around these activities. That is the best thing we can do to ensure that the know-how that we generate in this country is translated into the actual maximum economic benefit by producing, selling and making these commercial products. A good example of that is what is happening in Albany, New York, in the nanotechnology arena where this shared research capacity looking at this emerging area of nanomanufacturing is driving very strong attraction by other companies to want to be located near that to reap the benefits of both the knowledge that is being created and the talented researchers in that area, and so I think we are doing a lot in that case. That region is doing a lot to capture as much as possible that knowledge and ensure that we benefit from it.

Mr. LIPINSKI. Thank you. I yield back.

Chairman QUAYLE. Thank you, Mr. Lipinski.

The Chair now recognizes the gentleman from Minnesota, Mr. Cravaack, for five minutes.

Mr. CRAVAACK. Thank you, Mr. Chair. I appreciate being recognized, but since I just came in from another committee meeting, I would like to yield my time to Mr. Palazzo.

Mr. PALAZZO. Well, thank you, Mr. Chairman. Thank you, Mr. Cravaack, for doing so.

Dr. Gallagher, thank you for being here today. As I see it, you are coming in, or the Administration is requesting \$1 billion, and I have tried to review everything, and what I keep coming back to is, I would much rather spend \$1 billion on roads and bridges or possibly even \$1 billion into the NASA Heavy Lift program.

But with all that being said, I would like to say a couple—provide a statement for you, and I think it will be pretty clear. You may have heard some of these questions earlier. But Thomas D. Hopkins, a researcher for the Small Business Administration, said in his report, a Survey of Regulatory Burdens, “Compliance with regulation imposes burdens on businesses for which they receive no explicit benefits or compensation.” The National Association of Manufacturers asserts that their industry is at a significant competitive disadvantage in the global marketplace as a result of the corporate tax rate in America, which is the highest among developed nations. Also, a recent Small Business Administration study showed that U.S. manufacturers bear \$162 billion annual burden to comply with federal regulations. These are dollars manufacturers are not spending on capital investment or hiring new workers. So you are asking for a one-time investment of \$1 billion, but as a former small business owner and a CPA, I would be trying to remove these hurdles to job creation and American competitiveness before I invested \$1 billion.

And so with that, in the face of the uncertain future of taxation and the regulatory environment on manufacturers in America, what is the NNMI going to do to reduce these burdens on U.S. manufacturers?

Dr. GALLAGHER. So I would agree with you that in manufacturing, we have what I call a chain of performance problem, that all of these things have to work in concert, and I am actually in agreement with you that we have to look at the business condition that these companies are operating in including the tax rate. We agree. We have to lower the corporate tax rate for these businesses. We want to provide incentives for them to do research and development. We have to address trade promotion, make sure the barriers are down so they can sell into global markets. We have to make sure they have access.

So one of the challenges we will face in working together on manufacturing is that it always brings up a very broad spectrum of issues and they really have to work in concert. The NNMI is really about one type of barrier that they face and the barrier is access to the ideas and the talent that are the new products that they are going to make, and we have seen this. It is quite compelling that the manufacturing sector’s competitiveness is tied to being at the cutting edge of these emerging technology areas, and if there are barriers there and our companies are at a disadvantage in harnessing the know-how that is being created by our scientists, by

our engineers, by innovators and entrepreneurs, then that is a different type of barrier. It may play out on a different time scale than immediate barriers like, you know, certain types of tax issues or regulation, but it is a barrier nonetheless.

And that is going to be a challenge, and I think that is why we want to work with you across a portfolio of programs, but this NNMI won't solve all of these different issues and it is not intended to. It is designed to address this one barrier that we are concerned about, which is this growing valley of death, if you will, between basic public sector-funded research and the private sector development.

Mr. PALAZZO. So basically you agreed with me, being overtaxed and overregulated, and again, it just comes back. If I had, you know, a billion dollars and I was going to invest in a company and they had internal control problems, fiscal problems, I would want them to clean those problems up before I took that kind of an American investment, which is not my money to give, it is the America taxpayers', it is the people who get up every day, go to work to put food on their table, to provide the best education for their children and provide a home, safe transportation, and I would expect if they were in here, they would be demanding some governmental reforms, you know, like a lower corporate tax rate. Removing these obstacles to job creation and possibly addressing just the frivolous litigation in our society that three of the greatest things, many of them generated from former Congresses that are basically providing that wet blanket in our economy because I do believe that manufacturers free, if we just unshackle them, they would be able to go out and compete globally and they will fill any need that we need them to fill. So thank you for your time.

Mr. Chairman, thank you. I yield back.

Mr. CRAVAACK. Reclaiming my time, and I will yield back to the Chair.

Chairman QUAYLE. Mr. Cravaack, do you have any questions? Are you ready?

Mr. CRAVAACK. If there are no more questions and my time allows, I will be glad to.

Chairman QUAYLE. Mr. Palazzo, I recognize you for five minutes. Do you want to yield to Mr. Cravaack?

Mr. PALAZZO. Thank you, Mr. Chairman. I have to leave, so I would love to yield my five minutes to Mr. Cravaack.

Mr. CRAVAACK. I just love parliamentary procedures.

Thank you, Dr. Gallagher, for being here today, and thank you for addressing so many very important issues. We are a manufacturing giant. We just have to unleash the entrepreneurial spirit in this great country and has always been in this country, and Mr. Palazzo hit it right on the head in regards to—there are two things when I talk to manufacturers. There are two things they talk about: taxation and regulation. Those are the two main components that they talk about.

So with that said, you know, I want to invest in making sure that we have a return on this investment. I understand you are getting a billion dollars, but I want to make sure at the end of the five years, we have a result of that investment. So can you tell me

how you are planning to move this forward after five years so we don't see you again in five years asking for another billion dollars?

Dr. GALLAGHER. Yes. I think the way we would like to do this is make the development of a sustainable business model for these institutes. This is really about the private sector being able to work together to cover this gap.

Mr. CRAVAACK. When you—sorry. When you say a sustainable business model, and you have said that a couple of times, how can you produce a sustainable business model without—with innovation, of course, making more efficient, better productivity, understand that, but until we get to the true root cause of why companies go overseas, which is taxation and regulation, is that going to be part of your paradigm?

Dr. GALLAGHER. Well, look, as I said, we agree that the taxation and regulation is part of creating a competitive business environment. There is no disagreement there. But the reasons companies go overseas, and there have been a number of recent surveys that have looked at this, are actually broader than just the taxation and regulation or labor cost issues. Those are clearly drivers, but one of them is that they are following capacity. In other words, if you look at what is happening in R&D investment by companies overseas, it is growing much faster overseas than it is growing in this country and it is growing specifically in those areas where the manufacturing sector is growing, so it is Asia, the Asia Eight or the Asia Ten or where all the R&D growth is occurring. So what is happening in Asia is, they are actually using the synergy between manufacturing and research to build their research capacity. They are working it the other way. They first come in with, you know, the advantage of relatively cheap labor and they build their way and move up the value chain and so they are building research capacity, and then what happens is, you get the synergy effect where it is easier for a company or they make a decision just because we have hollowed out a capacity in the United States that for those reasons access to talent, access to—that they move there, and that is really what these are about addressing because we don't want to lose that capacity to translate the knowledge that we are creating into U.S.-based companies and let them profit from that. And what will happen of course is, you are right, and from a business perspective, you are looking at short-term cost and those conditions matter. I don't disagree with you. But there is also strong evidence that you can make a decision that makes sense on the short term where you decide to offshore something because it is cheaper to make that product, and what we find now is that you have actually lost the capacity to generate the next generation of product. And that is a long-term tradeoff that we are trying to address here.

Mr. CRAVAACK. Thank you. We have talked a little bit about the public-private partnerships and the co-investment from participating entities. Is it expected there is going to be funding of an in-kind match? Is there a minimum investment? Who is going to invest? How much are they going to invest as part of this partnership?

