



UNITED STATES MANUFACTURING COUNCIL

April 29, 2014

The Honorable Penny Pritzker
Secretary of Commerce
U.S. Department of Commerce
Washington, D.C. 20230

Dear Madam Secretary:

There is no doubt that manufacturing matters to the United States. Indeed, manufacturing success is recognized globally as critically important for economic vitality, national security and jobs. As a result, many nations are investing heavily in research and infrastructure, engineering and development labs, and supply chain creation to strengthen national capabilities.¹ Substantial, sustained investment and policies encouraging innovation, research and development for U.S. manufacturing are imperative to regain U.S. leadership in high-value manufacturing segments and to catalyze desirable new industries. President Obama is committed to “making America a magnet for manufacturing jobs.”² The Department of Commerce has a major role in designing and implementing a strategy to realize that goal.

The Manufacturing Council (Council) has worked to identify the most significant challenges to U.S. manufacturing innovation and recommend actions. Over the last year, the Council has taken major strides in understanding the dynamics related to manufacturing innovation in the public and private sectors. This understanding comes from a comprehensive due diligence process that has included sharing our own professional experience within Council member companies, visiting the National Additive Manufacturing Innovation Institute, hosting a regional roundtable, and discussing relevant topics with numerous subject matter experts.

Based on these activities, the Council has reached four key insights which underpin our recommendations:

¹ Charles W. Wessner, “21st Century Manufacturing: Leading National Programs”, Webinar presentation, Oct, 2013

² Office of Management and Budget fact sheet, “Making America a Magnet for Manufacturing Jobs”, www.whitehouse.gov/omb/budget/factsheet, accessed December 17, 2013

1. The United States needs a clear, explicit and diverse manufacturing innovation strategy which is visibly integrated across participating federal agencies. We recommend that the Department of Commerce lead this effort.

2. U.S. spending on manufacturing research and development (R&D) is critically important to realize value from investments in product and material innovation. However, research in enabling processes and technologies for advanced manufacturing often fails to keep pace with product development research. This contributes to product manufacturing being performed in other countries and the loss of U.S. jobs. Competing nations, including France, Germany, the United Kingdom, Taiwan and Canada, are focused on manufacturing growth and sustainability and are investing to support innovation in national manufacturing capabilities.³ As an example, China recently announced a major \$5B manufacturing investment fund “to bolster what it has long considered a strategically important segment of its economy.”⁴ In this case, the specific sector is microelectronics; however we found other examples in our discovery process. The United States must channel investment into manufacturing R&D and maintain investment levels comparable to competing nations.⁵

3. Many U.S. companies, especially small and medium enterprises (SMEs), need to become more deeply engaged in the U.S. manufacturing R&D infrastructure. They need increased knowledge of and visibility within the range of existing government programs related to procurement, innovation, research and development, and further exposure to manufacturing technology, processes and innovations.

4. Manufacturers need a widely, recognized, single mechanism which could provide visibility of current U.S. manufacturing capabilities among public and private sector procurement officials. Industry purchasing managers and federal program managers have neither the time nor a cost efficient mechanism to search the existing manufacturing base for high potential suppliers. A single mechanism could increase transparency to manufacturing capabilities (especially for SMEs) and significantly reduce search cost/time. Characteristics of such a mechanism should include transparency, accessibility, timely data and robustness to create a self-sustaining system.

This mechanism could potentially take the form of an on-line National Manufacturing Supplier Capability Directory. A single supplier directory would create the necessary bidirectional exchange of manufacturing requirements to U.S. based manufacturers with relevant expertise and spur innovation, research and development opportunities. The Manufacturing Council will

³ The National Research Council, 21st Century Manufacturing, The Role of the Manufacturing Extension Partnership Program, 2013, Appendix A2, pp. 224-389.

⁴ Paul Mozur, “China to Spend \$5Billion on Microchip Industry”, Wall Street Journal, Dec. 19, 2013

⁵ Charles W. Wessner, “21st Century Manufacturing: Leading National Programs”, Webinar presentation, Oct, 2013.

investigate this and other options in order to provide additional suggestions in a forthcoming recommendation letter.

