

Ignite 2.0

Voices of American University
Presidents and National Lab
Directors on Manufacturing
Competitiveness

Executive Summary
June 2011



Approach & Methodology

On behalf of the Council on Competitiveness, Deloitte¹ conducted a series of interviews in the fall of 2010 with approximately three dozen CEOs and other senior executives representing some of the world's largest U.S.-based manufacturing companies. The findings of those interviews were released in January 2011 in *Ignite 1.0: Voice of American CEOs on Manufacturing Competitiveness*.

In the spring of 2011, Deloitte interviewed approximately 30 leaders of colleges, universities and national laboratories for *Ignite 2.0: Voices of American University Presidents and National Lab Directors on Manufacturing Competitiveness*. The summary of *Ignite 2.0* presented here provides key messages and recommendations on improving U.S. manufacturing competitiveness via talent-driven innovation, education and advanced skills development, as well as research, science, technology, innovation and full life-cycle commercialization.

A copy of *Ignite 1.0* and the full *Ignite 2.0* report are available for download at the Council's website, Compete.org.

¹ As used in this document, "Deloitte" means Deloitte & Touche LLP, Deloitte Consulting LLP, Deloitte Tax LLP, and Deloitte Financial Advisory Services LLP, which are separate subsidiaries of Deloitte LLP. Please see <http://www.deloitte.com/us/about> for a detailed description of the legal structure of Deloitte LLP and its subsidiaries.

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From Our Leadership

The Council launched its U.S. Manufacturing Competitiveness Initiative (USMCI) in June 2010 to tackle the challenges facing domestic manufacturers and drive the dialogue, policies and programs necessary to ensure the long-term health of American manufacturing. Our vision is a reinvigorated, vibrant, diversified and technologically advanced manufacturing sector that produces American jobs, economic growth, prosperity, energy sustainability and an improved ability to meet national security needs.

To inform our efforts, the Council began the *Ignite* report series; a multi-part, interview-driven project capturing insights from diverse leadership groups across the American manufacturing landscape. The first report, *Ignite 1.0: Voice of American CEOs on Manufacturing Competitiveness*, was released in February 2011 and recorded the input of nearly 40 CEOs on the measures necessary to advance U.S. manufacturing.

We are now pleased to share with you *Ignite 2.0: Voices of American University Presidents and National Lab Directors on Manufacturing Competitiveness*. The insights that follow are compiled from a series of interviews with nearly 30 leaders in higher education and advanced research. In the coming months, we also look forward to releasing *Ignite 3.0*, which will highlight the perspectives of U.S. labor leaders.

The outcomes from the *Ignite* reports, in conjunction with the ongoing work of the USMCI Steering Committee and Executive Advisory Committee, will form the foundation of the Council's 3rd Millennium National Manufacturing Strategy. This strategy will explore the entire manufacturing ecosystem and the full life cycle of product development to provide a truly comprehensive path forward for U.S. manufacturing. We will present this strategy to private sector leaders, the administration, Congress, governors and other key stakeholders at a national manufacturing summit on December 8, 2011, in Washington, DC.



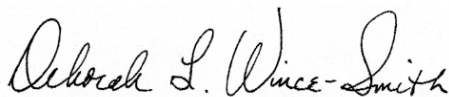
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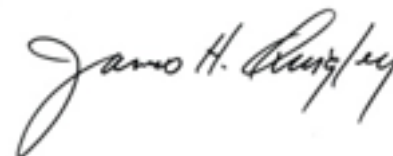
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From left: Dr. Edward Moses, Principal Associate Director of NIF & Photon Science, Lawrence Livermore National Laboratory; Ron Bloom, Assistant to the President for Manufacturing Policy; Deborah L. Wince-Smith, President & CEO, Council on Competitiveness; Dr. Tomás Díaz de la Rubia, Deputy Director for Science and Technology, Lawrence Livermore National Laboratory before a tour of the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory.

The NIF boasts the world's largest and most energetic laser, which has the goal of achieving nuclear fusion and energy gain in the laboratory for the first time—in essence, creating a miniature star on Earth.