Dr. GALLAGHER. So our goal in doing these is to maximize the private sector investment in the institutes, and that would be both in evaluative criteria in evaluating these proposals. It is even true

in the pilot that there has been stated an expectation, they would like to see at least 50 percent match in terms of the participants. And in addition, we want to see that match change over time. In other words, we would like the Federal Government to not have a mortgage, a long-term role in supporting these. We are trying to support the creation of these institutes where you can have shared activity among companies and then be able to get out, and that has happened before. The semiconductor industry and the auto industry where the government played a very important convening role to set these up has been able to back out over time and those companies and sectors continue to enjoy very strong interactions across companies and have very strong applied research activities, so that is the goal here.

Mr. CRAVAACK. If the Chairman would indulge me a little bit, do we have—these private-sector entities, have they been identified and have they had a commitment?

Dr. GALLAGHER. For the pilot?

Mr. CRAVAACK. For the pilot.

Dr. GALLAGHER. So the pilot right now is basically undergoing a call. There was an industry day or proposer's day that was hosted by the Defense Department a couple weeks ago. I understand there were at least 20 potential groups that were looking at forming these, and that is under a very abbreviated call. I think it was only 30 or 40 days or something of that type. So the interest appears to be exceedingly high. That would be my early read.

Mr. CRAVAACK. Thank you, Dr. Gallagher. I appreciate your time, and I will yield back.

Chairman QUAYLE. Thank you very much, Mr. Cravaack.

I thank Dr. Gallagher for his valuable testimony today and the Members for their questions. The Members of the Subcommittee might have additional questions for the witness, and we will ask you to respond to those in writing. The record will remain open for two weeks for additional comments and statements from Members. The witness is excused.

Thank you all for coming. This hearing is now adjourned.

[Whereupon, at 11:06 a.m., the Subcommittee was adjourned.]

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

Responses from Dr. Patrick Gallagher were not submitted.

QUESTIONS FOR THE RECORD
THE HONORABLE BEN QUAYLE (R-AZ)
U.S. House Committee on Science, Space, and Technology
Subcommittee on Technology and Innovation

Assembling the Facts: Examining the Proposed National Network for Manufacturing Innovation.

Thursday, May 31, 2012

1. In your testimony you describe that the government will be identifying focus areas for each institute, and that the activities are envisioned to include applied research and development. I am extremely concerned with politically driven R&D and that this would provide an advantage or attention to one area of study that may not be justified by market forces. How can you be certain that researchers will not subsequently be chasing the favored research of the day? Why do you think it would be appropriate for each institute to pick a certain subject area?
2. The optics of NIST, NSF, NASA, and the Department of Energy transferring funds to the Department of Defense to conduct a pilot manufacturing institute focused on an area of manufacturing most important to the DOD makes me uncomfortable for several reasons. We did not authorize funding for this pilot program, and it clearly takes away from other agency activities. It seems to have evolved midway through the current fiscal year, after agencies had already obligated funds for their programs. Some agencies may have even been caught off-guard by the program, since it was not announced until March and very limited details about the pilot are available even now.

I understand that the pilot will need to receive discretionary funding in FY13 and FY14. Can we expect to see the pilot funding detailed in future budget requests for all the participating agencies?

3. Has NIST's Visiting Committee on Advanced Technology (V-CAT) provided any feedback or review of the proposed NNMI pilot or program?
4. Do you anticipate that legislation authorizing the NNMI would sunset the federal funding after 5 years, when they are expected to be self-sustaining? If physical infrastructure is part of the federal investment in the institutes, how will that be managed when federal funding is no longer supporting the NNMI?

QUESTIONS FOR THE RECORD
THE HONORABLE LAMAR SMITH (R-TX)
U.S. House Committee on Science, Space, and Technology
Subcommittee on Technology and Innovation

Assembling the Facts: Examining the Proposed National Network for Manufacturing Innovation.

Thursday, May 31, 2012

1. Regarding the pilot, will the agencies participating in fiscal year 2012 also commit resources to the pilot in fiscal years 2013 and 2014? If so, what amount do you anticipate to be contributed from NIST? Furthermore, please provide detail on other agency contributions to the additive manufacturing pilot in FY13-FY14.
2. How much extramural funding is NIST currently sending out the door to support advanced manufacturing? How is the National Network for Manufacturing Innovation (NNMI) different from the Advanced Manufacturing Technology Consortia (AMTech) program? Will recipients of one program be able to receive funding for the other?

QUESTIONS FOR THE RECORD
THE HONORABLE RANDY NEUGEBAUER (R-TX)
U.S. House Committee on Science, Space, and Technology
Subcommittee on Technology & Innovation

Assembling the Facts: Examining the Proposed National Network for Manufacturing Innovation

Thursday, May 31, 2012

1. The proposed National Network for Manufacturing Innovation (NNMI) represents a new, \$1 billion program. How did the Administration decide that \$1 billion was the appropriate amount to spend? Why does the funding need to be mandatory and not discretionary? The legislation authorizing the NNMI would be subject to PAYGO. What revenues would be proposed to offset the mandatory funding?
2. How many awards would you anticipate making in fiscal year 2013, provided the \$1 billion is available? What amount will be available to each grant recipient?
3. The goals of the National Network for Manufacturing Innovation (NNMI), while diverse, appear to focus on advancing certain types of technology through applied research and demonstration. Though still considered “pre-competitive” in nature, some question whether government support at this point in the innovation process alters normal market forces which would determine the best available technology and processes instead. Does the NNMI overstep the role of government and wade into areas which would be more appropriately handled by the private sector?

QUESTIONS FOR THE RECORD
THE HONORABLE RANDY HULTGREN (R-IL)
U.S. House Committee on Science, Space, and Technology
Subcommittee on Technology and Innovation

Assembling the Facts: Examining the Proposed National Network for Manufacturing Innovation.

Thursday, May 31, 2012

1. In the hearing you drew a distinction between what type of research federal funds under the NNMI would support, versus the type of research that private funds under the NNMI would support. If I understood correctly, any given project may have both basic and applied components, but that anything that veered into technology development would not be supported by federal funding? I appreciate the desire to ensure that federal funds are supporting work that would not otherwise be supported by the private sector, but how would this differentiation actually be carried out? It seems like it might be very complicated to distribute funding in this manner, so I would appreciate more information about how you see this distinction being both determined and implemented.
2. At this point in time, do you have any commitment from the private sector to match any of the federal funding provided to the NNMI? Will there be a match requirement prior to awarding an institute award?
3. Will National Network for Manufacturing Innovation (NNMI) funds be available for new buildings? Equipment? Will there be a limit on the amount of a grant that can be used for administrative/maintenance fees?

Appendix 2

ADDITIONAL MATERIAL FOR THE RECORD

MATERIALS SUBMITTED BY SUBCOMMITTEE RANKING MEMBER DONNA F. EDWARDS,
HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

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May 30, 2012

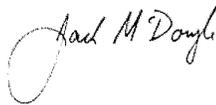
The Honorable Ben Quayle, Chairman
The Honorable Donna Edwards, Ranking Member
Committee on Science, Space and Technology
Subcommittee on Technology and Innovation
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Quayle and Ranking Member Edwards,

The Council on Competitiveness is interested in the Subcommittee's Hearing
"Examining the Proposed National Network for Manufacturing Innovation"
scheduled for May 31, 2012. We are pleased to share the attached comments
outlining our views on this initiative.

If we can answer any questions or provide additional information, please let me
know.

Sincerely,



Jack McDougale
Senior Vice President

Enc.





**Council on Competitiveness
Written Comments Regarding
“The National Network for Manufacturing Innovation”
May 31, 2012**

Opening and Summary

The National Network for Manufacturing Innovation (NNMI) begins to address the current problem of underinvestment in critical pre-competitive advanced manufacturing research and development (R&D). This investment promises to drive industry-wide transformations needed to ensure that the United States maintains essential advanced manufacturing capabilities to meet national economic and security requirements. The government must play a role since the scope of these economy-wide efforts prevents any single firm from capturing a disproportionate share of the economic benefits generated. Further, the time-horizons required for such R&D are typically longer than private sector investments can justify. As a result, the market is not responding to this critical national need.

