Council on Competitiveness

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Council on Competitiveness
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Chairman Murkowski, Ranking Member Cantwell, and Members of the Committee, thank you for the opportunity to appear before you today to discuss technologies that could radically transform manufacturing in the United States.

I have the honor and privilege of representing the Council on Competitiveness, a non-partisan leadership organization of corporate CEOs, university presidents, labor leaders, and national laboratory directors committed to advancing U.S. competitiveness in the global economy, and a rising standard of living for all Americans. Analyzing emerging forces transforming the economy and shaping the future, and catalyzing action to leverage them for the benefit of the United States, is one of the Council's most important roles. Today, our "seismograph" is signaling the beginnings of a competitive and technological earthquake.

As we have traversed through a deep transition in the world order of production, with the universe of competitive manufacturing nations ever more crowded, U.S. manufacturing took a severe blow. But, the winds of competitiveness have begun to blow back in the direction of the United States. Wages overseas are rising, for example, labor costs in China have increased five-fold since 2005, and 15-fold since 1995.[1] China's manufacturing activity appears to be slowing down. Its industrial value-add, which grew at 14.9 percent during its peak in 2007, has more than halved to 6.9 percent in 2014.[2] In China, manufacturing's share of GDP has also declined from 41 percent in 2007 to 36 percent in 2014, most of which shifted to services.[3]
Nevertheless, China remains a formidable manufacturing competitor, owing not only to its traditional low-cost value proposition, but also to its development of innovation infrastructure, significant growth in R&D, sheer volume of annual STEM graduates, and a strong focus on technology commercialization.

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[1] EIU, Manufacturing labor costs (US dollars per hour), http://www.eiu.com, accessed in February 2016.
[2] National Bureau of Statistics of China, http://www.stats.gov.cn/english/statisticaldata/AnnualData/), accessed on February 19, 2016
[3] Manufacturing, value added (% of GDP), World Bank (http://data.worldbank.org/indicator/NV.IND.MANF.ZS); Services, etc., value added (% of GDP), World Bank (http://data.worldbank.org/indicator/NV.SRV.TETC.ZS), accessed on February 19, 2016.

Energy and manufacturing are inextricably linked, and the U.S. shale oil and gas boom has given many American producers, especially our energy industry industries, a critical cost advantage. For example, as reported in our new Council on Competitiveness and Deloitte *2016 Global Manufacturing Competitiveness Index*, on average German manufacturers pay more than twice the cost for natural gas as U.S. producers, and China, India, Japan, and Korean pay about three times as much. And Germany and Japan pay almost three times as much for electricity as U.S. producers do. Natural gas is also a key feedstock for the chemical industry, and lower natural gas prices have created a clear competitive advantage for U.S. chemical producers. Chemical companies globally have begun or are planning new projects in the United States valued at more than $160 billion in new investment, with 61 percent of the announced investments by firms based outside of the United States.[4]

We must build on these positive developments.

The Emerging Transformation of Manufacturing

Today, we stand at a critical juncture, presented with a tremendous opportunity to strengthen U.S. manufacturing competitiveness, with disruptive innovation and powerful new capabilities almost unimaginable a decade ago. We are living in the midst of great revolutions in science and technology. A new age of unprecedented knowledge, unparalleled technological power and inconceivable innovation is unfolding before our eyes, with profound implications for U.S. manufacturing.

Nanotechnology—a new materials, product and process paradigm for manufacturing –is no longer coming of age, it is here, reaching the $1 trillion market milestone.[5] It will shape the future of key industrial sectors such as chemicals, pharmaceuticals, materials, food production and energy.

We are at an inflection point in the commercialization and use of biotechnology. It took 13 years and $3 billion to sequence the first human genome.[6] Today, sequencing a genome takes about 24 hours at cost you could pay for on credit card.[7] These remarkable cost reductions will have profound implications for our pharmaceutical industry. As biomanufacturing emerges, new tools could allow us to engineer biological systems with applications for fuels, medicine, and electronics.