Our recommendations are based on these observations and support a strategy to strengthen American manufacturing innovation, research and development. We recommend that:

1. The President designate federal manufacturing innovation programs as an Inter-Agency Science and Technology Initiative.

The initiative, chaired by a senior appointee and with discrete budget fully funded to support U.S. global leadership in manufacturing capabilities and output, would align efforts across the multiple departments and agency units (e.g., Department of Defense, Department of Energy, Department of Commerce, National Science Foundation) to accelerate discovery, development and deployment of manufacturing technologies to serve the national interest. The initiative would also create visibility into all programs that support manufacturing innovation and provide a foundation to collect and analyze program data, identify gaps, improve coordination and collaboration, and eliminate costs of duplication. It would enable the navigation and interaction between manufacturing companies, federal, state and local governments, and academic institutions, and facilitate public outreach. This would require a high level policy making body with operational responsibilities in an appropriate agency. A precedent for such centralized program management exists for the National Nanotechnology Initiative, the Networking and Information Technology R&D program, and the U.S. Global Change Research Program within the National Science and Technology Council (NSTC). NSTC coordinates science and technology policy for the President across the federal government. For manufacturing R&D, the National Institute of Standards and Technology, within the Department of Commerce, should function as the NSTC program office and primary point of contact for the Manufacturing Innovation Initiative under the Inter-Agency Science and Technology Initiative.

2. Research and development that enables manufacturing processes and technologies be expanded and optimized by evolving the role of national labs and strengthening the National Network for Manufacturing Innovation (NNMI) program.

Historically, the United States has emphasized fundamental discovery research. In manufacturing, however, government R&D programs should focus not only on fundamental research for new materials and products, but also on fundamental R&D for manufacturing itself, and, importantly, support links to business. Today, the most competitive nations in manufacturing invest in extensive technology transfer infrastructure, advanced manufacturing strategies, and collaboration models. They also maintain funding profiles that extend beyond product and material innovation.

The United States already has an extensive portfolio of fundamental research programs in materials, particularly at the Department of Energy (DOE) and the National Science Foundation. To exploit this and other research, and to commercialize it into new products, the United States needs an equal level of innovation focused on fundamental R&D to create enabling manufacturing processes and technologies.

Strengthen the NNMI program. We support the mission of the NNMI program. Creating disruptive technologies to drive growth is the fundamental goal of the manufacturing institutes. In developing these technologies, U.S. manufacturers face significant challenges in both commercialization and collaboration. New products often require totally new manufacturing processes which can be complex, capital intensive and require collaboration. NNMI has the opportunity to provide cost-shared funding for technology development and commercialization, and build “teams” to facilitate collaboration between OEMs, SMEs and suppliers for new manufacturing technologies.

The Council believes the NNMI program can be strengthened in several ways. In selecting new institutes, NNMI should establish priority investments in areas with the greatest potential economic impact and industry demand, fund these areas at a critical mass level, and include concise commercialization criteria that articulate the path to a saleable end product. The engagement of suppliers in the R&D phase is often a critical link missing between research and commercialization. Commercialization either cannot occur or will slow significantly while a supply chain for the new innovation is developed. NNMI should focus on the development of these suppliers for the ultimate technology commercialization. NNMI should also provide more technical and business support, such as IP negotiations, to facilitate participant engagement.

Evolve the role of the national labs. The role of the DOE national labs should evolve so that it enables manufacturing process and technology research. The new mission would support industry commercialization of technologies associated with manufacturing institutes. The labs could then enhance the NNMI program by providing more effective engagement with industry and the NIST manufacturing programs. The labs are well funded and well-equipped, with highly trained staffs that could assist NNMI participants with complex systems-level issues, encourage technical transfer, and provide customized and flexible field services. Research personnel exchange programs between industry and national labs should be initiated to support increased tech transfer, improve technical networks and increase understanding between the different sectors of industry, government and academia. These activities would be particularly useful for SMEs.