Collaborative NNMI efforts will improve the system-wide benefits of developing and deploying next-generation disruptive manufacturing technologies, processes and linked supply networks. A number of national economies in Europe and Asia are pursuing aggressive manufacturing growth strategies. In these economies, government, industry, labor and academia are establishing increasingly effective full life-cycle innovation and production ecosystems. U.S.-based manufacturing will find it increasingly difficult to compete with these national economies. There are numerous actions that America should take to accelerate manufacturing innovation. Particularly important are expanding R&D incentives – such as a permanent 15-20 percent R&D tax credit that also covers applied manufacturing research. Also important are cross-sector research collaborations and public-private partnerships to develop and deploy breakthrough advanced manufacturing tools, processes and applications.

American Manufacturing

Manufacturing is a cornerstone of American independence, economic prosperity and national security. It remains a driver of innovation, job creation and economic growth. The United States must implement sound policies to sustain and expand the manufacturing sector.

Manufacturing is broader; more deeply integrated with services and has a higher multiplier effect on the economy than at any time in history. Manufacturing includes all facets of research, development, production, sales, distribution, logistics, customer service, marketing, and support. It extends from the making of physical products to the delivery of services -- an increasingly important component integrated across the manufacturing spectrum. Properly understanding the breadth of today’s manufacturing and its multiplier effect on the domestic economy is essential to enacting public policy that ensures the United States will improve its standard of living and be competitive in the long-term.

American manufacturing added \$1.8 trillion to GDP, or nearly 12 percent of the nation's total economic output, in 2011. Manufacturing firms pay higher wages than those in other sectors and employ 11.5 million U.S. workers. Manufacturing also supports nearly 7 million jobs in other industries. Due to substantially larger supply chains than other sectors, manufacturing firms have the highest multiplier effect on the U.S. economy of any industry. For every dollar of value created in manufacturing, \$1.40 is created in other sectors of the economy.

Many U.S. manufacturing firms remain at the technology frontier, especially in computers, medical devices, chemicals, machinery, aerospace and military equipment—though this advantage is narrowing. The U.S. has had a trade deficit in manufactured goods for some time, and in 2010 the country ran an \$81 billion deficit in so-called high-tech manufactured products alone. Also within the past ten years, the U.S. has lost 687,000 high-tech manufacturing jobs—a 28 percent decrease. Manufacturers account for roughly two-thirds of U.S. R&D expenditures and employ more engineers and scientists than any other private sector industry. Manufactured goods also represent over half of U.S. exports and drive more net wealth creation than any other sector.

The Right Policies Needed for Manufacturing

America's future requires a dramatically improved business environment in which to build an integrated national ecosystem for high-performance production with new technologies, designs, processes and materials. More effective collaboration will be essential between managers, employees, suppliers, researchers and educators. Government and regional support organizations also have crucial roles as conveners, connectors and policymakers—supporting conditions for a dynamic manufacturing base.

There are enormous opportunities to increase production and grow exports. The digital, biotechnology and nanotechnology revolutions are unleashing vast opportunities for innovation, manufacturing and services. They will enable new business formation, product development and job creation. In some cases they will serve as platforms for entirely new industries and markets.

Supporting American manufacturing does not mean advocating an industrial policy of selecting favored sectors or firms, subsidizing decaying industries, or protection from fair competition. These tactics, while used at times, rarely prove effective over the long-term. Instead, the government should focus on creating the right conditions for manufacturing to thrive, especially given the changing dynamic of global competition and the steady rise of state-supported capitalism. Doing so will allow the United States to capture a much greater share of the benefits resulting from its innovation enterprise.

The Council has outlined a comprehensive and integrated set of actions to support American manufacturing excellence in its report: *Make – An American Manufacturing Movement*. Implementing this strategy will require changing the national conversation, embracing new competitive realities and resolving to take meaningful action to unleash America's production potential. The high-level actions *Make* recommends include the following:

1. The United States needs to quickly enact fiscal reform, transform tax laws and reduce regulatory and other structural costs to fuel the innovation and production economy from

start-up to scale-up. These policies must improve the rule of law, reduce uncertainty in the business climate, encourage risk-taking and ease access to investment capital.

2. The United States must utilize multilateral fora, forge new agreements, advance intellectual property protection, standards and export control regimes to grow high-value investment, expand exports, reduce the trade deficit, increase market access and aggressively respond to foreign governments protecting domestic producers.
3. The United States needs to prepare the next generation of innovators, researchers and skilled workers at every level to harness the power and potential of American talent to win the future skills race. Production work today is knowledge work. Support for career and technical education and community college programs is vital to making America an ideal place to scale manufacturing. We must also encourage entrepreneurs and risk taking, and make it attractive for the best and the brightest to come and stay in this country.
4. The United States must create national advanced manufacturing clusters, networks and partnerships, prioritize R&D investments, deploy new tools, technologies and facilities, and accelerate commercialization of novel products and services to achieving next-generation productivity through smart innovation and manufacturing. Funding is needed for basic and applied scientific research in advanced manufacturing technologies. Such a model of government funding has been extremely effective in creating world-class Information Technology and biomedical sectors in the U.S.
5. The United States needs to develop and deploy smart, sustainable, secure and resilient energy, transportation, production and cyber infrastructures to create competitive advantage through next generation supply networks and advanced logistics and systems.

The adoption of comprehensive, pre-competitive policies – i.e. policies that do not provide undue advantage or disadvantage to a particular industry or sector – are of great importance to the long-term strength of our nation’s manufacturing base. The recommendations above address some of the most pressing challenges facing U.S. manufacturers today, and while useful if implemented individually, these reforms would have a far greater impact if implemented as a suite of solutions, geared to support organic growth of the American industrial base while strengthening and deepening critical domestic supply networks.

Manufacturing is Innovation

Manufacturing is central to the life-cycle process that brings solutions to customers. This involves cutting-edge science and technology, design, modeling and simulation through advanced computing, systems engineering, testing and verification and the contributions of complex supply networks. It also involves a wide range of services and transactions, transportation, maintenance and energy, plus the talent of many occupations—all of which is in addition to “bending metal.” Firms that commercialize new technologies and scale production grow faster, are more profitable and create more jobs than other firms do.

Unfortunately, government policies and programs tend to focus almost exclusively on product R&D, technology transfer and, in some ways, early stage commercialization. These phases are

all critically important, but manufacturing at scale and manufacturing technologies are often not considered a part of the innovation ecosystem. In fact, they are often discounted, creating a negative ripple throughout the manufacturing value chain.

In recent history, manufacturing business models evolved to a point where production and innovation became separate. Manufacturing was viewed as a cost to be minimized rather than a process to be optimized for competitive advantage. Conventional wisdom emerged that as long as high-value added work—e.g. engineering and design—remained in the United States then the economy would grow and large-scale production could be left to its own devices.

This model, however, is not sustainable. A broad array of government policies, both foreign and domestic, have important impacts on the innovation and production process, from research funding to taxes to market access. Presently, U.S. policies are not aligned with the full life-cycle perspective of innovation that includes production at scale.

Without strong public and private support for the complete life-cycle innovation and production process, the United States cannot maximize the return on its innovation investments—a return measured in jobs, growth and tax revenue. Today, foreign investors—especially through sovereign wealth funds—acquire production of U.S.-developed technologies and innovations. Even domestic investors typically condition their investment in new technologies on a business plan that directs manufacturing abroad.

The policies, programs, strategies and business models that worked in the past are inadequate to secure America's future. Government, business, labor and academic leaders must rethink and retool the nation's business environment to seize arising opportunities and address several shortcomings. The leveling effects of globalization are diminishing the low cost advantages offered in emerging economies and potentially opening the door to increased manufacturing in the United States.

Structural Changes in the Global Economy Create Opportunities and Challenges

Manufacturing is global and the forces coloring America's manufacturing future are highly complex. Structural changes are reshaping the global economy, and firms are becoming more sophisticated in adapting and contributing to that change. Tectonic shifts in technology and talent are augmenting what, how and where products are manufactured—and the dynamics vary by sector. America's edge in innovation and entrepreneurship is narrowing, and another valley of death has opened where startups struggle to find capital for domestic production at scale. Further complicating the environment is the promise of an energy boom in natural gas, the dark shadow of America's struggle to curb its debt and the need to invest in people and infrastructure.

