



Report to Congress FY 2022

January 2024



About This Document

This annual Report to Congress documents the progress of the Manufacturing USA program in meeting its goals and highlights accomplishments of the federal agency-sponsored manufacturing institutes that participated in the Manufacturing USA program in fiscal year 2022.

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CONTENTS

- A MESSAGE FROM OUR INTERAGENCY TEAM 1
- ABOUT MANUFACTURING USA..... 2
- MANUFACTURING USA AT A GLANCE 4
- SECURING U.S. GLOBAL LEADERSHIP IN ADVANCED MANUFACTURING 5
- DEVELOPING ADVANCED MANUFACTURING TECHNOLOGIES..... 6
- EMPOWERING THE ADVANCED MANUFACTURING WORKFORCE 7
- BUILDING A SUSTAINABLE ADVANCED MANUFACTURING INNOVATION ECOSYSTEM 8
- APPENDIX A: MANUFACTURING USA METRICS MAP AND PERFORMANCE METRICS DATA..... 9
- APPENDIX B: SUMMARY AND ASSESSMENT OF THE NIIMBL REPORT TO THE SECRETARY OF COMMERCE
..... 12
- APPENDIX C: ADVANCED MANUFACTURING NATIONAL PROGRAM OFFICE INTERAGENCY WORKING
TEAM PARTICIPANTS 14
- APPENDIX D: FEDERAL AGENCIES PARTICIPATING IN MANUFACTURING USA 15

A MESSAGE FROM OUR INTERAGENCY TEAM

This past year brought renewed collective focus on harnessing the power of technology to accelerate manufacturing and bolster economic and national security for communities and the nation. From once-in-a-generation legislation to bolster U.S. manufacturing via the CHIPS and Science Act¹, the Bipartisan Infrastructure Law², and the Inflation Reduction Act³, to increased leverage of public-private partnerships, Manufacturing USA is poised to deliver even more impact through advanced manufacturing technology, ecosystem growth, and workforce development efforts.

Through the Manufacturing USA[®] network, our agencies support a coalition of partners collaborating to secure U.S. global leadership in advanced manufacturing. Through large-scale technology, supply chain and ecosystem, and workforce development initiatives, we are helping ensure that what's invented here is made here by a skilled American workforce. The manufacturing innovation institutes sponsored by our agencies and participating in the network serve as unique public-private partners helping make our vision a reality.

In 2022, the institutes worked with more than 2,500 member organizations on more than 670 applied research and development technology projects of high priority to industry. Manufacturers represent 63% of institute members, with nearly three-quarters of those being small and medium-sized. Continued industry support is also evidenced by its investments in these efforts. The institutes attracted \$307 million from state, federal, and private funds in addition to \$109 million in base federal funding. This 2.8 to 1 investment match exceeds the program design of a 1-to-1 match, demonstrating how federal investment effectively catalyzes investment in industrial innovation.

The institutes also helped to recruit and train the current and future workforce. The number of people participating in institute and partner-led advanced manufacturing education and workforce programs increased by 25% over the prior year, engaging 106,000 workers, students, and educators. This reflects a significant 80% increase in post-secondary teachers trained over the prior year.

This year, the White House led an effort by the agencies and institute directors⁴ to develop a more comprehensive set of advanced manufacturing scale-up and workforce development programs.

As this report highlights, the institutes and their members position the industry and the nation to deliver technical leadership, empower the current and next generation manufacturing workforce, and build a sustainable, resilient innovation ecosystem. We are pleased to share these accomplishments.



