



**STRENGTHENING THE U.S.  
MANUFACTURING SECTOR**

## BACKGROUND

Manufacturing is an integral part of the U.S. economy. “One in seven U.S. private sector jobs depends on the U.S. manufacturing base”<sup>1</sup> and in 2015, manufacturers contributed \$2.17 trillion to the U.S. economy. However, manufacturing today stands at a crossroads between the “dirty, dark, and dangerous” manufacturing jobs of the past, and the new, high-skill/high-wage jobs of the future. As manufacturing worldwide enters a season of renaissance, the potential exists for the U.S. to reemerge as a global leader in advanced manufacturing, creating high-skilled, high-wage jobs here at home. Other countries such as China, Germany, and England have already begun to seize this moment and have successfully instituted innovative, 21st century advanced manufacturing policies, whereas the U.S. is just beginning to lay the groundwork. While the U.S. has made major progress in recent years with the creation of the Manufacturing USA program and the passage of the Revitalize American Manufacturing Innovation (RAMI) Act, there is still much that needs to be done to ensure that the U.S. remains globally competitive in this new, high-tech field of advanced manufacturing.

For America to remain a global technology leader, there must be continued, sustained investment in the scientific and engineering enterprise. The lack of proper investment has the U.S. falling behind in critical measures of technology, education, innovation, and highly skilled workforce development. This is especially worrisome given that new, emerging manufacturing technologies are spurring growth in the demand for highly-skilled workers. Over the next decade, it is predicted that “nearly 3½ million manufacturing jobs will likely be needed, and 2 million are expected to go unfilled due to the skills gap.”<sup>2</sup> For the U.S. to be able to confront these challenges, we need to commit to invest in preparing the workforce for advanced manufacturing practices. If the U.S. does not act now, we will miss out on the opportunity to fulfill the global demand for manufacturing processes development, making the U.S. obsolete in the global manufacturing community.

Investing in manufacturing processes development and readying a workforce to meet the manufacturing challenges of the future will have significant short- and long-term impacts. The jobs produced by manufacturing activities are generally high-wage and represent an entry point into the middle class for a significant portion of the workforce. Furthermore, a strong manufacturing base is critical to America’s national security as domestic capacity for the manufacturing of key products and a highly skilled and creative workforce make up the foundation of a strong national defense. The U.S. must seize this opportunity and commit to investing in the future of U.S. advanced manufacturing or we will see the continued erosion of the U.S. manufacturing base, which will only increase procurement costs for the DOD and place further strain on defense funding resources in a time of already tightened defense budgets.

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<sup>1</sup> <http://www.themanufacturinginstitute.org/Research/Facts-About-Manufacturing/Economy-and-Jobs/Jobs-Supported/Jobs-Supported.aspx>

<sup>2</sup> [http://www.themanufacturinginstitute.org/Research/Skills-Gap-in-Manufacturing/~/\\_media/FF00360FC3344AD9B62F600B9FDEBD5B.ashx](http://www.themanufacturinginstitute.org/Research/Skills-Gap-in-Manufacturing/~/_media/FF00360FC3344AD9B62F600B9FDEBD5B.ashx)

**ASME recommends that the U.S. commits to investing in advanced manufacturing initiatives by prioritizing Federal funding to support key programs focused on:**

- Fostering cooperation among manufacturers and other R&D performers and users
- Training, educating, and building a skilled workforce
- Securing a robust and enduring domestic manufacturing base
- Developing innovative industrial technologies through basic research
- Ensuring the national security of the U.S.
- Protecting our ability to compete globally

