TESTIMONY ON THE ROLE OF MANUFACTURING HUBS IN A 21st CENTURY INNOVATION ECONOMY BY SECRETARY OF COMMERCE PENNY PRITZKER COMMITTEE ON COMMERCE, SCIENCE AND TRANSPORTATION UNITED STATES SENATE

November 13, 2013

Introduction

Chairman Rockefeller, Ranking Member Thune, and members of the Committee, thank you for calling this important hearing to examine the role of manufacturing hubs in a 21st Century innovation economy.

I welcome the opportunity to discuss a proposed National Network for Manufacturing Innovation (NNMI), and am supportive of the approach in the bipartisan legislation recently introduced by Senators Sherrod Brown and Roy Blunt on this topic.

The NNMI legislative proposal would largely implement recommendations by the first Advanced Manufacturing Partnership (AMP) Steering Committee, a task force of 12 leading company CEOs and six university presidents, with input from 1,700 members of industry and academia. Co-chaired by Dow CEO Andrew Liveris and former Massachusetts Institute of Technology (MIT) President Susan Hockfield, the AMP Steering Committee issued a report to the President in July 2012 entitled *Capturing Domestic Competitive Advantage in Advanced Manufacturing*. Among its findings was the need for a network of manufacturing innovation institutes. These institutes would allow companies to collaboratively invest in precompetitive research to tackle manufacturing challenges they cannot address individually. The institutes would provide companies, including small manufacturers, access to capital equipment and facilities to conduct testing and research in order to accelerate to the market new cutting edge technologies. A new generation of our manufacturing workforce would be trained in an environment similar to a "teaching hospital" for advanced manufacturing, where engineers, researchers, and workers are able to gain new skills and capabilities working on state-of-the-art equipment and new manufacturing challenges.

Manufacturing Innovation

It is an exciting vision that has been widely embraced. Just two weeks ago, the National Association of Manufacturers (NAM) and other organizations including Semiconductor Equipment and Materials International, publicly announced that they are supporting this effort.

Before elaborating on this vision, I would first like to discuss the commercial problems these institutes are meant to solve. As you know, I come to the Department of Commerce as a business person, particularly sensitive to market demands. Many in private industry have embraced the institute concept because they see a need for industry leaders to collaborate on

advanced technology challenges in order for the United States to secure a competitive edge. Others believe it will spark economic development in regions that have been hard-hit by previous recessions. And these private sector leaders wholeheartedly endorse the Institutes as a critical national investment to rebuild manufacturing capabilities and strengths that have eroded over the last decade as manufacturing went offshore.

In fact, since 2001, the United States has lost production across a range of advanced technology industries where the United States had previously been dominant. This phenomenon was caused largely by companies' increased reliance on global supply chains, which has allowed companies to tap specialized manufacturers from other countries to produce high-performance parts. Over the long-run, this reliance shifted production and often innovation overseas as well.

As a recent MIT study points out, innovation occurs not only at the point of invention, but at every stage of product development and delivery. This was the rationale behind the iconic Bell Labs where engineers co-located beside technicians to develop and continually improve production processes for telecommunications equipment. Or at companies like DuPont, where partnerships between design and production specialists led to an affordable manufacturing process for Kevlar in 1970 – finally making the material marketable, five years after it had been invented.

On the other hand, when a company's inventors and design engineers are separated from the production process, that company may be hindered in its abilities to improve products or develop new goods and services. This separation is why scholars now suggest that certain industries created in the United States – such as flat panel displays and certain consumer electronics – have moved entirely offshore. In some of these cases, manufacturers built assembly facilities in Asia which made it attractive for parts suppliers to re-locate there as well. Soon, entire supply chains were migrating out of the United States, and we lost our ability to lead in the innovation and production of these types of products.

The NNMI will allow the United States to rebuild the dense networks of capabilities that it lost during the past two decades of manufacturing offshoring. Bringing large manufacturers, universities, and small businesses together in institutes will help restore U.S. competitiveness in manufacturing. This is critically important for boosting U.S. innovation and exports, and it will facilitate middle class job growth. Indeed, the manufacturing sector accounts for 70 percent of U.S. private-sector research and development, 70 percent of patents, and the vast majority of U.S. exports. Manufacturing jobs provide a key pathway into the middle class, with workers earning between wages and benefits 17% more than their counterparts in other sectors.