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¹ <https://www.congress.gov/117/plaws/publ167/PLAW-117publ167.pdf>

² <https://www.congress.gov/bill/117th-congress/house-bill/3684/text>

³ <https://www.congress.gov/bill/118th-congress/house-bill/812/text>

⁴ <https://www.whitehouse.gov/briefing-room/statements-releases/2022/10/24/readout-of-the-first-white-house-leadership-summit-with-manufacturing-usa-innovation-institute-network-directors/>

ABOUT MANUFACTURING USA



Our Vision

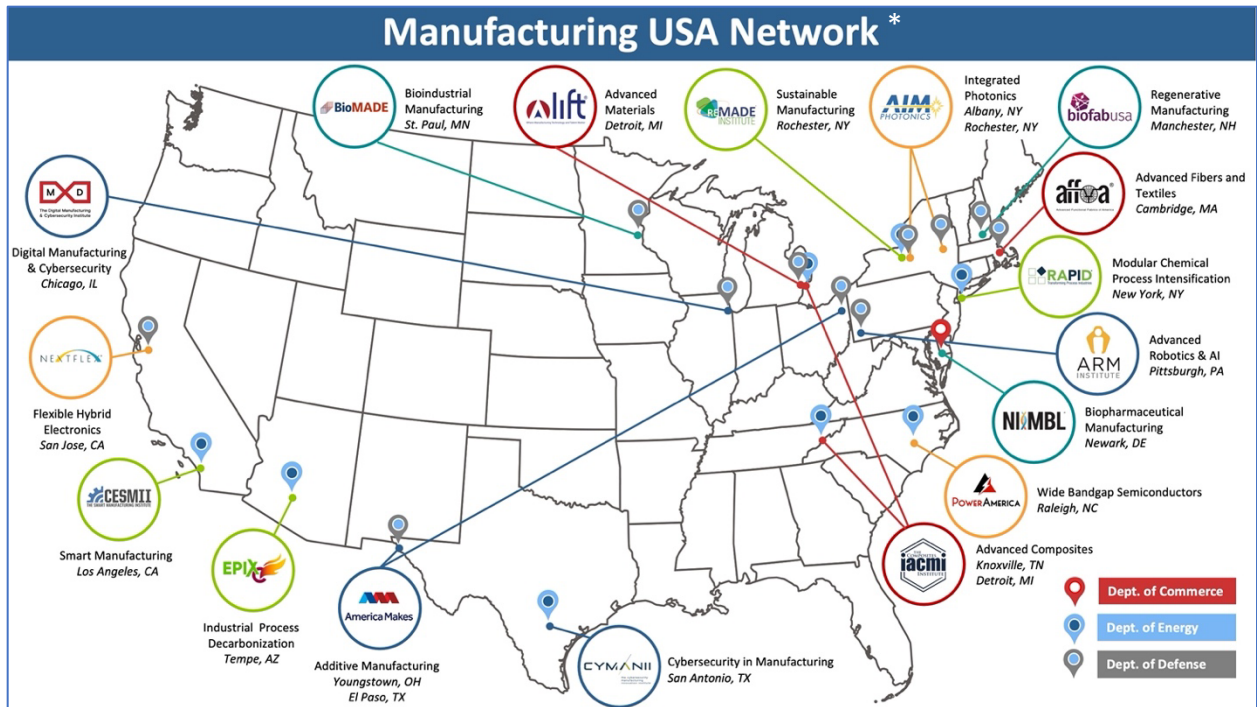
The vision for the Manufacturing USA Program is U.S. global leadership in advanced manufacturing.

Our Mission

To support this vision, the mission of the Manufacturing USA Program is to connect people, ideas, and technology to solve industry-relevant advanced manufacturing challenges, thereby enhancing industrial competitiveness and economic growth, and strengthening our national security.

The Manufacturing USA vision is to secure U.S. global leadership in advanced manufacturing. Manufacturing USA coordinates and catalyzes public and private investments in precompetitive advanced manufacturing technology to: 1) increase the competitiveness of U.S. manufacturing; 2) facilitate the transition of innovative technologies into scalable, cost-effective, and high-performing domestic manufacturing capabilities; 3) accelerate the development of an advanced manufacturing workforce; and 4) support business models that help the Manufacturing USA institutes to become stable and sustainable after the initial federal startup funding period.