**Existing programs that work to accomplish these goals include:**

- The Advanced Manufacturing Technology Consortia (AMTech) competitive grants program at NIST
- The Advanced Research Projects Agency-Energy (ARPA-E) at DOE
- The Advanced Technological Education (ATE) at NSF
- The Alliance for Manufacturing Foresight (MForesight) at NIST and NSF
- The Defense Advanced Research Projects Agency (DARPA) at DOD
- The Industrial Technologies Program (ITP) at the Office of Energy Efficiency and Renewable Energy (EERE) at DOE
- The Investing in Manufacturing Communities Partnership (IMCP) multi-agency program led by NIST
- The Manufacturing Extension Partnership (MEP) at NIST
- The Manufacturing Technology Program (ManTech) at DOD
- The Manufacturing USA multi-agency program led by NIST
- The National Nanotechnology Initiative (NNI) multi-agency program
- The NSF Innovation Corps (I-Corps)
- The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) multi-agency program
- The Technology Innovation Program (TIP) at NIST

These programs have resulted in a number of innovations that have spawned new technologies and industries essential to U.S. manufacturing leadership, and contributed to improved capabilities and cost savings for U.S. national security needs. Many of these programs are operated in partnership with the private sector, leveraging and attracting additional outside funding to achieve innovation and create jobs. For instance, for every \$1,900 of Federal investment, MEP creates or retains one manufacturing job, and since 1988, MEP has helped create and retain more than 797,994 U.S. jobs.<sup>3</sup>

<sup>3</sup> <http://www.nist.gov/mep/about/>

Given the challenges our country is facing in the globally competitive field of manufacturing, strong, committed funding for these initiatives is vital to bolstering the proven success of these programs as well as to spurring further innovation, job creation, and economic growth. U.S. manufacturers need additional skilled workers, an efficient fiscal and regulatory environment, open markets, and strong partnerships between government, industry, and academia to ensure a healthy innovation pipeline. Accomplishing these goals requires we take a surround-sound approach to the problems facing the manufacturing sector by addressing challenges beyond the traditional trade and tax issues commonly associated with it. While trade and tax policies are important to business in general (i.e. lower tax rates and greater access to markets), these policies will have little effect on the U.S. manufacturing sector if our domestic manufacturing base is not adequately equipped to handle the demands of the day. In order for the U.S. to compete with other nations that are investing heavily in advanced manufacturing technologies, our domestic policies need to support a robust and sustainable manufacturing R&D infrastructure. For this reason, our recommendations focus specifically on the challenges most significant to the U.S. manufacturing sector and support programs that will allow the U.S. to better compete globally and strengthen our own workforce and security.

Specific recommendations are as follows:

### **SUPPORT AN APTLY BUILT DOMESTIC MANUFACTURING SECTOR**

The U.S. attained its position as a world leader in R&D through substantial, dedicated Federal funding for our research universities and national labs. However, there is a clear disconnect between the government's commitment to R&D and the lack of proper investment to ensure that research is brought to market. In fact, many of the discoveries that occur in the U.S. are taken overseas to be further developed and manufactured. This has a negative impact on our nation's economy, evidenced by the decline of U.S.-manufactured goods exports. From 2015 to 2016, U.S.-manufactured goods exports fell 5.9 percent with significant decline to the top six markets, including Canada, Mexico, China, Japan, the United Kingdom, and Germany.<sup>4</sup> To reverse this negative trend, America must invest in manufacturing processes development to bridge the gap between basic research and scaled production.

There needs to be a clear, quick, and dedicated path for basic research to move forward through validating and prototyping, and on to commercialization. Strategic, sustained investments in moving projects through Technology Readiness Levels (TRLs) as well as Manufacturing Readiness Levels (MRLs) will not only reduce the time it takes for new innovations to be brought to market, but further stimulate technological progress. To best accomplish this, the Federal government should:

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<sup>4</sup> <http://www.nam.org/Newsroom/eNewsletters/Global-Manufacturing-Economic-Update/2016/Global-Manufacturing-Economic-Update--August-2016/#sthash.bc2ZCbGP.dpuf>

### **Fully fund and expand the Manufacturing USA program.**

The U.S. has begun to invest in establishing manufacturing institutes, each with a specific focus. However, the full impact of Manufacturing USA cannot be realized with just a few institutes. For the network to function as intended and truly spur manufacturing innovation and technological progress, the U.S. must commit to developing a large, nationwide network of dozens of institutes.