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[4] Shale Gas: $164 Billion and Counting, American Chemistry Council, April 2016.
[5] National Science Foundation and Lux Research.
[6] The Human Genome Project Completion: Frequently Asked Questions, National Human Genome Research Institute.
[7] DNA Sequencing Costs, Data from the NHGRI Genome Sequencing Program, National Human Genome Research Institute.

In the midst of a fundamental energy system transition, we are presented with a "once-in-a-generation" opportunity to capture a large share of the manufacturing and jobs associated with a $300 billion per year set of clean energy markets, expected to grow into the trillions of dollars per year. Fostering greater energy productivity, deployment of renewable energy technologies and deepening clean technology manufacturing investment, while propelling private sector innovation, energy efficiency and competitiveness is at the core of the American Energy and Manufacturing Competitiveness initiative, a partnership between the Council and the U.S. Department of Energy. The AEMC's goals are to:

- Increase U.S. competitiveness in the production of clean energy products by strategically investing in technologies that leverage American competitive advantages and overcome competitive disadvantages.

- Increase U.S. manufacturing competitiveness across the board by increasing energy productivity by strategically investing in technologies and practices to enable U.S. manufacturers to increase their competitiveness through energy efficiency, combined heat and power, and taking advantage of low-cost domestic energy sources.

This multi-year initiative has sponsored a national dialogue across the United States throughout 2013, 2014, and 2015, identifying concrete actions and policy solutions to increase U.S. competitiveness in the production of clean energy products and boosting energy productivity in U.S. manufacturing.

Tangible impacts of this partnership include exciting new programs like the DoE's HPC for Manufacturing initiative that will enable companies to gain access to this key competitiveness driver.

Beyond the Council's partnership with DoE, building upon more than a decade of leadership on energy and manufacturing policy, the Council's Energy and Manufacturing Competitiveness Partnership (EMCP) catalyzes Council research and action around the nexus of energy and manufacturing. The EMCP will capitalize on a distinctly modern breed of energy abundance characterized by new generations of research, talent and technology.

This initiative approaches the country's diverse industrial landscape as a network of distinct but interdependent productive sectors, each with its own challenges and opportunities. To this aim, the EMCP is organized into a series of sector studies hosted around the nation by members of the EMCP Steering Committee. Each sector study dialogue is designed to gather subject matter expertise on key sectors of the U.S. economy and explore the Council's four cross-cutting pillars—

infrastructure, technology, investment and talent. Together, the common challenge and opportunity threads observed across these discrete sectors will be synthesized into tangible policy recommendations for future growth and development in energy and manufacturing.

We are now entering a new stage of the digital revolution. The physical world and the digital world are converging across numerous dimensions through sensors, networks, and a data tsunami. We are connecting things on a scale once unimaginable through the Internet of Things. The stunning potential of these technologies for driving optimization, efficiency, and discovery is an industrial productivity revolution in the making.

For example, the microscope revolutionized biology, medicine, and environmental science, and the telescope revolutionized our understanding of the universe. Imagine giving tools of such profound consequence to every U.S. industry. That is the potential of today's digitally driven data revolution, the illumination of what we have never before been able to see in manufacturing.

In production alone, we will have the ability to illuminate the operation of every machine and device, the cut of every blade, every movement of material, and the consumption of energy minute by minute. Data will provide unprecedented insight for optimizing all aspects of manufacturing, while the Internet of Things will enable unprecedented control of the supply chain. The data tsunami will also transform the way manufacturers approach their markets, manage their organizations, deploy their people, conduct their R&D, interact with the supply chain, and more. In an era where great opportunities center around creating value from data, the ability to manage big data—to perform modeling, simulation, and analysis—will determine the products, industrial processes, and business models of the future.

But the value of the insight created by this convergence will extend across the manufacturing value chain, leveraged by numerous actors such as equipment and machinery suppliers, service providers, economists, insurers, and investors.