Manufacturing USA's mission is accomplished through a uniquely structured interagency and public-private partnership network. Participating federal agencies and Manufacturing USA institutes coordinate to collectively advance the goals and objectives of the Manufacturing USA Program.



*Manufacturing USA Network at time of publication, January 2024

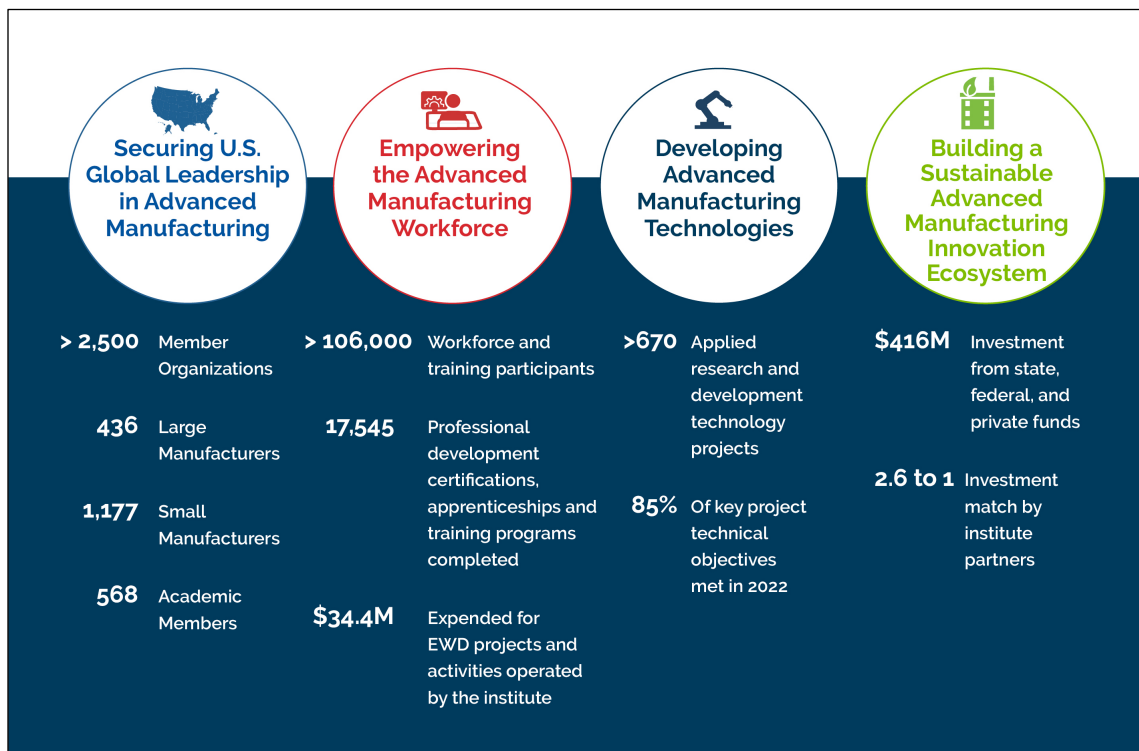
Together, with institute members from industry and academia, this "whole-of-government" effort seeks to drive innovation in advanced manufacturing through technology and workforce development. In FY 2022, the Manufacturing USA network included 16 institutes: one managed by the Department of Commerce (Commerce or DOC), nine through the Department of Defense, and six from the Department of Energy. The Advanced Manufacturing National Program Office (AMNPO) at DOC's National Institute of Standards and Technology oversees the coordinated activities of Manufacturing USA.

Each institute promotes the nation's leadership in advanced manufacturing by focusing on a unique technology. The institutes' flexible business models and a highly collaborative approach to applied research and development (R&D) catalyze important new relationships across government, industry, and academia. Industry, academia, start-ups, and non-profits become members of the institutes to leverage their unique project and networking opportunities to collectively solve manufacturing technology challenges and educate the workforce needed to advance new technologies. These unique institute-led ecosystems also serve as invaluable resources for the Federal government to tackle agency-specific challenges.