Catalyzing industry to strengthen American manufacturing capabilities has worked for us in the past. Twenty-seven years ago, the Reagan Administration sounded the alarm over a crisis in the semiconductor industry. We were fast losing market share and would eventually lose our entire industry if nothing was done.

For the Department of Defense this posed a national security risk. As a result, SEMATECH was born; the Pentagon invested $500 million into a small consortium of U.S. companies, allowing industry rivals to collaborate in road-mapping the future of semiconductor chip technology and to develop the manufacturing processes necessary to mass produce those chips. Instead of each

semiconductor manufacturer spending money to design its own equipment in isolation, SEMATECH provided a forum for companies to work together and develop common standards for next generation chip manufacturing technology.

Just this last July, I visited SEMATECH at its new home on the seven-year old campus of the College of Nanoscale Engineering of the State University of New York (SUNY) in Albany, New York. SEMATECH has not received federal matching funding for over fifteen years, having evolved into a self-sufficient enterprise - and having grown to include over a hundred international players.

What I found particularly fascinating were some of the College's other partners. Unlike SEMATECH, which focuses on research into manufacturing processes, the College's other partners are helping transition additional emerging research into actual manufacturing capabilities – in the same vein that we are proposing for NNMI. One such initiative is the Global 450 Consortium – an effort to make the surface on which we make chips – called wafers – bigger. This could bring down costs and add more functions to our smartphones, tablets, and car electronics.

This consortium, started up just in the last two years, is comprised of IBM, Intel, Samsung, TMSC, and Global Foundries as well as the State of New York. Each company recognized this effort was high risk, extremely expensive, and beyond the capability of a single company. But, on this great college campus, these companies are now pooling resources and sharing risk to try to develop manufacturing equipment together. By collaborating they advance the "pre-competitive" technology that can be inserted into final products that are more proprietary. Because this work goes on here, the innovation, company growth, and high tech jobs are here. Additionally, students at various levels on the campus will have an opportunity to train on how to use this equipment and develop new production techniques. The College itself functions as a trusted third party, not only providing the space for conducting collaborative research, but also managing complex arrangements for sharing intellectual property. The College is in effect coach, convener, and arbiter – and has developed a successful model for protecting companies' proprietary interests.

The innovations taking place at this facility are breathtaking. So much so, that semiconductor companies from around the world are investing tens of billions of dollars to build factories in that region and creating thousands of new jobs, just to be close to the College and tap the collaborative research and scholars available nearby. In fact, just this year Global Foundries – the second largest chip maker in the world – announced another $7 billion expansion of its multi-billion dollar facility in neighboring Saratoga Springs.

Companies in this industry are flocking to the region because they believe being a part of this industrial ecosystem is critical to their long-term competitiveness; in turn they are building multi-billion dollar complexes. This case shows what can happen when the government - whether federal or state - provides initial seed funding, and helps convene industry and university partners to collaborate in manufacturing research and workforce training. In my view, this should be an inspiration for aspiring NNMI institutes.

The Missing Middle

What is transpiring in upstate New York can and must take place elsewhere around our country. The United States has long invested public dollars in initial or basic research, and, in many industries, companies are likely to invest in late-stage development – once a product has been proven and a market is beginning to materialize. But what about that middle stage – when a technology has been invented but there is no established process for scaling up its production?

To lead the world in advanced manufacturing means to lead not just in initial invention but all the way through production. Other countries, particularly in Asia and Europe, have been investing billions of dollars in such "technology transition" for decades, and have their own programs analogous to NNMI. It is time to find a uniquely American solution to the challenges associated with moving technology from lab to shop.

National Network for Manufacturing Innovation

A uniquely American solution must be led by the private sector. The Administration relied on the advice of 1,700 members of industry and academia who provided inputs into the AMP report. The NNMI program will eventually be wholly owned and operated by companies and universities – not the Federal Government. However, as evidenced by history, these endeavors will require seed funding to make it possible for companies, universities, community colleges, nonprofits, and others to join a manufacturing innovation consortium. Our proposal is for the government to provide that "patient capital" for about five to seven years, and then allow an institute to operate on its own. In essence, the public investment is in the U.S. innovation ecosystem – to create the space for industry and academia to solve industry-relevant problems. In the process, the institute will need to prove that it can and will be self-sustaining long after the government ends its investment, and that it can meet critical market demands. There is indeed a demand for this sort of program. I have seen it firsthand in Albany. But I can assure you, there is a hunger for these institutes all across the country. This is evidenced by the great interest and robust competitions for new manufacturing innovation institutes being held by the Departments of Defense and Energy right now.