3. The framework for collaboration and teambuilding within and between the public and private sectors be improved.

Facilitate early supply chain creation for new innovation. The Department of Commerce should increase its focus on building “teams” that facilitate early engagement of suppliers for eventual manufacturing of the new product innovations. Again, the value of the manufacturing institutes is apparent, as institute consortia enable connections between organizations and improve the linkage between innovation and production. Each institute needs a clearly articulated definition of the technology game changers to attract the participation of suppliers capable of manufacturing the end product. Without this, any manufacturing institute will run the risk of developing new materials and products which have no path to commercialization within the institute participants.

There is precedent for claiming this as a best practice, as some industry geographic clusters convene multiple players, coordinate research, development, design, engineering and manufacturing, and become critical to successful commercialization. SEMATECH in the semiconductor industry is a leading example. Regional cluster programs should be included in the Manufacturing Innovation Initiative budget matrix to provide improved visibility of these cluster programs within communities. The Department of Commerce should expand its program of national workshops to identify industry commercialization path priorities and requirements, as well as increase the advertising and promotion of existing state and federal programs. It should require state Manufacturing Extension Partnerships (MEP) to include a reference to MEP directly in their name. This will highlight federal involvement and improve recognition of federal investment and support within manufacturing communities.

Expand connections for collaboration and commercialization of technologies. Government should fund and support activities that facilitate teaming and connections across industry (end customers, end producers, suppliers), education (academic institutions, community colleges), public sector, economic development groups, and investors to accelerate technology commercialization and supply chain development. Creating connections between companies conversant in government R&D programs and companies new to them will provide visibility to market opportunities, identify ‘first customer’ opportunities, stimulate investment, create collaboration “teaming” opportunities from a capable supplier base, and directly address the widespread lack of awareness of federal programs and relevant manufacturing technology, processes and innovation. This is especially difficult for SMEs, where internal resources often do not exist and finding the right place to begin externally can be confusing and time-consuming. Expanding the scope of services of MEP and/or NNMI to perform these intermediary services is a possible solution.

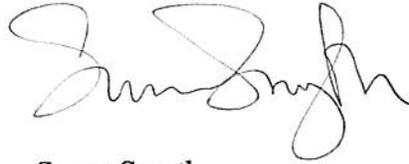
Underpinning the aforementioned recommendations is the need for long-term, sustained funding and policy focus on manufacturing innovation.

We appreciate your interest in these recommendations to revitalize manufacturing innovation. We commit to work with you to implement them in our joint efforts to strengthen American manufacturing for today and tomorrow.

Sincerely,



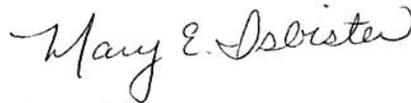
Albert Green
Chair, Innovation, Research and Development
Subcommittee



Susan Smyth
Vice-Chair, Innovation, Research and
Development Subcommittee



Mike Laszkiewicz
Chair, Manufacturing Council



Mary Isbister
Vice-Chair, Manufacturing Council

APPENDIX 1: Sources of Information

- Charles W. Wessner, “21st Century Manufacturing: Leading National Programs”, Webinar presentation, October, 2013.

	 Fraunhofer	 ITRI	 IRAP	 Catapult	 Carnot
Direct Supervisory Authority	Ministry of Education & Research	Ministry of Economic Affairs	National Research Council of Canada	Technology Strategy Board	National Agency for Research
Form of Entity	Private not-for-profit association	Government-owned research institute	Government program	Various private and public organizations	Public research institutions
Geographic Footprint	Widely distributed across Germany	One main site in Hsinchu, one site in Tainan	Across Canada; heavily concentrated in Quebec and Ontario	Plans for distribution across the UK	Distributed across France
No. of Institutes	60	1	18	7	34
Staff	20,000	5728	4,000	Evolving	19,000
Patents	6131	17,569	NA	NA	880/year
Annual “Core” Government Funding (\$M)	\$723M	\$300M	\$90M	\$65M	\$79M
Population	82 million	23 million	34 million	62 million	65 million

THE NATIONAL ACADEMIES
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In comparison, the United States has a population of 319 million and President Obama’s budget request for FY2015 provides \$2.2 billion for advanced manufacturing R&D. While this is a 12 percent increase over FY2014, at \$6.89/per capita, it is less than investments in manufacturing R&D programs being made in both Germany and Taiwan on a per capita basis.