MANUFACTURING USA AT A GLANCE

Based on the vision and mission of the Manufacturing USA Program, the participating agencies and institutes work toward four goals that flow from the purposes stated in Manufacturing USA’s authorizing statute⁵ and are consistent with each sponsoring agency’s mission and own authorities: securing U.S. global leadership in advanced manufacturing, developing advanced manufacturing technologies, empowering the advanced manufacturing workforce, and building a sustainable advanced manufacturing innovation ecosystem.

These four program goals are embodied within the four themes listed below which comprise a robust strategy for supporting manufacturing innovation by reducing the time required to transition early-stage research to commercial development and, ultimately, deployment in U.S. manufacturing environments. These themes help guide the network of participating agencies and institutes to advance U.S. domestic manufacturing capability while leveraging the economic and national security benefits from other federal and private sector investments in fundamental research. The performance metrics for and the mapping of these performance metrics onto each of the corresponding goals are presented in more detail in Appendix A.



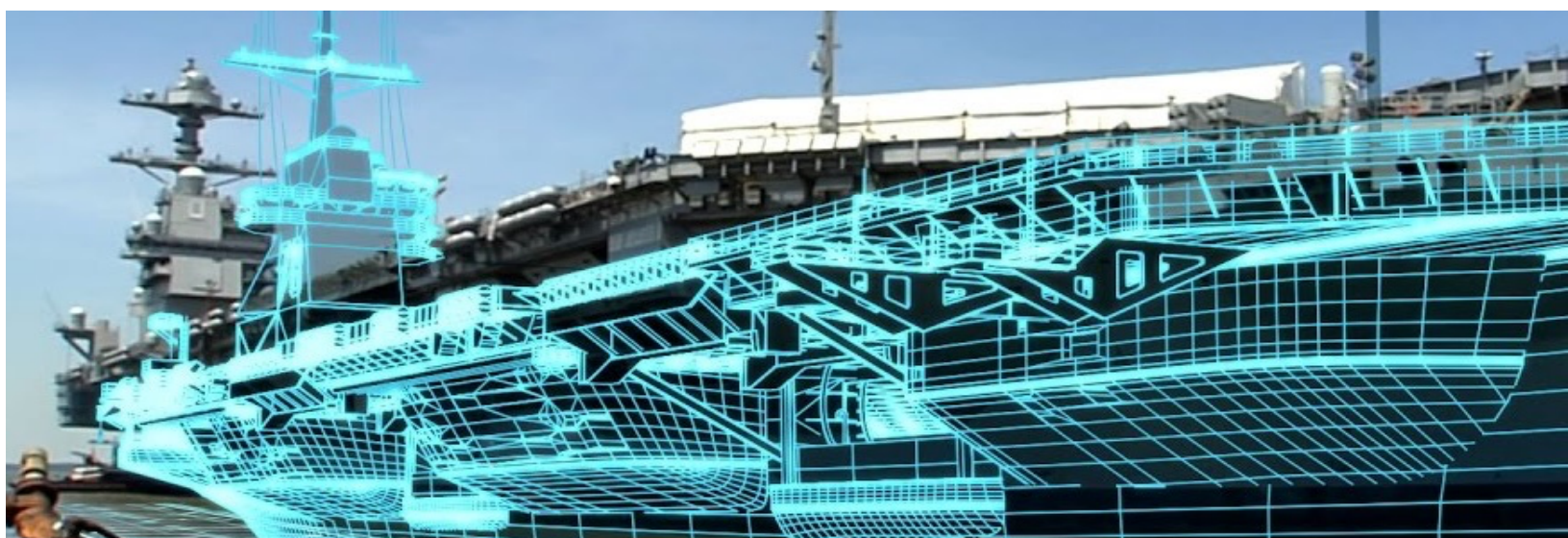
⁵ 15 U.S.C. § 278s(b)(2)). [http://uscode.house.gov/view.xhtml?req=\(title:15 section:278s edition:prelim\)](http://uscode.house.gov/view.xhtml?req=(title:15 section:278s edition:prelim))