As members of this committee are aware, last year, the Department of Defense led a competition to establish a pilot institute. The institute focuses on additive manufacturing and 3D printing – an area of great importance both to the Armed Forces and the broader economy. This technology is literally something out of "Star Trek" – allowing individuals to use a computer to design intricate structures and shapes traditional manufacturing processes simply could not make, and then "printing" or "beaming" them layer-by-layer into existence with unprecedented precision.

The Air Force and Navy want to use this technology to build high-performance aircraft and engine parts. The Army and Defense Logistics Agency might use this technology to have instant access to spare parts in-theater, when combat vehicles break down, or to recreate replacement parts that have been out of stock for decades. And in the commercial market, one can conceive of virtually endless applications for these tools – ranging from automotive and medical device

production to fashion and apparel. These sophisticated and expensive production machines are far from perfect – and the institute is a big part of making them better. It is also important to develop the standards for 3D printed parts, training programs, and the skilled workforce needed to support new businesses. Improvements in these production machines are spilling over to consumer markets, where inexpensive printers for schools and homes are rapidly expanding. But much remains to be done to bring the technology fully into the mainstream.

Moreover, if the United States is going to be a global leader in advanced technologies, such as 3D printing, we are going to need to bring all of our leading industry and university resources to bear. We need to recognize that the rest of the world is not sitting on the sidelines. I assure you, many other countries are investing heavily in 3D printing as well as a host of other advanced manufacturing technologies. We need to get this right to remain globally competitive.

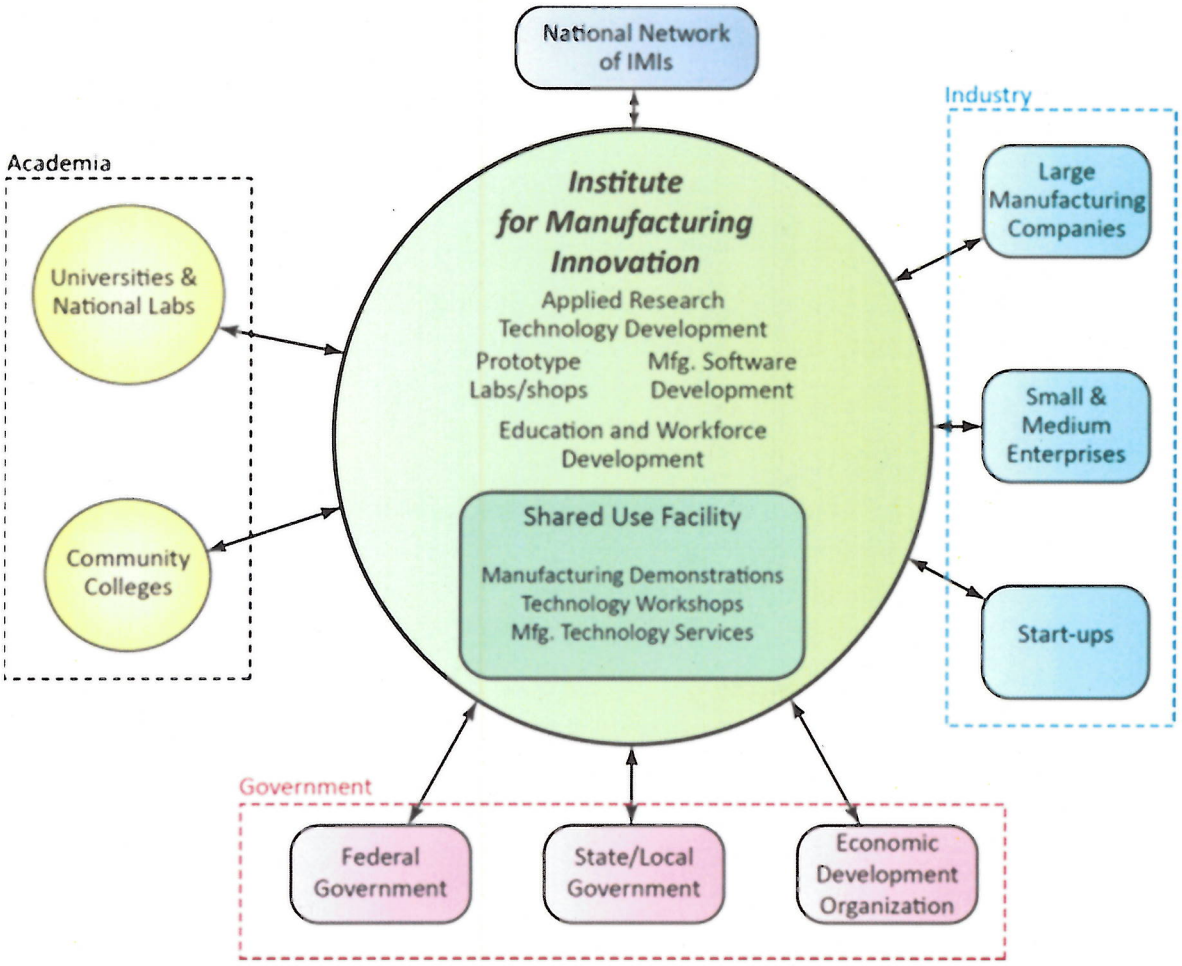
Fortunately, there is high demand in the United States to do just that.