The global migration toward free enterprise and open markets is driving growth in emerging economies. Several nations have rapidly developed into formidable manufacturing competitors. China's manufacturing output, for example, is now approaching that of the United States. As development spreads, with it comes a burgeoning consumer class in economies around the world. About 1.8 billion people occupy the consumer class today. By 2030, this number could reach 5 billion, with 95 percent of the growth occurring in emerging and developing economies—creating large new demands for manufactured goods.

Global companies see significant sales and investment opportunities in emerging economies.

Emerging markets' share of global foreign direct investment (FDI) inflows has grown from about 20 percent in 2000 to more than half today. In the 2011 "World Investment Prospects Survey," global companies saw China, the United States, India, Brazil, Russia and the United Kingdom as top prospects for future foreign investment.

U.S.-based operations must also compete with aggressive mercantilist policies from foreign governments. Many countries have put in place policies and financial incentives to attract investment, manufacturing facilities, foreign intellectual property and talent while protecting domestic business interests. China for example, is suspected of keeping the Renminbi weak to spur exports and often acts outside of international protocols to gain control of foreign technologies. China also uses indigenous innovation policy, forced technology transfer and government procurement without adherences to World Trade Organization principles to keep their market closed and build national industrial champions.

The digital revolution and the pace of technological change also profoundly impact the way that business and production are organized. Digital technologies have made many facets of the global economy nearly borderless. In an earlier era, the location of natural resources often determined where manufacturing would take place. In today's economy, knowledge, know-how, technology, creativity and capital are the most important resources for production, and they are highly mobile.

The pace of technological change is transforming not only product life-cycles and time-to-market pressure; it is also pushing firms to compete by using technology to improve their manufacturing processes and business models. Companies like NanoMech are transforming the face of modern manufacturing. Founded in 2002, the company offers breakthrough nano innovations in machining and manufacturing, lubrication and energy, packaging for fresh produce, biomedical implant coatings and strategic military applications.

Put together, these trends—emerging manufacturing nations, growing consumer class, neo-mercantilist policies and revolutions in digital and other technologies—create a hyper-competitive manufacturing environment. Not surprisingly, firms are growing more sophisticated in their ability to react to these changes and, where possible, leverage them to their advantage in the marketplace. But they can't do everything.

Technology and Innovation Capacity

America's technology and innovation capacity remains among the greatest in the world. In crucial fields like biotechnology, bio-mimicry, nanotechnology, materials science and computing, U.S. researchers and entrepreneurs define the leading edge. American universities and research laboratories are unparalleled, pushing the boundaries of knowledge in life, physical and social sciences. Despite the nation's budget woes, Congress has thus far been reluctant to impose drastic cuts to scientific research funding that is viewed correctly as an engine of economic growth. America remains the world's largest investor in R&D and is among the upper ranks in R&D investment as a share of GDP.

At the same time, other nations are making rapid progress relative to the United States in developing the talent, investment and infrastructure needed to foster innovation. On several education performance metrics, the United States trails its global competitors. Furthermore, a

number of policies and practices limit American innovation today. Licensing practices, export controls and immigration policy, for example, were designed for a different era. Removing those impediments could generate greater levels of innovation and commercialization from today's assets and investments.

In addition, the United States, which in the 1980s offered the world's most generous R&D tax credit, today trails 23 other nations for R&D incentives. Plus, the uncertainty surrounding extension of U.S. R&D tax credits does not instill confidence in firms developing cutting-edge technologies and world-class innovation in the United States. Given this uncertainty and the fierce global competition for R&D investment dollars, it is no surprise that the U.S. share of global R&D has fallen by eight percentage points, from 38 percent to 31 percent since 1999.

In 1960, the United States accounted for more than two-thirds of global R&D. Today, two-thirds of global R&D is performed somewhere other than the United States. Although a more prosperous and innovative world is a welcome trend, the shift has significant implications for U.S. manufacturing, economic and security interests. America has long been the global leader in creating new, high value-added goods and services. In time, this lead will undoubtedly continue to narrow, and graver concerns will emerge around America's ability to develop and produce sufficient numbers of the high-margin products that sustain and improve living standards.

Smart Manufacturing

The potential for manufacturing process innovation is enormous. Smart manufacturing is an ongoing effort to integrate many key technology trends—such as high performance computing (HPC), robotics, optics and sensors, additive manufacturing, cloud computing, nano engineering, data mining and user-driven customization—across global production enterprises and supply networks. By marrying these and other technological capabilities with human insight, smart manufacturing promises to revolutionize the way production is organized and delivered. As manufacturing intelligence of this kind grows, it will inspire innovations in processes and products that will unleash new, disruptive capabilities—such as a micro-manufacturing megatrend that will put the tools of production into the hands of consumers. Imagine the possibilities for rapid innovation and value creation with a “micro-factory” in every home.

Smart manufacturing enables a coordinated and performance-oriented enterprise that responds quickly to the customer, minimizes energy and material use, maximizes health and safety and generates innovation. Today, smart tools and systems that generate and analyze greater amounts of data are being used to plan, design, build, operate and manage industrial facilities and networks.

Smart manufacturing is a growth engine for jobs and a sustainable economy. A \$50 billion investment in retooling factories would generate up to \$120 billion in revenue resulting from increased demand for products, according to a study by the Apollo Alliance, a business-labor coalition. Manufacturers would achieve higher levels of business performance, turn resources into assets and discover unique opportunities for competitiveness.

Though industry is adopting components of smart manufacturing, the infrastructure, capabilities and investments needed to deliver the full potential of this knowledge-based environment have yet to be developed. Because of the tremendous scale of these investments, U.S. private and

public sector leaders will need to partner in order to capitalize on this potential advantage. Small and medium sized manufacturing firms (SMEs) will be especially hard pressed to absorb the costs and time required to integrate smart manufacturing tools and techniques.

Manufacturing R&D

Competing economies like the European Union, China, South Korea and others are making significant advanced manufacturing technology investments to benefit their own companies. The European Union has already approved 1.2 billion Euros for a new "Factories of the Future" research program as part of their economic recovery plan, putting the E.U. ahead of the U.S. in the race to re-industrialize their manufacturing base with smart, safe and sustainable manufacturing.

Conversely, the development and deployment of advanced manufacturing technologies in the U.S. is being constrained by a number of structural barriers that no single, private firm can solve. For example:

Research Barriers: R&D can be prohibitively expensive, and hard to capture profits, for large companies and SMEs alike. Both public and private sector R&D sponsors have experienced constraints brought on by economic uncertainty, which have driven renewed interest in measurable returns on R&D investments. In the pharmaceutical industry, which has come under increased pressure to justify high R&D spending and limited productivity, companies are slashing their R&D budgets by \$1 billion or more over the next few years.

Risk Barriers: Research is inherently risky, costly, and time consuming and a typical R&D project in the manufacturing sector spans five to 10 years. U.S. manufacturing firms have also progressively shifted the composition of their R&D portfolios toward shorter-term, less risky objectives.

Platform Barriers: No single firm could coordinate national projects like the internet or smart electrical grid. Interoperability across multiple production platforms, for example, must be addressed through various means, including collaborative-based standards setting.

Innovation Barriers: Firms need help translating new discoveries into the production process, especially across supply networks; manufacturers are increasingly investing in mission-specific R&D that will provide benefit to their company and few others.

Current underinvestment in advanced manufacturing R&D requires government involvement. There are a lack of economic incentives in these areas, as companies would not be maximizing profits from R&D investments. The needed technology platforms will be derived from a combination of public and private assets. These new policies must tackle head on early-phase R&D investment inefficiencies and subsequent supply-chain integration and technology life-cycle management requirements.

Government Role in Manufacturing R&D

The government can address the market inefficiencies incumbent in advanced manufacturing R&D through two primary mechanisms:

1. Improving incentives for company-funded basic and applied R&D
2. Providing funding and technical expertise for public private partnerships to develop and deploy breakthrough technologies and platforms. The NNMI would play a role in this broader effort.

The United States should leverage R&D investments across the federal research enterprise to solve challenges in sustainable smart manufacturing systems and to ensure a dynamic discovery and innovation pipeline. It is equally important to sustain federal investment in key agencies that support basic research, infrastructure and STEM education. Agencies include the National Science Foundation, the National Institute of Standards and Technology, the National Aeronautics and Space Administration, the Department of Defense, the Department of Energy Office of Science and the National Institutes of Health.