The Council believes strongly that modern manufacturing is both complex and rapidly evolving. To remain competitive in the global marketplace, sustained cooperation and ongoing collaboration between government, industry, academia and labor leaders is required to effect real change. We feel that the recommendations contained in the *Ignite* report series and the broader efforts of the USMCI represent the highest levels of cross-sector collaboration, and we look forward to advancing our work on manufacturing competitiveness in the coming months.

We would like to extend our sincere thanks to the education leaders and national laboratory directors who have shared their valuable thoughts and insights with the Council. We also want to thank our colleagues at Deloitte for their tremendous support in conducting the interviews and preparing this report. Without their efforts, this project would not be possible.

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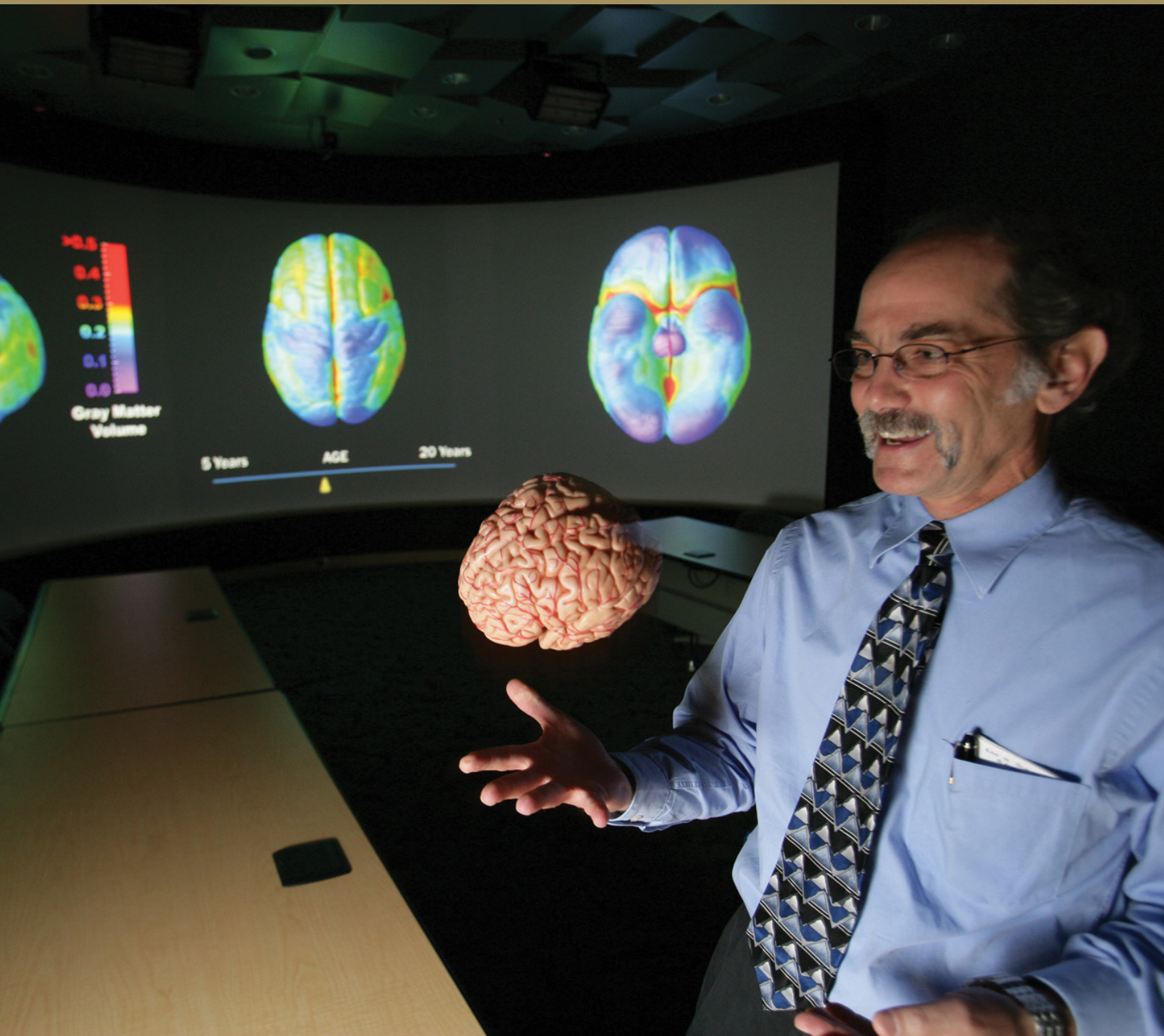
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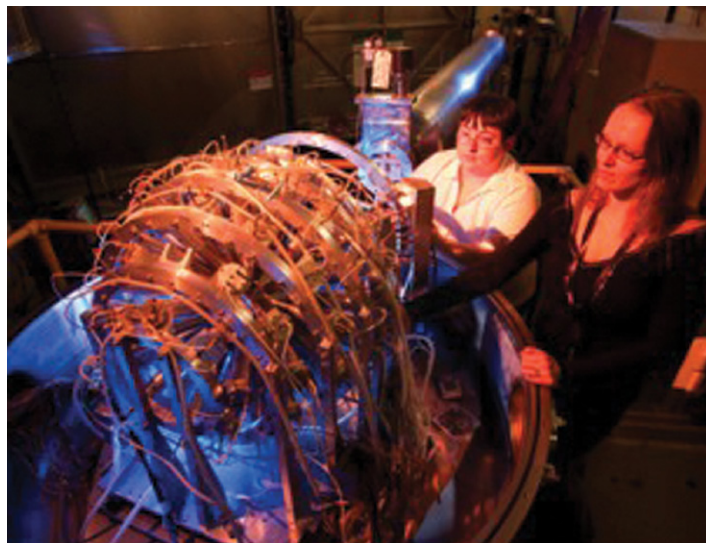
*Neurology professor Arthur Toga directs computer science, biostatistics and neuroscience researchers in brain mapping.
Photo by Stephanie Diani, courtesy of the University of California, Los Angeles.*