SECURING U.S. GLOBAL LEADERSHIP IN ADVANCED MANUFACTURING

Advanced manufacturing is essential to our economic and national security. American manufacturers contribute more than \$2.8 trillion to the U.S. economy which on its own would represent the eighth-largest economy in the world.⁶ Every dollar spent in manufacturing results in an additional \$2.60 added to the economy and creates jobs and economic opportunities in communities and regions throughout the country. Manufacturing USA institutes are integral to creating and catalyzing these opportunities:

MxD Cyber Resource Hub: Manufacturing is the number one targeted sector for cyber-attacks. To address this growing challenge, Manufacturing times Digital (MxD, a DoD-sponsored institute) has gathered a library of cybersecurity resources to create the MxD Cyber Resource Hub, launched in 2022. By consolidating resources ranging from the most high-level to in-depth tools that provide governmental guidance on cyber preparedness, MxD provides U.S. manufacturers the information needed to identify, protect, detect, respond, and recover from attacks of all types.

Renewable Resources: As a leader in the U.S. transition to a circular economy, REMADE (a DOE-sponsored institute) tackles barriers within the manufacturing cycle that limit recovery, reuse, remanufacturing, and recycling of metals, fibers, polymers, and electronics across the product lifecycle in such industries as automotive, consumer products, electronics, and heavy-duty equipment. The institute's research portfolio of 82 projects, worth \$85M, grew by 21 projects and \$15M. This portfolio has the potential to increase the use of recycled materials by more than 40 million metric tons annually, save 1.2 quads of energy per year, and reduce greenhouse gas emissions by 67.2 million metric tons each year, the equivalent of eliminating the emissions of 13.1 million cars.



⁶ *Facts About Manufacturing*, National Association of Manufacturers, U.S. Bureau of Economic Analysis, International Monetary Fund.

DEVELOPING ADVANCED MANUFACTURING TECHNOLOGIES

The institutes and their member organizations collaborate on pre-competitive applied research and development projects (R&D) that lead to innovations in products and processes with broad industry-wide application. Examples of the 670 ongoing R&D technology advancement projects include:

Physical Therapy Soft Robotic Glove: Five million stroke survivors suffer from lasting hand impairment. Without high-repetition rehab (which is not achieved in standard care), many patients are left with little hope of recovery. The Advanced Functional Fabrics of America Institute (AFFOA, a DoD-sponsored institute) startup member Imago Rehab developed an innovative soft robotic glove solution to this problem and needed help to transition to production scale. AFFOA introduced Imago Rehab to apparel manufacturer 99Degrees to collaborate on development and prototyping the next iteration of the glove. The partnering companies focused on designing for manufacturability, simplifying the construction process, developing new actuators, and preparing the proper technical documentation for manufacturers to scale production.

Cost Improvement Opportunities in Wind Blade Fabrication: This IACMI (Institute for Advanced Composites Manufacturing Innovation, a DOE-sponsored institute) project is reducing the cost of wind turbine blades by developing new manufacturing processes and materials that are more efficient, cost-effective, and environmentally sustainable. An on-going project since the inception of IACMI, a team of institute members developed a workflow to analyze the feasibility of four new manufacturing strategies. This project wrapped in FY 2022, ultimately selecting a 'One-Step Close' manufacturing concept that provided a clear indication of the viability of this approach for blade manufacturing and good validation of its economic impact.