There is growing evidence that cross-sector research collaborations and public-private partnerships are more able to accelerate the development and commercialization of breakthrough advanced manufacturing tools, processes and applications. These include “materials by design,” automation and intelligent robotics, modeling and simulation, complexity and data analytics, sub-atomic to extreme systems engineering, cyber security and operation logistics and business management.

These partnerships should also be leveraged to create a national network of advanced manufacturing clusters and smart factory ecosystems. The U.S. needs blueprints for smarter factories and industrial communities; and plans to modernize the aging industrial base with information technology-enabled smart manufacturing processes.

Incentives should be used to establish multi-user advanced manufacturing facilities, capable of rapid reconfiguration to support fabrication of a wide range of products. These facilities would provide broad access to cost-effective prototyping, testing and low volume manufacturing for small businesses, entrepreneurs and small innovators.

Cross-sector consortia with industry, academic, national laboratory and federal agency partners should be used to identify and solve critical technical challenges in developing advanced manufacturing tools, technologies and processes. Such consortia would be well positioned to apply agile manufacturing techniques to transition all levels of U.S. industries from one technology generation to the next faster and more efficiently than competitors.

As manufacturing continues to become more data driven, especially given the growing accumulation of production feedback from automated systems, the U.S. must sustain federal investment in moving the nation’s computational capabilities to the exascale level, and incent the necessary private investment to ensure that the United States maintains global leadership in HPC.

Production is becoming more sophisticated and companies will need increased access to simplified, cost-effective design and engineering tools, visualization technologies, modeling and simulation and collaborative platforms that can be used more widely by U.S. innovators and manufacturers through open and virtual campus facilities. The U. S. Department of Commerce through the Economic Development Administration, in partnership with the Council on

Competitiveness should expand the Midwest Project for SME—OEM Use of Modeling and Simulation through the National Digital Engineering and Manufacturing Consortium (NDEMC).

Technology transfer is often lamented as a significant barrier. Increased efforts are needed to accelerate innovation from universities and national laboratories by facilitating greater sharing of intellectual property and incentivizing commercialization. Part of the solution includes shifting a greater percentage of investments at national laboratories and research universities to end-use inspired basic research. Also, the missions of federal R&D agencies should be amended to support U.S. industry as stipulated in the National Competitiveness Technology Transfer Act and associated legislation. More can be done to facilitate and incentivize access to labs and universities to encourage research partnerships and greater commercialization opportunities.

National Network for Manufacturing Innovation (NNMI)

The NNMI presents an opportunity to develop and deploy at scale the next generation of disruptive manufacturing technologies, processes and integrated supply networks. Given the complexity and long-term nature of many of these challenges, it is unlikely that the private sector alone can address these critical challenges. The network must provide an effective platform to explore and resolve key challenges facing future U.S. advanced manufacturing tools and technologies.

The NNMI should rely on public-private partnerships, collaborative dialogues, research and demonstration projects to provide knowledge-based platforms, tools, methodologies, business models and policies for lifecycle product development, production and end-life. There must be clear investment criteria to determine the NNMI is not funding projects that the private sector should be funding on its own. The strategic scope for NNMI exploration should be to:

1. Facilitate smart manufacturing at scale in the United States, emphasizing more long-term, breakthrough research for a diversified portfolio of emerging technologies with broad application.
2. Improve the economic impact and benefits of demand-driven research and development of new manufacturing and energy related technologies and processes.
3. Foster broader and deeper collaborations and knowledge sharing across industrial sectors and with government, universities and national laboratories to improve collective R&D returns.
4. Address full life cycle manufacturing including concept modeling, simulation and evaluation to reduce commercialization times, ensure greater pre-competitive knowledge, improve risk management and lower uncertainty for better-informed manufacturing decisions, investments, policies and strategies.
5. Leverage existing and create new regional innovation and manufacturing clusters.

Manufacturing legacy systems and infrastructures in the United States need to be propelled forward in a global context, which requires an overhaul of government policies and programs as well as business strategies and processes. Policy makers, manufacturing executives and other key players need to change the view of manufacturing from a cost-center to a knowledge-based value creation center, in order to achieve sustainable, competitive and long-term growth.

The NNMI provides a vehicle for conducting collaborative research and demonstration projects to facilitate this game-changing transition. Learning under this initiative will make a significant contribution to the long-term viability of U.S. based manufacturing.

Success requires the NNMI to represent a broad range of pre-competitive interests and perspectives in order to accelerate and leverage the knowledge of the entire manufacturing ecosystem. To the extent possible and practical, the NNMI should work with and utilize existing facilities and resources. Key areas of focus for the NNMI should be:

1. Lifecycle Management and Total Cost of Production
2. Transforming Manufacturing Facilities and Processes
3. High Performance Manufacturing Tools and Technologies
4. Sustainable Resource Optimization and Advanced Materials

Lifecycle Management and Total Cost of Production

The NNMI must adhere to a shared baseline understanding of product lifecycle management to better understand the fully burdened cost of production. These assessments will include economic, energy and environmental issues, along with traditional production lifecycle analysis. Policy makers must be able to more fully evaluate environmental and economic impacts against each other along the complete product lifecycle in ways that are not currently available.

Transforming Manufacturing Facilities and Processes

The NNMI should focus on the transformation of current factories and the creation of new factories, looking at capabilities ranging from flexible and modular to affordable and easy-to-use. Expanding the productivity and useful life of production assets requires new approaches. Emerging information technologies including cloud computing are expected to improve efficiencies, product capabilities, product authentication, intellectual property rights protection, facilitate new business models and improved effectiveness of global networks.

High Performance Manufacturing Tools and Technologies

NNMI investments should create knowledge-based platforms, tools, technologies and processes to simulate and improve full-lifecycle product development and manufacturing. Complex manufacturing ecosystems will increasingly rely on high-skilled, high-performing workers collaborating with advanced tools and technologies. One goal of the NNMI should be to develop faster transitions from early stage commercialization to at-scale manufacturing, thereby minimizing the effects of multiple valleys of death. Flexible adaptive production tools, systems and facilities are needed for rapid deployments optimal resource use and energy effectiveness.

Sustainable Resource Optimization and Advanced Materials

NNMI investments should result in new applications in different technologies, disciplines and materials to improve energy efficiency, reduce resource consumption and ensure profitability. "Re-manufacturing" of products and production processes will be a strategic driver. NNMI should work towards solutions with significant cost reduction through optimization of resources, equipment and facilities in order to maximize overall manufacturing effectiveness.

Conclusion

Government supported long-term goals and investments have been catalysts for innovation and advancement in science, technology, and the competitiveness of the United States. From breaking the sound barrier, to landing a man on the moon, to nuclear energy, to the advent of the internet age – advancements have been achieved through cutting edge research and development, often spurred by bold goals set by the U.S. government. Moreover, the federal government has supported these goals with assertive science and technology policies, and the requisite long term funding to achieve success.

The U.S. government should once again take a strong leadership role and establish significant manufacturing R&D programs, enabled by policy, which could drive meaningful advancement and innovation. These programs and investments would spur the competitive U.S. spirit, inspiring additional investment in innovation and promoting the cultivation of highly skilled scientists, engineers and workers, as well as the manufacturing capabilities required to advance U.S. competitiveness for decades to come.

About the Council

Begun in 1986, the Council is a community of U.S. leaders who work together to ensure economic growth, national security and a better quality of life for all Americans. Our unique membership – corporate CEOs, university presidents, labor leaders and national lab directors – collaborate to establish action agendas and deliver strategic, operational and innovative solutions that drive our nation's competitiveness in the global economic arena.

By maintaining our reputation as an established and forward thinking non-partisan organization, the Council has worked successfully with every Administration in its 25-year history. Policymakers listen to and adopt our recommendations because they understand that our only special interest is America's enduring prosperity.

Recognizing the many and varied challenges facing American manufacturers, the Council formally launched the U.S. Manufacturing Competitiveness Initiative (USMCI) in June of 2010 and in December 2011, the Council released its national manufacturing strategy – Make: An American Manufacturing Movement. The USMCI is led by Sam Allen, the Chairman & CEO of Deere & Company; Michael Splinter, the Chairman, President & CEO of Applied Materials; Shirley Ann Jackson, the President of RPI; William Hite, the General President of the United Association of Plumbers and Pipefitters; and Paul Hommert, Director of Sandia National Laboratory.