Key Messages: Education, Research and U.S. Manufacturing Competitiveness

For much of the 20th century, the United States was recognized as the world's greatest innovator and leading manufacturing economy. Driven by science and technology challenges important to the nation and the world, the United States has been responsible for innovations like supersonic flight, space exploration, chemotherapy, lasers, integrated circuits, mobile phones, GPS and personal computers. America's strong industrial base and skilled workforce enabled many of these innovations to be commercialized, generating prosperity for America's middle class and laying an economic foundation that continues to drive the U.S. and global economies.

Today, the United States is still recognized as the world leader in the areas of research and post-secondary education. However, a number of global and domestic factors have contributed to a steady decline of U.S. manufacturing competitiveness, impacting the country's ability to produce and scale leading innovations. According to the *2010 Global Manufacturing Index*², the United States ranks fourth in global manufacturing competitiveness behind China, India and South Korea. Moreover, the *Index* suggests the United States will fall to fifth by 2015 as these countries and others continue developing manufacturing-based economies supported by strong infrastructures, robust education programs and pro-business public policies. The multiplier effect of these efforts has created strong domestic economies that attract additional direct investment and create middle class workforces that grow more prosperous and competitive.

The *2010 Global Manufacturing Index* also identifies several drivers that define the manufacturing competitiveness of a country, including cost of labor,



Micha Kilburn, graduate student (left), and Daniela Henzlova, research associate (right), of the Michigan State University National Superconducting Laboratory.

Photo courtesy of Michigan State University.

energy costs and policies, quality of infrastructure and trade. Topping the list of competitive drivers, however, is talent-driven innovation.

All of the university presidents and national lab leaders interviewed agree that a highly-skilled workforce is perhaps the most important factor impacting U.S. competitiveness. Like their CEO counterparts, they see talent-driven innovation as the foundation on which America's future will be built.