White House Office of Science and Technology Policy, March 2014, www.whitehouse.gov/ostp

2) **Global Funding of R&D**, Mon, 12/09/2013, R&D Magazine/Battelle

<http://www.rdmag.com/articles/2013/12/global-funding-r-d>

“In 2014, China will continue its two-decade trajectory in R&D investment, consistent with the current Five-Year Plan (FYP 2011 to 2015). According to our Forecast, China’s research intensity will increase to 1.95% of GDP in 2014. China’s FYP is aimed at achieving 2.2% of GDP by 2015. This rate of growth is expected to continue through the end of the decade as China strives to transition from a manufacturing economy to being “innovation-driven” by 2020. At current rates of R&D investment and economic growth, China could surpass the U.S. in total R&D spending by about 2022.

Outlook

The broad patterns of R&D spending are not expected to change significantly in 2014, but regional shifts are occurring. Just five years ago, the U.S., Canada and Mexico were responsible for nearly 40% of global R&D. That share has dropped to about 34%, with the U.S. shrinking from a 34% share in 2009 to 31% now. Europe has experienced a similar decline from 26% in 2009 to less than 22% in 2014. Where the west has retrenched, Asia has advanced. In the same five years, Asia's share of R&D investments has risen from 33% to nearly 40%, with China rising from 10% to nearly 18%. China's high level of research intensity has now been sustained for nearly 20 years, and its total R&D investments are now more than 60% those of the U.S. The economic and political contexts in each of these regions suggest these trends are not likely to change in the near term and are likely to continue through 2020."

IRD Subcommittee Discovery Process:

The IRD Subcommittee followed a rigorous discovery process regarding the state of federally funded manufacturing R&D in the United States.

- The Subcommittee decided to focus its work on the manufacturing R&D and innovation programs in Department of Commerce, as the Manufacturing Council advises the Secretary of Commerce, not the entire USG. It determined to focus specifically on programs in NIST, both the internal NIST research lab work (in those areas that relate to manufacturing) and the external programs such as the Manufacturing Extension Partnership, the Technology Innovation Program and the new Manufacturing Institutes, as well as the Advanced Manufacturing programs.
- The Subcommittee met a number of times by conference call to establish a baseline understanding for Subcommittee members of:
 - -fundamental economic theory which supports R&D investment and linkage to manufacturing,
 - -current DOC manufacturing program content,
 - -best practices globally.
- The Subcommittee held discussions with the following experts with presentation materials distributed in advance:
 - **-Dr. Greg Tasse**y - **NIST economist** (recently retired). Dr. Tasse
 - y has written extensively on economic theory and strategy. A reference for portions of Dr. Tasse
 - y's work:<http://www.nacfam.org/Portals/0/NACFAM%20Misc%20Files/Mfg%20Role%20&%20Strategies%20Wilson.pdf>
 - **-Mike Molnar** - **NIST Manufacturing leader** - The Subcommittee members discussed the current DOC manufacturing programs in detail.
 - **-Dr. Charles Wessner** - **National Academy of Sciences** , innovation expert and author/editor to discuss the recommendations in his recent report, [Rising to the Challenge, US Innovation Policy for the Global Economy \(2012\)](#); Link to the National Academies report: http://www.nap.edu/catalog.php?record_id=13386

- Supplementing these meetings and findings and subcommittee member expertise, the Subcommittee met in Youngstown, Ohio and also visited the National Additive Manufacturing Center there.
- The Subcommittee participated in detailed conference calls to discuss the approach two major multinational manufacturing companies, GM and IBM, take regarding technology development and commercialization.
- Individual interviews with Subcommittee members to gain their experience and perspectives were conducted with the President/CEOs of Correct Craft, Kent Displays, MacArthur Corporation and MCT-Industries.
- Finally, the Subcommittee hosted a regional roundtable in Orlando, Florida to gain the insights of local business leaders on the issues included in the Subcommittee's recommendations. A second roundtable is planned for summer, 2014 in Albuquerque, New Mexico to gain further perspectives which are diverse both regionally and organizationally, in terms company size and focus.