From what I am told, competition was fierce for the pilot institute. In the end, the government put $30 million on the table, and the winning consortium matched this sum with an additional $40 million. That money is going towards funding labor, equipment, and applied research projects. The pilot institute was formerly known as the National Additive Manufacturing Innovation Institute, and was recently renamed America Makes. Its headquarters is now open for business in Youngstown, Ohio. Consortium members included, among others, Northrop Grumman, Honeywell, IBM, Timken, and RTI International; university participants included Case Western, Carnegie Mellon, Penn State, and Youngstown State – as well as Marshall University in your home state, Mr. Chairman. And membership continues to grow. While many feel the future promise of this technology is certain to be astonishing, what is far from certain is where the global innovation hub for 3D printing and additive manufacturing will be located. The mission of our pilot institute is to ensure this hub is in the United States.

But what exactly happens at an institute?

The answer is: "A lot." Industry members are crafting detailed roadmaps of their technology needs, collectively defining milestones and then developing strategies to meet those goals. Institute members are collaborating on applied research projects, developing facilities to evaluate nascent technologies and improving equipment and processes for unproven technology to be scaled up to production. By using shared facilities, manufacturers can pool their risk, and drive down the cost of commercialization. Working with university researchers and design engineers, manufacturers can accelerate the insertion of these critical technologies into mainstream manufacturing. Through this process, institute members are establishing new business networks, coordinating their actions, and redefining supply chains and business practices. In particular, institutes offer opportunities for small and medium-sized enterprises to enter these supply chains and access equipment they ordinarily would not be able to afford to use. Finally, community colleges and universities are training new generations of workers on cutting edge technology available at the institute and establishing pipelines for U.S. employers to hire skilled workers. By engaging with colleges and universities, the institutes will both incent and support educators to assure the knowledge and skills of our workforce – building additional science, technology, engineering and mathematic (STEM) career pathways for youth and adults. This aspect of the institutes will be essential to keep the manufacture of new products from moving offshore.

The institute itself provides facilities, equipment, and software for collaborative research. It also helps arrange intellectual property sharing, both to advance technology breakthroughs as well as protect members' proprietary rights. As illustrated below, institute members can range from research universities and national laboratories to community colleges; large manufacturing companies to small and medium-sized enterprises and start-ups; and state and local governments to economic development organizations.



Ultimately, the Administration envisions a collection of these institutes forming a network. Institutes will thrive not only from collective action within their own consortia, but also through cross-pollination across industries. All parties involved in these institutes will advance competitiveness in their respective technology fields as well as more broadly support our economic and national security interests.

