Options for a National Plan for Smart Manufacturing

Workforce Development

Smart manufacturing utilizes next-generation technologies such as advanced sensing and computing technologies to improve the productivity, precision, efficiency, and sustainability of the workforce, factories, and supply chains. While these technologies and tools offer significant opportunities, it is critical that there is a robust and skilled workforce in place to ensure that the U.S. manufacturing system is competitive in this fast-moving field.

At the request of Congress and the Department of Energy (DOE), the National Academies of Sciences, Engineering, and Medicine conducted a study to evaluate options for a national plan to promote and support smart manufacturing. *Options for a National Plan for Smart Manufacturing* explores promising technologies transforming the manufacturing sector and identifies research and resources needed to adopt and accelerate smart manufacturing while establishing the United States as a global leader in the field. Learn more and download the full report at https://nap.nationalacademies.org/catalog/27260.

ADVANCING THE WORKFORCE

The nation faces a shortage of skilled and trained individuals, such as production workers, engineers, and technology developers, for the manufacturing workforce, and particularly those knowledgeable about and experienced with smart manufacturing technologies and methodologies. Existing efforts to train and educate the manufacturing workforce are fragmented and insufficient, creating significant gaps and inefficient duplication of work.

As more smart manufacturing technology and methodologies are implemented, the workforce must adapt to keep pace. New job roles and expertise areas will emerge and many existing manufacturing jobs in production, engineering, quality, and leadership will require new competencies to meet the demand. Continuous education and workforce development are paramount to the success of smart manufacturing and ultimately the U.S. manufacturing ecosystem, from large multinational corporations to small- and medium-sized enterprises.

To solve these workforce challenges and support workforce development, the report recommends that workforce planning is a cornerstone in the development of a national plan for smart manufacturing. An effective initiative to nurture the U.S. smart manufacturing workforce could take the form of a nongovernmental organization, such as a smart manufacturing education and training academy or institution. This academy could serve as a central resource for manufacturing education and training, focusing on areas such as curriculum development, program evaluation, standard setting, and outreach to underrepresented groups.

INVESTING IN EDUCATION AND TRAINING

Certification and training programs provide a means to ensure that new technologies and innovations are adopted and supported by the U.S. workforce. This is key to growing the next-generation highly trained personnel and ensuring that the current workforce is cyber ready and data savvy. The national plan could adopt one or more of the following initiatives to provide direct investment and support for smart manufacturing skills development:

- Set up fellowship programs, traineeships, or other experiential training programs in smart manufacturing for individuals and invest in much needed infrastructure to train the workforce;
- Improve and modify existing continuing education programs to provide funding for microcourses and microcredentialing opportunities;
- Create a career exploration requirement in middle school with a federal mandate that covers it;
- Offer tax incentives for corporations and grants for small- and medium-sized businesses to fund job training and education; and/or
- Support wraparound services for students and workers with mentoring and implementation services to assist those pursuing entry-level positions.

SUPPORTING EDUCATIONAL DEVELOPMENT

If the United States wants to lead efforts in smart manufacturing, it will need to increase the number of qualified workers with credentials in the field. The national plan for smart manufacturing could pursue options to cultivate new talent with specific skills, further train existing workers across various levels and disciplines, and invest in training and education. These options include:

- Financing sabbaticals for instructors at the high school, community college, and university level for training in the latest developments in smart manufacturing;
- Providing need-based financial support for both new and returning students enrolled in smart manufacturing credentialing and upskilling programs;
- Providing grants to high schools and community colleges for smart manufacturing training laboratories; and
- Developing a national repository of learning materials and curricula for industry, high school, community college, university, adult education, and independent training in smart manufacturing.

Given the fast-moving nature of the smart manufacturing sector, it is critical to ensure that the nation's current and future manufacturing workforce is and remains relevant, robust, competitive, and adaptable. Developing and growing the U.S. smart manufacturing workforce and ecosystem will provide next-generation capabilities, improve the productivity and energy efficiency of the manufacturing sector, and ensure U.S. leadership.

Community colleges and 4-year colleges are current mainstays in providing workers with the technical credentials needed for entry-level jobs in smart manufacturing. The Department of Education and local stakeholder groups and communities should provide financial and other incentives to instructors at both community and 4-year colleges to help keep them abreast of new developments in smart manufacturing.

FOR MORE INFORMATION

This Consensus Study Report Issue Brief was prepared by the National Academies' National Materials and Manufacturing Board based on the report *Options for a National Plan for Smart Manufacturing* (2024).

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To read the full report, visit https://nap.nationalacademies.org/catalog/27260.

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