EMPOWERING THE ADVANCED MANUFACTURING WORKFORCE

Alongside their members and workforce development partners, institutes are targeting diverse and underserved populations to bring opportunities to all Americans interested in manufacturing careers. In FY 2022, more than 106,000 workers, students, and educators participated in institute workforce programs that offered newly developed curricula and certificate pathways in specific technology fields in collaboration with industry. A few examples include:

Helping Military Personnel Develop New Skills for Careers in BioPharma: NIIMBL (a DOC-sponsored institute) worked with Texas A&M University and its partners to develop Military Service Members in Biopharma Manufacturing (MSMBM) program. MSMBM helps industry tap into a significant and underutilized talent source and offers veterans new career possibilities. Last year, the program was delivered to five cohorts—41 veterans and military spouses—in Texas and North Carolina. Students had the opportunity to interview with Merck & Co. and Pfizer, Inc. upon completion of the program. In addition, participants in North Carolina were invited to attend BioNetwork's Career Fair to interview with biotechnology companies. Of the 41 participants, half received offers from biopharmaceutical companies within three months of completing the program.

Expanding FlexFactor's Reach: FlexFactor, NextFlex's (a DoD-sponsored institute) flagship education and workforce development program, addresses the skills gap and workforce shortage in the flexible hybrid electronics (FHE) industry. FHE combines traditional electronics with flexible, stretchable, and conformable materials, enabling the creation of new products and applications. Since its inception in 2016, FlexFactor has reached more than 10,000 K-12 students from around the country, with increased number of new participants every year. NextFlex's full workforce program portfolio extends from K-12 to college and university students, and the incumbent workforce, providing opportunities for students and adults to engage and consider a STEM career.