The *Ignite 2.0* university presidents and lab leaders agree broadly with the recommendations put forward by executive participants in *Ignite 1.0*. Both groups recognize that manufacturing is critical to America's competitiveness in the 21st century. Some of the key messages and themes conveyed include:

² 2010 Global Manufacturing Competitiveness Index. http://www.deloitte.com/assets/Dcom-Global/Local%20Assets/Documents/Manufacturing/DTT_Global_Manufacturing_Competitiveness_Index_6_23_2010.pdf.

Manufacturing is essential for America. A robust American manufacturing sector advances national security, defense readiness, increases exports and catalyzes economic growth across many sectors of the U.S. economy. The manufacturing base creates high-value jobs for middle-class America, and its multiplier effect cultivates a network of supporting service sector jobs. Most importantly, however, manufacturing is vital to America's innovation ecosystem. The United States must articulate a globally competitive, long-term innovation and manufacturing strategy that identifies clear goals and achievable steps to keep America in the business of innovation and "making things."

Translational pathways for innovation must be bolstered. The closed-loop product development cycle, spanning from idea to process and product generation, flourishes when an intimate and co-located research and manufacturing connection is encouraged. Co-location enables continuous product and process improvement through the symbiotic relationship which exists between the manufacturing and innovation processes. A manufacturing innovation ecosystem that promotes the maturation of basic research to applied research, and encourages the transition of pilot projects into the full commercialization of new ideas, is needed to enhance the quality, impact and return on investment of breakthrough discoveries. The United States must create the right incentives and allocate enough resources to generate new ideas, develop these ideas through focused research, and in turn, start new businesses that produce well-paying jobs.

Superior talent is the key to America's competitiveness. In today's borderless economy, the United States must be the global leader in attracting, developing and retaining top science and engineering talent to drive world-class innovation and R&D. This demands an education system that arms students with advanced science, technology, engineering and math (STEM) skills, creative problem solving skills, entrepreneurial training and leadership skills. America's key for success lies in a workforce equipped with the science and math backgrounds to compete with the best, and the creativity and leadership to be pace setters for the world. Educational institutions should establish programs to engage top talent with manufacturing firms to advance the U.S. manufacturing innovation ecosystem.

America's K-12 education system needs to be improved to create the world's most desired talent pool. Primary and secondary level students need teachers who are subject matter experts in the STEM disciplines. These experts are better equipped to educate and inspire students to pursue the advanced STEM education and career opportunities that will drive growth of the U.S. economy for years to come. Educators must move away from the persistent focus on pedagogy and return classroom focus to superior content and student performance. Flexible pathways for advanced degree acquisition and certifications must also be established through collaboration across K-12 schools, community colleges and universities. These programs will spawn creative, multi-disciplinary leaders who will enable the next generation of innovations to flourish.

U.S. universities and national laboratories are gems that must be protected. America has developed an unparalleled network of higher learning institutions and national laboratories. These valuable assets set the United States apart from other nations and are a critical component of America's competitive advantage that must be protected and kept strong through thoughtful policy setting and stable funding models. This will ensure that these institutions continue to achieve the insights and advances that have become a hallmark of U.S. innovation. Policymakers should ensure that they "do no harm" to our most valuable resources when addressing the urgent deficit and budget challenges facing the federal and state governments.

Collaboration enhances America's ability to compete. Colleges, universities, national laboratories, and the public and private sectors must collaborate, devising new ways to incentivize innovation and commercialization. Successful innovation hubs generate breakthroughs and develop mutually beneficial, long-lasting partnerships. These partnerships are the heart of many regional economies and self-perpetuate by engaging and inspiring students to become America's next generation of innovators.

Government policies need to address uncertainty and encourage business. Several public policies should change to foster a competitive business environment and encourage the world's leading researchers to pursue careers in state-of-the-art facilities in the United States. Such policies include the tax code, patent processing, intellectual property protection, immigration, export controls and funding for research and facilities.



A welder modifies newly designed jets that spray steam into the condensers at The Geysers geothermal power plant. With a 750-megawatt output from 14 units, The Geysers is the largest producer of geothermal power in the world.