Strengthening Manufacturing Competitiveness

Dennis Harwig, PhD
December 8, 2011



Our Thesis

- ◆ U.S. losing manufacturing leadership position
- ◆ Manufacturing competitiveness requires innovation
- ◆ Current U.S. structures are not effective at maturing, commercializing, and broadly disseminating world-leading technologies to U.S. manufacturers
- ◆ A new U.S. innovation infrastructure is needed to bridge the gap between basic research and best practice outreach programs
- ◆ Other countries have made investments in such an infrastructure. We should learn from these and create a unique model which leverages our strengths



Status of U.S. Manufacturing

◆ Positives

- U.S. still leads global manufacturing output
- If U.S. Manufacturing were a country, it would be the world's eighth largest economy
- Created 230,000 jobs in the first nine months of 2011
- Highest multiplier effect among the major sectors, with every dollar in final sales supporting \$1.40 in output from other sectors

◆ Negatives

- Dominant position has steadily eroded over the past decade
- Lost 2.1 million manufacturing jobs during the recession
- Over half of 360 manufacturing executives surveyed see U.S. manufacturing modestly or strongly declining

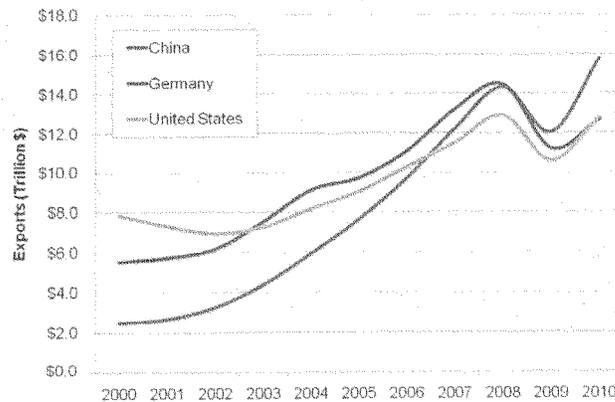


source: Oct. 2011 Economist Intelligence Unit survey



Global Competitiveness Challenge

Total Exports

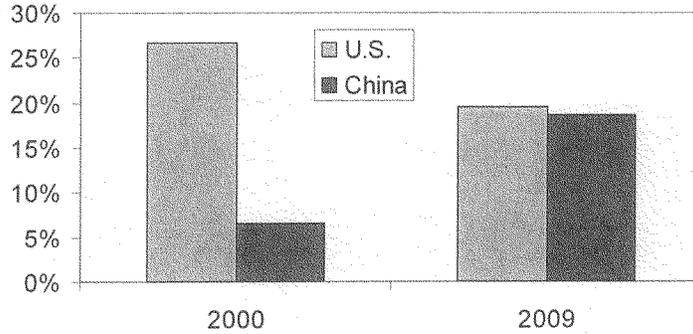


source: World Trade Organization, 2011



Global Competitiveness Challenge

The United States has led in share of Global Manufacturing Output since 1895, until now...

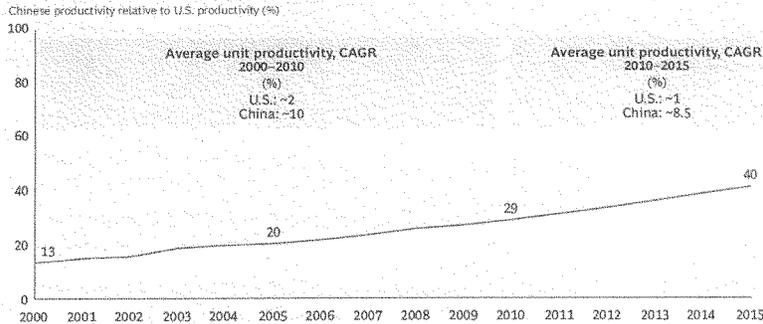


source: World Bank



Not Just About Low Wages

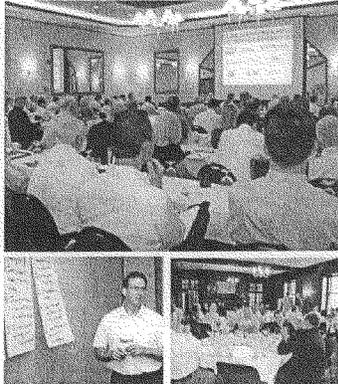
Growing at nearly 10 percent per year, China's productivity could reach 40 percent of U.S. productivity by 2015



source: Boston Consulting Group report "Made in America Again", Aug 2011



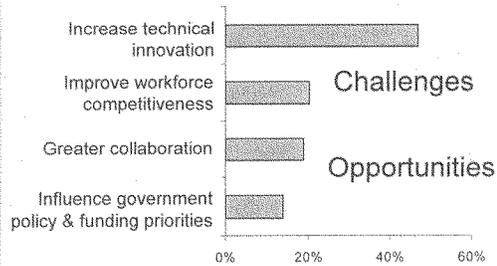
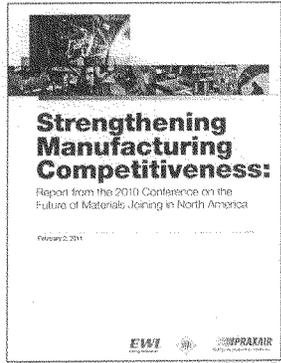
2010 Leadership Conference



- ◆ Goal: explore collaborations to advance North America's competitive position
- ◆ 70 invitees from industry, government, national labs, universities, non-profits
- ◆ Identified "grand challenges"
- ◆ Discussed opportunities to address the challenges
- ◆ High sense of urgency
- ◆ Leadership needed from national organizations

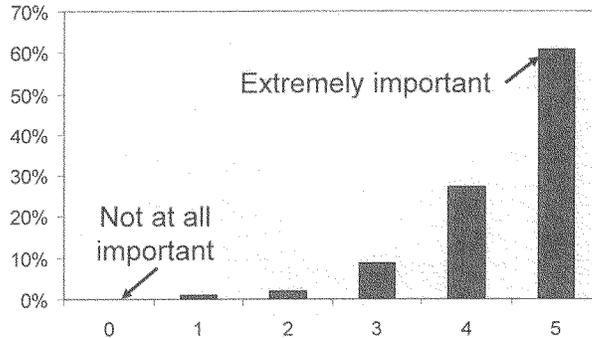


Priorities to Improve Manufacturing Competitiveness



Manufacturers Recognize the Importance of Innovation to Competitiveness

How important will having world-class manufacturing technologies be to your company's overall competitiveness in the next 5 years?



Source: 2011 EWI Member Survey; 350 respondents



Importance of Innovation to Competitiveness Widely Recognized

- ◆ **June 2010 Global Manufacturing Competitiveness Index**
 - Global survey of 400 manufacturing executives found the number one driver of manufacturing competitiveness to be "talent-driven innovation"
- ◆ **February 2011 President's State of the Union Message**
 - "We need to out-innovate, out-educate and out-build the rest of the world"
- ◆ **June 2011 President's Council of Advisors on Science and Technology (PCAST) report:**
 - The country needs "a fertile environment for innovation" to remain a global leader
- ◆ **October 2011 Economist Intelligence Unit Survey of senior executives from U.S. manufacturing firms**
 - 90% identify innovation as the key to long-term success



EWI uses Surveys and Focus Groups to Assess Emerging Needs

Example Question: What will be your most important materials-joining related business challenges in the next five years?