Industry experts estimate that investments in smart manufacturing could generate cost savings and productivity gains that could add $10-15 trillion to global GDP over the next 15 years; that is an enormous value, equivalent to about the size of the U.S. economy today.[8] The CEOs surveyed for our *Index* ranked cost competitiveness and productivity as the second and third top drivers of

[8] Evans, P.C. and M Annunziata, "Industrial Internet: Pushing the Boundaries of Minds and Machines." General Electric Company, Fairfield, CT, 2012.

manufacturing competitiveness, and key to boosting profits in an era of sluggish economic growth.

Couple smart manufacturing with entirely new classes of product technologies—from flexible electronics to the vast applications for technical fibers and textiles—and you see incredible opportunities for innovation and new industrial capacity.

Not surprising, the U.S. CEOs surveyed for our new *Index* ranked predictive analytics; smart, connected products; and smart factories as #1, #2, and #4, respectively, in terms of future importance to manufacturing competitiveness. As manufacturing industries increasingly apply more advanced and sophisticated product and process technologies, the traditional manufacturing powerhouses of the 20th century—including the United States—are back toward the very top of the 10 most competitive nations in 2016, according to our new *Global Manufacturing Competitiveness Index* analysis.

There is even more potential. The Internet disrupted and democratized publishing, broadcasting, and communications, and hundreds of millions of new participants poured in with podcasts, blogs, YouTube videos, and web pages. What happened in the world of bits in cyberspace is now happening in the world of atoms, in digitally enabled push-button manufacturing.[9]

The tools of production are now available to individuals, disruptive technologies—$1,000 3D printers, prototyping tools, laser cutters, easy-to-use design software, off-the-shelf electronics, and desktop machine tools. These are changing the economics of production, who can be a manufacturer or creator, and putting the power of production into the hands of the masses.

Barriers to entry are falling. An individual innovator can design and make a product without owning any manufacturing infrastructure—no warehouse, no assembly line, no forklifts, no heavy equipment, no inventory. Things can be made through micro-factories, Kinko's-like Tech Shops, or using small production contracts. It used to take cumbersome bank transfers, letters of credit, and purchase orders to engage an assembly line in China. Now you can do it with a text message, an email, a credit card, or Pay Pal account. It is becoming possible for someone to imagine, develop and scale a disruptive technology independent of traditional institutions of innovation and production.

Enabled by these new technologies, a "Maker Movement" is growing across the country, a huge opportunity for the United States to gain competitive advantage by expanding and empowering our pool of creators, innovators, and entrepreneurs.

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[9] In the Next Industrial Revolution, Atoms are the New Bits, Wired, January 25, 2010.

The policy community needs to better understand this new, democratized manufacturing landscape, and devise ways to support the creativity and innovative capabilities of independent innovators who numbers could be significant. In this regard, I commend the OSTP/OMB FY 2017 science and technology budget guidance for encouraging Federal agencies to use approaches to foster collaboration with members of the Maker Movement.

The United States Has Significant Manufacturing Competitiveness Advantages

As we enter this new age, the United States has significant competitive advantages, according to global CEOs:

- We remain the world's epicenter for disruptive innovation, thanks to our exceptional research infrastructure, and low barriers to entrepreneurs and start-ups.

- We are, by far, the world's largest investor in R&D, accounting for one-third of global R&D spending. Spending more than $450 billion per year, the United States invests more than $100 billion more than the EU and more than $100 billion more than China, building up a globally unparalleled national stock of science and technology. The recent policy change to make the R&D tax credit permanent will foster increased levels of investment in advanced technologies and innovation.

- We have unique assets such as our national laboratory system and top research universities, pioneers in basic research and breakthrough technologies.

- We have a superb innovation ecosystem where industry, start-ups, labs, and universities collaborate on R&D to enhance manufacturing competitiveness, with new opportunities emerging in initiatives such as the National Network of Manufacturing Innovation Institutes.

- We stand at the top in terms of patents filed, 29 percent of patents filed by all countries in 2014.

- We have a vast amount of venture capital pouring in to commercialize advanced technologies.

These are key assets for establishing the future of our global advanced manufacturing potential.