### **Commit to continued investment in the Manufacturing Extension Partnership (MEP).**

The MEP program fosters partnerships between small-sized manufacturers to promote collaboration that enables U.S. manufacturers to develop products, expand their markets, and adopt new technologies that help to strengthen the innovation pipeline in the U.S.

### **Authorize and fund a grant program supporting manufacturing curricula at designated institutions of higher education to build a skilled and ready workforce.**

Through this legislative initiative, designated institutions of higher education chosen through a competitive grant process will support industry-relevant, manufacturing-focused, engineering training in the U.S. Designated universities and institutions will be given the resources necessary to infuse manufacturing education throughout their curricula and align their educational offerings with the needs of modern U.S. manufacturers. Updating existing programs and creating manufacturing-focused education tracks that align with the actual skill-needs of U.S. manufacturers will allow students and researchers to better navigate commercialization, encourage new partnerships between manufacturing firms, grow hands-on training opportunities for students, and foster manufacturing entrepreneurship nationwide.

## **PROMOTE MANUFACTURING INNOVATION AND COMPETITIVENESS**

The government plays a key role in promulgating policies that encourage innovation and set the groundwork for competitiveness. These policies must be mindful of the long-term, capital-intensive nature of investments in manufacturing capacity, as well as those of engineering and basic science innovation. Federal R&D investments as a percentage of GDP has been declining steadily<sup>5</sup> and furthermore, Federal R&D investments as a share of GDP has begun to fall behind that of other nations. If the U.S. does not begin to reverse this trend immediately, we could see a significant and rapid decline in our science and technology ecosystem.

In order to ensure strong growth in domestic R&D and to support the U.S. manufacturing innovation pipeline, beginning with fundamental advancements in science and progressing through technology commercialization, the Federal government should:

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<sup>5</sup> <http://www.aaas.org/sites/default/files/Budget%3B.jpg>

**Expand the Research and Development (R&D) Tax Credit** to increase competitiveness and prevent the U.S. from falling further behind other countries in tax incentives. The R&D Tax Credit rates should be periodically revisited to make sure they are competitive globally. Increasing the R&D Tax Credit will strengthen innovation at home and make the United States more competitive abroad.

**Prioritize long-term Federal research projects and support a balanced portfolio of engineering and scientific research** among the physical and life sciences. Congress should do this by supporting basic research at key agencies, including NSF, DOE Office of Science, and NIST, agencies that support basic research in engineering and have a high impact on economic competitiveness.

**Make permanent the first-year 50 percent Bonus Depreciation Tax Credit.**

The Bonus Depreciation Tax Credit allows small- and medium-sized manufacturers a chance to establish themselves firmly as a U.S.-based business. To ensure this tax credit is able to accomplish its purpose, it is necessary to extend the 50 percent depreciation bonus amount to all future fiscal years.

### INVEST IN WORKFORCE DEVELOPMENT

Federal investments in fundamental scientific discovery and technological development have declined almost 60 percent in the last 40 years, when adjusting for inflation. Fewer research dollars over time has resulted in fewer companies with skilled workers capable of designing and building complex systems. As a result, the U.S. is increasingly dependent on immigration to meet its technical workforce needs. The NSF's 2016 S&E Indicators report found that from 1993 to 2013, (which is the most recent data collected and published in the NSF's 2016 S&E Indicators report) the number of foreign-born individuals that account for college-educated workers employed in S&E occupations in the United States rose 10.7 percent.<sup>6</sup> Further, the Government Accountability Office and National Science Foundation have consistently reported that the U.S. remains dependent on foreign talent for a large percentage of highly skilled workers to perform the critical tasks needed to sustain the key parts of our industrial base, particularly with respect to aerospace and defense industries.