Overall Rank	Challenge	Automotive	Oil & Gas	Defense	Aerospace	Heavy Man	Advanced Energy
1	Increased use of new materials or material combinations	1	4	3	4	4	1
2	Qualifying new processes and procedures			2	1		
3	Maturing and successfully transitioning technologies from R&D to production			1	3		4
4	Keeping staff current on the latest materials joining processes and methods	2					3
5	Shortage of engineers and designers with materials joining expertise		1	4			
6	Increased joint performance requirements	4	2			2	
7	Competition from low labor-cost countries	3					
8	Cost to introduce new processes, procedures, or product designs				2		2
9	First-time quality expectations are increasing					3	
10	Shortage of skilled welders and other skilled trades		3			1	

(Source: 2010 EWI Member Survey~550 responses)



Commonly Cited Needs

- ◆ **Quality:** More accurate, reliable, and portable NDE. Real-time process monitoring and control.
- ◆ **Materials:** Joining / repair of dissimilar, non-traditional, and advanced materials
- ◆ **Workforce:** Shortage of engineers and skilled trades; attracting talent; keeping skills current
- ◆ **Advanced Processes:** New processes or hybridized processes for demanding applications; and improved process optimization methods
- ◆ **Automation:** Improved process controls; and more flexible automation to maximize productivity and quality.
- ◆ **Modeling:** Improved modeling tools to allow material and process interactions to be simulated in a 3D structure.

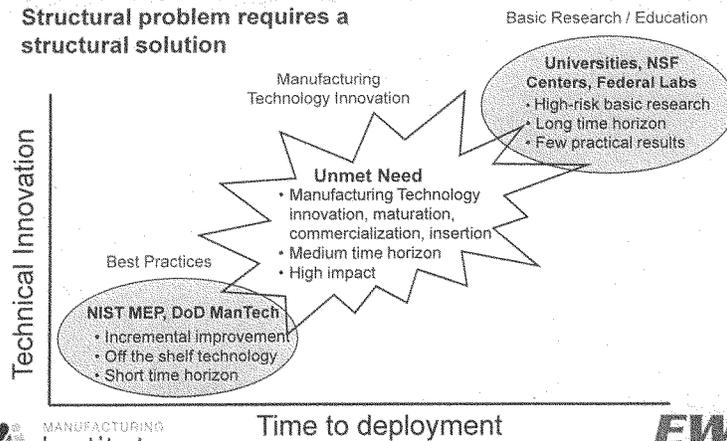


Cross-Cutting Challenges

- ◆ **Codes, standards, regulations:** Harmonize industry standards to reduce unnecessary variations in requirements. Update standards more quickly to changes in technology. More quantitative criteria and certification systems needed to reduce subjectivity.
- ◆ **Technology proliferation:** Keep up with technology. Share materials joining knowledge so more effective decisions can be made based on cost and performance
- ◆ **Technology maturation/transition:** Better ways to mature and transition technologies from R&D to production; bridge “valley of death” in commercialization



US Innovation Gap: Little Emphasis on Maturing New Manufacturing Technology



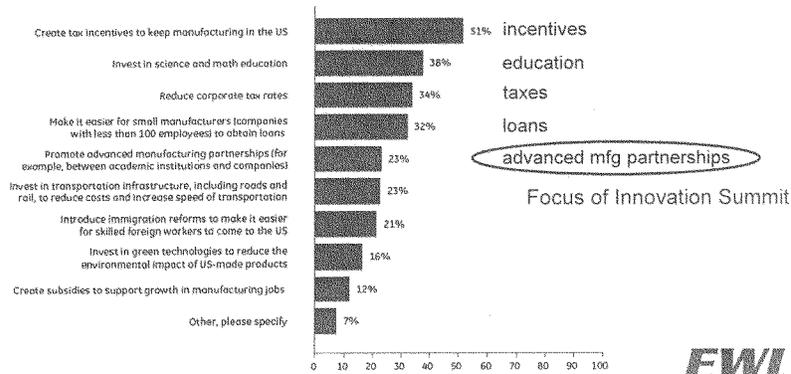
Global Manufacturing Innovation

- ◆ **Current US innovation model**
 - Developed out of necessity in 1946
 - Designed for agency-specific basic research at National Labs and universities
 - Less than 10% of total federal funding used to transition technologies to industry
- ◆ **Other nations are...**
 - Transitioning funding to development and deployment of manufacturing technology
 - Incentivizing (tax breaks, capital, and bricks & mortar funds) companies to set up manufacturing facilities locally
 - Surpassing the US in manufacturing



Government's Role

What are the most important things the U.S. government can do to improve the status of the U.S. as a manufacturing destination?



Source: Economist Intelligence Unit survey, Aug. 2011



Past Innovation Models have Strengths and Weaknesses

The following models were evaluated:

- ◆ Fraunhofer Institutes (Germany)
- ◆ A*STAR (Singapore)
- ◆ SEMATECH
- ◆ NIST MEPs
- ◆ NSF Centers
- ◆ EPRI
- ◆ EWI Edison Center
- ◆ DoD MANTECH
- ◆ Federal laboratories
- ◆ One-off Federal solicitations

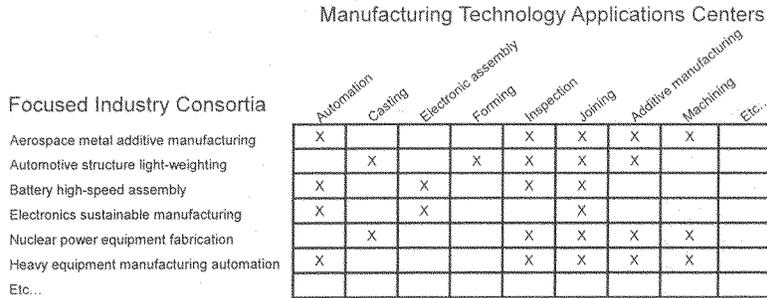


Overview of “New” Model for US Manufacturing Innovation

- ◆ **Manufacturing Application Centers (cross-sector)**
 - 501(c)(3) not-for-profit, technically savvy, geographically distributed organizations
 - World-class capabilities to develop, mature, commercialize, and broadly deploy innovative manufacturing technologies
 - Capital equipment and core capabilities funded by Fed Gov't (20% of MTAC revenue); balance funded by competitively bid programs
- ◆ **Focused Industry Consortia (sector specific)**
 - Identify key technology gaps and form project teams to develop solutions leveraging capabilities of MTACs
 - Convened by MTACs
 - Membership based, financial support from members required to demonstrate relevance of Consortia

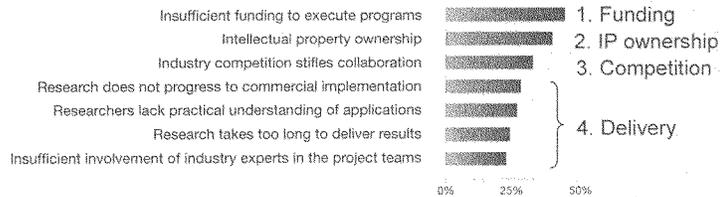


Synergistic Relationship Between Consortia and Application Centers



An Effective Model Must Overcome Four Principle Challenges

What are the biggest barriers to successful collaborative manufacturing technology development?



Source: Aug. 2010 EWI member survey; 550 respondents



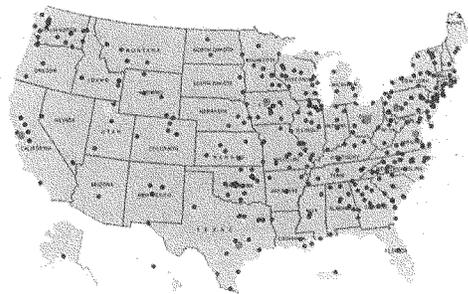
Two Pillars of the Proposed Innovation Model

- ◆ **Manufacturing Technology Application Centers (cross-sector)**
 - Goal: develop, mature, commercialize, and broadly deploy technologies that create sustained competitive advantage
 - Funding: 20% federal funding for core capabilities; balance fee-for-service work and license revenue; independent non-profits reinvest revenue
 - IP: retained by centers with incentives to share and commercialize
 - Competition: confidential development for individual clients
 - Delivery: permanent national network to make technology widely available; serve all sectors; intermediary between universities and MEP
- ◆ **Focused Industry Consortia (sector specific)**
 - Goal: identify gaps and form project teams to develop solutions
 - Funding: government / industry balance depend on technology maturity
 - IP: accessible by consortia participants; incentives to commercialize
 - Competition: pool resources for precompetitive R&D
 - Delivery: gated programs targeting greatest needs of specific sectors