Photo courtesy of the National Renewable Energy Laboratory (NREL).

Summary of Recommendations

Recommendations denoted in italics were also outlined as recommendations in *Ignite 1.0*.

Developing Talent and Skills for the 21st Century

1. Ensure that our universities and national laboratories remain the greatest in the world and continue to contribute to U.S. competitiveness by maintaining long-term, predictable, and steady support for these institutions.
2. Adopt more stringent and consistent standards for STEM disciplines throughout the entire educational system in the United States. These standards should be tied to metrics in other leading manufacturing economies.
3. Improve and incentivize primary and secondary teacher programs in the STEM disciplines to develop educators who are subject matter experts and better able to prepare students for advanced degrees or certifications programs.
4. *Benchmark best practices from other countries and reform immigration policies to better attract the world's most advanced workforce, and retain foreign talent educated in American universities upon graduation.*
5. *Advance performance-based legislation and incentives like the America COMPETES Act, the Elementary and Secondary Education Act, Investing in Innovation, Race to the Top and Teacher Incentive funds.*
6. Develop long-term programs that inspire and glorify careers in research, engineering, and other areas of science, technology and mathematics.
7. *Develop federal and state programs that promote and market manufacturing as a high-value, vital industry with rewarding long-term career opportunities for high school and college students in the United States.*
8. Build government-industry partnerships that incentivize workers to pursue careers in science, engineering, and manufacturing.
9. Ensure adequate support for the “manufacturing innovation ecosystem” and research and science infrastructure.
10. Replicate best practices from disciplines like health care to make work experience mandatory at the secondary and post-secondary levels.

Fueling Science, Technology and Innovation

1. *Establish a consortium of business, university, labor and public sector leaders to develop daring strategic long-term goals with a 15 to 20 year development horizon around science, technology and manufacturing.*
2. Develop a U.S. innovation strategy that establishes programs to feed an innovation pipeline through full life-cycle commercialization and supports both basic and applied research.
3. Break down barriers to collaboration between universities, laboratories and the private and public sectors.

4. Create long-term mechanisms that insulate funding programs from election cycles and changing administrations.
5. Create a system that seeds innovation and helps avoid the multiple “valleys of death” by establishing translational pathways that are supported by the private and public sectors and include enabling mechanisms to drive innovative ideas and technologies through to commercialization.
6. *Fuel private investment by ensuring globally competitive corporate tax rates and strengthening and making permanent research and development tax credits, especially for U.S.-based innovation.*
7. *Tax credits should address both human capital, and include support for continuing education for scientists and engineers, as well as R&D equipment and infrastructure to ensure the U.S. remains an attractive destination for long-term investment in innovation and manufacturing.*
8. Increase the number of public-private initiated industry clusters that convene research institutions, industry and the best talent to focus on advancing research and full life-cycle commercialization.
9. Focus should be given to sectors of strategic importance to the United States, including national security, defense and energy, as well as emerging sectors that serve as hot beds for rapid, concurrent research and innovation.

The Role of Colleges, Universities and National Laboratories in Improving U.S. Competitiveness