The pilot institute currently underway has demonstrated the great demand for these capabilities among all of these actors. Applied research projects co-financed by the government, industry, and universities are well-underway. And the institute continues to see its membership and

private investment rise. For example, in May of this year, Siemens announced a $440 million in-kind grant to Youngstown State University to help train the next generation of 3D printing manufacturers. I am eager to see how it matures over the next several years.

Meanwhile, the Departments of Defense and Energy have launched three more competitions. The Pentagon solicited proposals for consortia focused on lightweight and modern metals as well as digital design in manufacturing. Energy's new institute will focus on enabling more powerful, efficient, and more cost effective power electronics. These are critical endeavors, and we are eagerly awaiting the announcement of competition winners. These new institutes, like the pilot, will continue to help us hone this model and, more importantly, address critical manufacturing technology needs for our country.

In sum, by developing these institutes in partnership with industry and academia, the government will address two critical issues industry leaders say they cannot solve without assistance. First, it will incentivize companies and universities to work together in promoting innovation and production here at home. Second, it will help companies within an industry ensure that U.S. supply chains are effective and well-integrated.

Congressional Authorization

In order to enable this program to reach its full potential, Congressional action is required to authorize this program and provide the necessary funding. The "Revitalize American Manufacturing and Innovation Act of 2013," sponsored by Senators Blunt and Brown, would authorize Commerce to award funds to assist in planning, establishing, or supporting the centers for manufacturing innovation, which will constitute the network. It would also establish a National Office of the Network for Manufacturing Innovation Program within the National Institute of Standards and Technology to oversee and carry out the program. These are both important steps in meeting the President's call for the NNMI.

Although the institutes being developed under the leadership of the Departments of Defense and Energy under existing authorities are important, at present we have no federal program exclusively focused on identifying emerging technologies with broad potential impact and bringing together companies in associated industries to improve technology transition. Instead, we are meeting our nation's demand by tapping existing federal programs. By relying on these mission agencies, we are confining the institutes' topics to areas that are relevant primarily to these agencies' missions, which exclude many other topics with significant potential impact on manufacturing.

Ultimately, these institutes need to be driven from the bottom up; we need to empower U.S. industries to identify where their comparative advantage lies and where the need is greatest to collaborate in manufacturing innovation institutes. Our role should be to support those decisions, help them underwrite risk when we can, and thus help unleash the full might of the American innovation economy.

This question was posed to industry in five different public events along with a request for public comment – "What are the topics that are most important to industry, appropriate for an institute, and that industry would co-invest in?" The response was overwhelming – 135 topics. Which

should be established? Let consortia teams put together proposals based on market needs – not a federal agency's requirements. Awards will be made through merit-based competition that selects the best business case to receive start-up funding and become part of the network. Additionally, we will continue to rely on the private sector, through forums such as the Advanced Manufacturing Partnership, to ensure NNMI meets industry needs and advances American competitiveness.

In fiscal year 2014, the President's Budget has called for $1 billion for up to 15 institutes built over multiple years to jumpstart the vision shared by AMP, NAM, and so many other leaders across industry. This proposed multi-year funding will provide the consortia the certainty needed for members to commit to fully matching the government contribution. As the concept has developed, so has the demand. In fact, the Administration believes the network could ultimately reach a total of 45 institutes. As a comparison, Germany has 60 *Fraunhofer* Institutes – similar in concept to NNMI – despite having an economy a fraction of the size of ours. It is critically important that we make the NNMI a reality. The approach in the Brown-Blunt bill is an important step in advancing this conversation.

I look forward to working with this committee to move this important legislation forward.

Conclusion

Today, manufacturing remains critical for both economic and national security. As I discussed at the outset, addressing the challenges facing America's manufacturing sector is absolutely essential both for our ability to employ skilled workers as well as for our ability to maintain our competitive edge in the world economy.

Innovation is America's comparative advantage. It is the lifeblood of advanced industries that are fundamental to our nation's future – from nanomanufacturing to cyber-technology. But to truly stay out front in these exciting new fields, it is not enough to invent new products – we can and we must strengthen the ability to make these products too. Establishing the National Network for Manufacturing Innovation is essential to doing just that. I look forward to working with you to realize this vision.

This is just one piece of the Administration's manufacturing agenda; I look forward to returning to talk with you about other exciting initiatives in the near future.

Thank you for the opportunity to appear before you today. I look forward to answering your questions.