Geographically Distributed and Linked to Existing Assets

- ◆ Locate application centers near existing basic research assets
- ◆ Locate consortia at centers nearest to industry clusters
- ◆ Linkage to existing manufacturing outreach assets

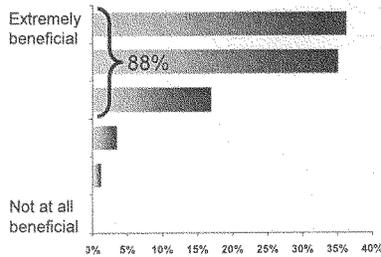


- Manufacturing extension partnership sites
- National labs
- Example application centers near related university programs or national labs

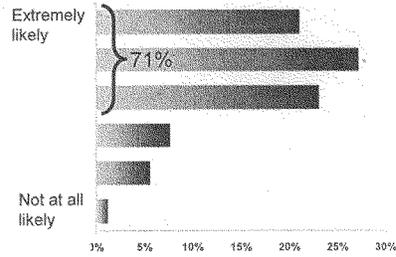


Receptivity to the Proposed Model

Benefit of non-profit technology centers
focused on manufacturing technology



Likelihood of participating in
industry led consortia for
manufacturing technology

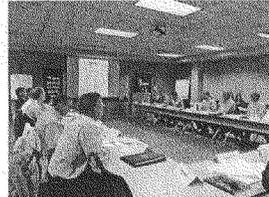


Source: Sept 2011 EWI member
survey; 350 respondents



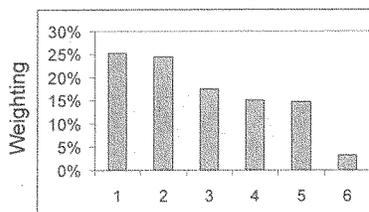
Manufacturing Innovation Summit: Validation of Model

- ◆ Manufacturing Innovation Summit
October 27, 2011, Columbus
- ◆ 25 industry participants
 - Large, medium, and small companies
 - Range of sectors
- ◆ Reviewed other innovation models
- ◆ Confirmed need for an infrastructure
to mature manufacturing technology
- ◆ Consensus behind proposed
framework
- ◆ Developed recommendations to
refine and strengthen the model



Manufacturing Innovation Summit: Recommendations

1. Focus on opportunities that create sustained competitive advantage for U.S. manufacturers
2. Structure to link with industry, universities, and labs
3. Communicate plan to build national support
4. Establish metrics to show impact
5. Develop industry incentives to participate
6. Articulate a workable IP strategy



Follow-up Activities

- ◆ Publish Innovation Summit report
- ◆ Get committed industry participants
- ◆ Agency / policymaker meetings
- ◆ Second Innovation Summit in DC, January timeframe

◆ **Let us know if you want to be involved**



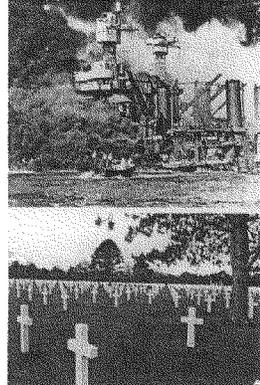
“...a date that will live in infamy.”

70 years ago this morning, the U.S. found itself at war

Despite the depression, “the greatest generation” rose to the occasion to simultaneously win wars in Europe and the Pacific

Their sacrifice established America as the dominant power for over 60 years

What will be said of our generation?



Questions or Comments?

Dennis Harwig, PhD
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About The Manufacturing Institute

- ◆ The Manufacturing Institute is the education and services arm of the National Association of Manufacturers;
- ◆ A strategic agenda to support U.S. manufacturers through education reform and workforce development, accelerating innovation, and research;
- ◆ Goal to build support for the creation of a network of Manufacturing Innovation Centers;
- ◆ Established a national system of industry-based certifications for the manufacturing workforce;
- ◆ Key reports include the Structural Cost Study, Skills Gap Report, and Innovation Imperative.



About EWI



- ◆ An applied engineering services company that develops and commercializes advanced manufacturing technologies
- ◆ Broadest materials joining technical capabilities in the Western Hemisphere
- ◆ *Mission to advance our customers' manufacturing competitiveness through innovation in joining and allied technologies*
- ◆ 240 member companies across all manufacturing sectors





Published on *The Information Technology & Innovation Foundation* (<http://www.itif.org>)

ITIF Welcomes President Obama's Proposal on Manufacturing Innovation

March 9, 2012

In response to an initiative to promote innovation and competitiveness in manufacturing President Obama is announcing today, ITIF President Rob Atkinson made the following statement:

"Finally, at the very highest levels of government there is recognition that manufacturing matters and an acknowledgement that our public policies have been failing this critical sector. The National Network for Manufacturing Innovation is one of the most important steps this or any Administration has taken in recent years to revitalize American manufacturing and it is urgently needed.

The United States has endured unprecedented erosion in manufacturing. As a share of the economy, we've seen a 32% decline in manufacturing jobs. That is worse than what we experienced in the Great Depression. As ITIF finds in a report to be released on March 21, this employment decline is not, as so many presume, about superior productivity leading to fewer jobs. It is about the loss of U.S. international competitiveness leading to reduced output and fewer jobs. Such a decline was not inevitable and it is recoverable.

We hope the 15 Institutes for National Manufacturing Innovation the President envisions will help harness America's inventive capacity and turn ideas into new products and enhance U.S. competitiveness. Germany, Japan, Korea, and other countries have demonstrated the effectiveness of similar approaches for creating and sustaining dynamic manufacturing sectors while also maintaining high wages and global market share.

The future of manufacturing transcends party identification. We hope this is an initiative that can be implemented as soon as possible."

Related Publications and Events:

[Medical Manufacturing Thinking: Manufacturing NOT the Bright Spot in the U.S. Economy](#)

[A Charter for Revitalizing American Manufacturing](#)

[Reviving Small and Mid-Sized Manufacturing With Technology: Learning from Best Practices Around the Globe](#)

###

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MATERIALS SUBMITTED BY SUBCOMMITTEE CHAIRMAN BENJAMIN QUAYLE, HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

U.S. doesn't need industrial policy — USATODAY.com

http://www.usatoday.com/news/opinion/story/2012-07-10/industrial-policy/1684447000

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Opposing view: U.S. doesn't need industrial policy

By Dan Ikenson

Updated 8/15/2012 9:14 PM

Recommends 34 5 0

For a nation whose consumers spend twice as much on services than on goods, and where 90% of the workforce is employed outside the manufacturing sector, the obsession with manufacturing is misplaced.

OUR VIEW: Sustain manufacturing rebound

This romanticized notion about manufacturing's value to the U.S. economy often fosters policies with pernicious long-term economic effects: tax breaks, subsidies, trade barriers and other codifying market distortions.

Even Christina Romer, an architect of President Obama's "stimulus" plan and one who is obviously not averse to government tinkering with the economy, concludes:

"American consumers value health care and haircuts as much as washing machines and hair dryers. And our earnings from exporting architectural plans for a building in Shanghai are as real as those from exporting cars to Canada. ... A persuasive case for a manufacturing policy remains to be made."

Manufacturing apologists erroneously point to China's near-double-digit growth during the sluggish U.S. economic recovery as further evidence that top-down economic policies can ensure economic health.

But China's evolution from subsistence to midlevel manufacturing is not instructive for an economy at the technological fore. Industrial policy is anathema to value-driven innovation, and thus doesn't play to America's strengths.

China engages in industrial policy because it doesn't have the advantages of the U.S., such as a culture that values dissent and experimentation and that has cultivated institutions supporting innovation, branding and entrepreneurship.

With America's pre-eminence in innovation and entrepreneurship still intact, the U.S. is situated at the top of the global value chain. Staying there will require policies that bolster the rule of law, inject greater certainty into the business climate, and encourage the best and the brightest to come and stay in the country. We must treat entrepreneurs as rock stars, not with contempt.

If we really want our companies — manufacturing and otherwise — to be competitive, policymakers should start

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by reducing the cost of superfluous regulations, frivolous lawsuits and runaway health care costs

Dan Ikenson is director of the Cato Institute's Herbert A. Stiefel Center for Trade Policy Studies.

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