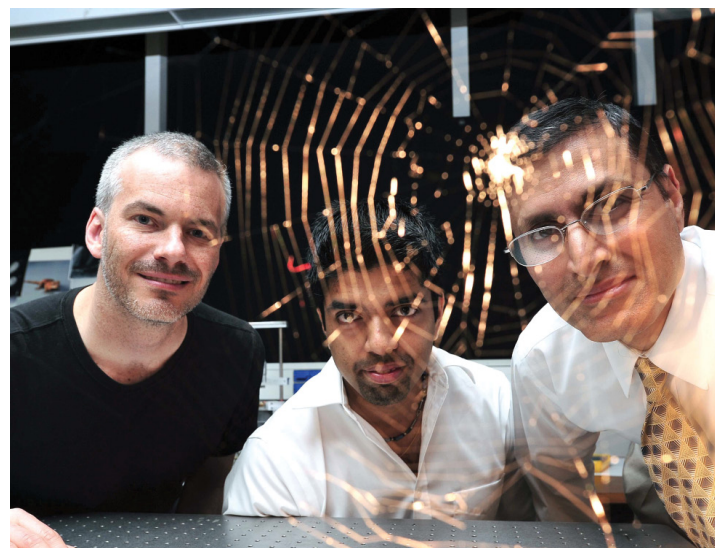
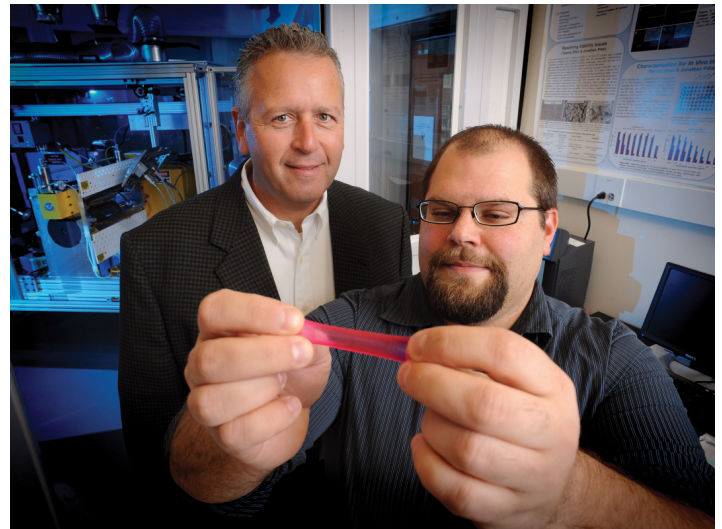
1. Continue to support community colleges and universities as catalysts for innovation and competitiveness through long-term government funding programs like the America COMPETES Act, the Carl D. Perkins Career and Technical Education Act and various research grants.
2. Utilize community colleges more effectively to develop a skilled workforce with the requisite vocational skills to support technology commercialization and manufacturing
3. Continue expanding the role of American universities to serve as economic development engines. Create conduits that connect talent and ideas at the university with the private sector and the local community in regional clusters.
4. Implement university programs that promote student interest in math, science and manufacturing.
5. Ensure that national laboratories develop mission-driven innovations that are crucial to national interests, while broadening the definition of national interest to include impactful economic development.

Closing Comments

All of the leaders interviewed for this report expressed optimism and excitement about the long-term opportunities for the U.S. manufacturing sector. They believe that it is important to raise awareness of how “making things” is crucial to the U.S. economy and citizens’ prosperity. Manufacturing competitiveness should be among the nation’s top priorities.

Long-term, participants envision a U.S. manufacturing sector that is once again a global leader in innovation and driven by a world-class ecosystem of education, research, public sector and industry partnerships. Participants described technologically advanced industries where all the stakeholders in the ecosystem support the process of identifying, prioritizing, testing, developing and commercializing new products and technologies in a globally superior model able to attract significant investment and talent from around the world.

Central to this vision are federal and state government policies that remove uncertainty and support competitiveness in areas such as research and development, the patent system, intellectual property protection, tax rules and immigration. By developing and adopting pro-competitiveness policies across these areas, noted many participants, businesses large and small would have increased incentive to make long-term investments in the U.S. manufacturing industry.



Top: Graduate student Timothy Merkel and Professor Joseph DeSimone stretch out a sample of the squishy hydrogel polymer they used to make synthetic red blood cells; in the background is a reel-to-reel system which enables the researchers to manufacture large quantities of such particles. Dr. DeSimone is a member of the U.S. Manufacturing Competitiveness Initiative (USMCI) Executive Advisory Committee

Photo courtesy of The University of North Carolina at Chapel Hill.

Bottom: Dr. Todd Blackledge and students in laboratory, The University of Akron.

Photo courtesy of The University of Akron.

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Dr. Miller, we thank you for your leadership and insightful perspectives, and wish you the best in your future endeavors.