Government Policies Matter to Manufacturing

Governments around the world are becoming increasingly aware of the significant benefits an advanced manufacturing industry provides to national economic prosperity. Likewise, manufacturing companies are keenly aware of the role government policy can play in their success. Therefore, many nations with unfavorable or overly bureaucratic manufacturing policies are working to improve and reform them, invest in greater economic development, and strengthen overall manufacturing infrastructure, while seeking to partner in more productive ways with businesses.

U.S. CEOs surveyed for the *Manufacturing Competitiveness Index* believe the United States has favorable policies around key elements of manufacturing, centered around sustainability, technology transfer, monetary control, science and innovation, foreign direct investment, and intellectual property protection.

However, U.S. corporate tax rates and taxation of foreign earnings are seen as disadvantages for manufacturing in the United States. Our corporate tax rate is the highest in the developed world, high compared to our major manufacturing competitors, which discourages investments from multinationals and foreign sources. The 39.5 percent corporate tax rate in the United States compares to 33 percent in Japan and Germany, 25 percent in China, and 24.5 percent in South Korea.

Also, we have repeatedly and consistently heard from executives their concern about the high cost, complexity, and uncertainty in the current U.S. regulatory environment. More than 2,000 manufacturing-related regulations have been enacted since 1981 in the United States—an average rate of more than 70 per year—according to a study by The Aspen Institute. Further, the research indicates that a dramatic increase in the number of regulations has resulted in higher compliance costs, which have grown at a sharper rate than inflation-adjusted GDP and manufacturing output.

Talent: The #1 Driver of Manufacturing Competitiveness

Finally, I want to emphasize the importance of America's creative, innovative, industrious, and productive workforce. Once again, the global CEOs surveyed for the Council's *Manufacturing Competitiveness Index* cited talent—defined as the quality and availability of highly skilled workers which facilitate a shift towards innovation and advanced manufacturing—as the most important driver of a country's ability to compete on the global stage. Over the past three of our manufacturing index studies, talent has been the most important driver of global manufacturing competitiveness, demonstrating the strong influence a highly skilled workforce can have on a nation's overall competitiveness.

Technology-intensive sectors dominate the global manufacturing landscape in most advanced economies and appear to offer a strong path to achieve or sustain manufacturing competitiveness. And these industries require high skills. As shown in an analysis included in the Council's new report *WORK: Thriving in a Turbulent, Technological and Transformed Global Economy*, U.S. technology-intensive, globally competitive manufacturing industries have higher than average skill requirements. For example, the share of jobs typically requiring an associates degree or higher is 48 percent in both the pharmaceutical industry, and the aircraft and aerospace industry, and 58 percent in computers and electronics manufacturing. This compares to 20 percent in manufacturing generally, and 26 percent in the economy overall.

Education infrastructure is a foundational requirement for the development of talent. In today's borderless economy, nations compete by being global leaders 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 STEM skills, creative problem solving skills, entrepreneurial training, and leadership skills. A nation's key to greater manufacturing competitiveness lies in a workforce equipped with the science and math backgrounds to compete with the best, and the creativity, business acumen, and leadership to be pace setters for the world. The CEOs surveyed see developed nations—including the United States—as the most competitive in terms of talent. But, as executives around the world rank talent as the most important driver of competitiveness, the competition for talent among nations and companies is expected to be fierce.

In closing, in this age of interplay between bits and atoms, we stand at the cusp of a fourth industrial revolution. The stakes, for countries and companies to successfully navigate this transition, are high. Our competitors also recognize this transformation. For example, the German government launched the "Industry 4.0" initiative that will bring together its capabilities in artificial intelligence, machine learning, sensors, advanced robotics, and automation with the intention to push Germany into a new industrial revolution.

As the new battleground for global competitiveness takes shape, the United States must leverage its foundational strengths in R&D, talent, and strong industrial ecosystems, and compete with high value innovation and high productivity underpinned by data and the emerging array of advanced manufacturing technologies. Thank you.