The decline in the U.S. manufacturing base and rise of manufacturing competitors abroad pose further workforce training and capacity issues for the economy. As other nations develop their production and design capacity, and are therefore better able to educate and retain the best science and engineering talent, our ability to attract foreign talent will erode. As the manufacturing workforce becomes increasingly more global and technology-driven, it is essential that the U.S. aligns its K-12, undergraduate, and graduate core curricula and education systems to better address the knowledge and skill requirements of its 21st century workforce. However, just preparing out students to meet the skills-gap isn't enough. The U.S. must also invest in training programs for experienced workers so that our current workforce is better equipped to meet the needs of the day.

<sup>6</sup> <https://www.nsf.gov/statistics/2016/nsb20161/#/report/chapter-3/immigration-and-the-s-e-workforce>

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We do not have time to wait for our kindergarteners to become engineers to address the challenges and opportunities facing our nation today. We need to invest in our current workforce and train workers to be able to utilize the technologies available to them today, as well as learn to adapt to the technologies of the future. While some of these issues have suffered decades of neglect and will take decades to correct, all require immediate attention and a national commitment to improvement. Accordingly, the Federal government should:

**Commit to continued, sustained investment in the Manufacturing USA and MEP programs to promote workforce development programs** that will help build a skilled workforce here at home, prevent companies from producing new products overseas, and speed up the time it takes for innovations to travel from conception through commercialization.

**Support scholarships and fellowships** to students and workers pursuing manufacturing engineering degrees and technical certificates.

**Establish a grant program to fund manufacturing-focused universities and institutions** that will engage in developing new curricula to be used in manifesting manufacturing education throughout institutions of higher education. Supporting this program will encourage partnerships with manufacturing companies. These partnerships will work to address the need for increased manufacturing education in STEM curriculum and support the retraining of workforce to meet future industry needs.

**Strengthen tax incentives for workforce development and continuing education**, including those at the graduate level, both for employers and employees.

**Conduct a high level review of the health and sustainability of the U.S. high-tech workforce** to ensure that education and immigration policies are working to expand the number of highly-skilled workers in STEM fields.

**Support community colleges and technical schools** to ensure worker training programs provide the next generation of technically skilled workers.

## CONCLUSION

Manufacturing has tremendous potential to spark economic growth and job creation in the U.S. In addition to being a critical part of the U.S. national security apparatus, innovation pipeline, and process for job creation, manufacturing holds the promise for the establishment of wholly new industries and the reinvention of new methods of doing business. The U.S. maintains leadership in a range of machinery and equipment manufactured goods, as well as in the pharmaceutical, transportation, food processing, and electronic products industries, with each sector slated for future expansion fed by global demand from expanding and emerging markets.

Other countries have already recognized the importance of spurring the creation of new products and industries – particularly in the energy technology sector – and have taken steps to ensure a healthy science and engineering workforce and a competitive market for attracting investment. The U.S. must use this opportunity to level the playing field and build a strong foundation here at home that will allow industry to properly invest in advanced manufacturing processes and technologies in the U.S. In particular, key steps the U.S. should immediately take to signal commitment to a long-term growth strategy include:

**Fully-funding the Manufacturing USA program** to encourage and sustain the formation of R&D partnerships among government, industry, and universities. Congress should do this by supporting the goals of the NIST MEP provision in the America COMPETES Act.

**Further investing in and expanding the Hollings Manufacturing Extension Partnership (MEP) program** as outlined in America COMPETES Act legislation.

**Authorizing and funding a grant program for manufacturing-focused universities and institutions.**

**Expanding the R&D tax credit and strengthening tax incentives for workforce development** and continuing education.

**Supporting scholarships for students and workers pursuing science and engineering degrees and technical certificates** and are committed to working in a manufacturing environment after completing their educational programs.

**Committing to long-term Federal investment in engineering and scientific research** and support a balanced portfolio of engineering and scientific research among the physical and life sciences. Congress should do this by supporting the goals of the America COMPETES Act – an effort to double investments at the NSF, DOE Office of Science, and NIST that support basic research in engineering and have a high impact on economic competitiveness.

**Encouraging and sustaining the formation of R&D and STEM education partnerships** among government, industry, and universities.