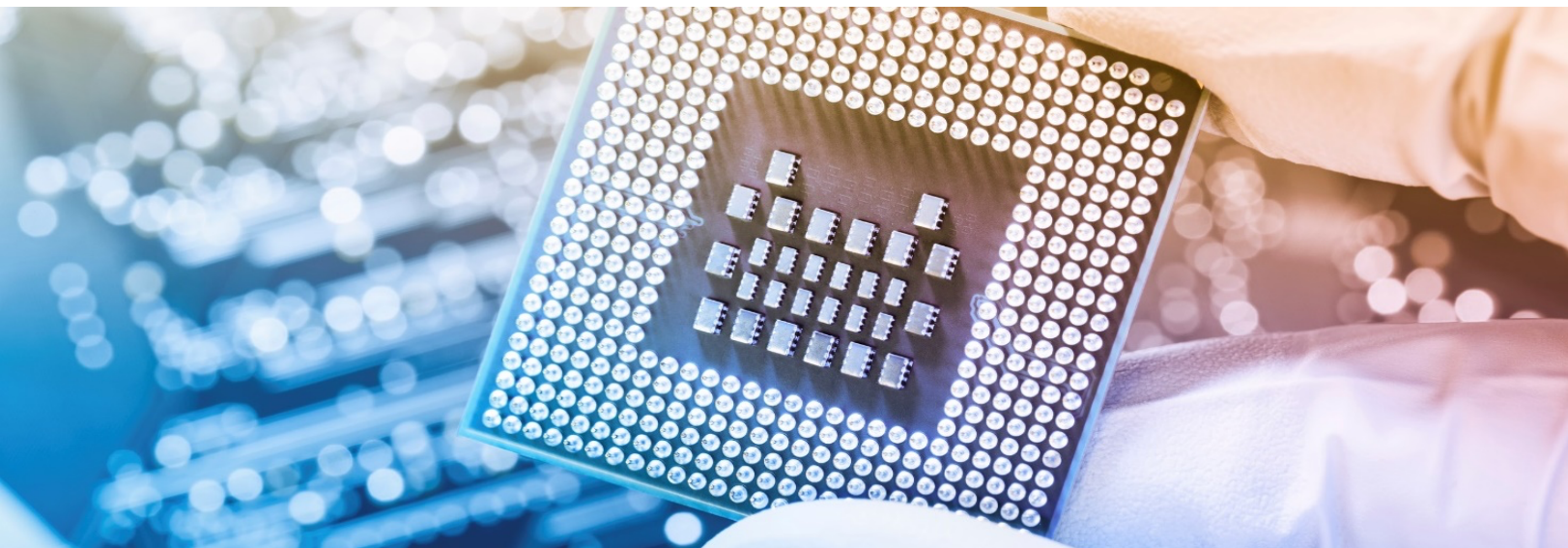


BUILDING A SUSTAINABLE ADVANCED MANUFACTURING INNOVATION ECOSYSTEM

American manufacturing innovation is reliant on strong and robust manufacturing supply chains, and diverse collaboration among manufacturing stakeholders. Small, medium, and large manufacturing companies, academia, member organizations, training and educational organizations, and many others must work together to advance and strengthen U.S. manufacturing and ensure our nation’s innovations become products here in the U.S.

Creating a Robotics Manufacturing Hub: The ARM Institute (a DoD-sponsored institute) received \$14.2M as part of a \$62.7M Build Back Better Regional Challenge⁷ to create a Robotics Manufacturing Hub at its Mill 19 in Pittsburgh. The goal of this Hub is to de-risk the adoption of advanced robotics and automation technology for small/medium manufacturers and accelerate the use of robotics technologies. The ARM Institute will work closely with the other recipients to achieve the overall mission of the grant, including working with members to expand use of robotics in small and medium-sized manufacturers, promote the formation of start-ups in robotics and automation, design a regional upskilling and training system, and increase pathways for under-represented populations in automation/robotics industries.

BioFabUSA Removing Barriers to Work: BioFabUSA (a DoD-sponsored institute) was part of a coalition awarded a \$44M Build Back Better Regional Challenge Award in late FY 2022 to establish a biofabrication cluster. With its partners, BioFabUSA is developing a “Work and Learn” program to remove barriers for youth and adult students interested in entering the biofabrication field. Barriers to entering the bioeconomy and regenerative manufacturing will be addressed, in part, through scholarships for targeted courses, certifications, and programs, while also tackling technological access, transit, and English language acquisition.



⁷ <https://www.eda.gov/funding/programs/american-rescue-plan/build-back-better>

APPENDIX A: MANUFACTURING USA METRICS MAP AND PERFORMANCE METRICS DATA

Measuring Manufacturing USA Program Performance

Manufacturing USA’s performance metrics are periodically updated. The quantitative performance metrics measure progress toward overall Manufacturing USA program objectives, as shown in Table 2. Each metric category provides information for tracking progress toward four interrelated high-level goals⁸ based primarily on legislative program purposes.⁵

Twenty-six metrics (Tables 3 and 4) are complemented by an additional 14 education and workforce metrics being piloted (Tables 5 and 6). Current metrics are compared with FY 2021 figures in this report.

In addition to the Manufacturing USA program metrics reported here, each lead funding agency has established metrics relating to the agency’s unique mission requirements. Those additional metrics are separately collected and evaluated by the funding agency.

Table 1. Performance Metrics Mapped to the Manufacturing USA Program Goals

| Institute Metric Category | Goal 1 Increase competitiveness of U.S. manufacturing | Goal 2 Facilitate the transition of innovative technologies into scalable, cost-effective, high-performing domestic manufacturing capabilities | Goal 3 Accelerate the development of an advanced manufacturing workforce | Goal 4 Support institute business models that help institutes become stable and sustainable |
|---|---|--|--|---|
| 1. Impact to U.S. innovation ecosystem | ● | ● | | ● |
| 2. Financial leverage | | ● | | ● |
| 3. Technology advancement | ● | ● | | |
| 4. Development of an advanced manufacturing workforce | ● | | ● | |

This whole-of-America approach is catalyzed and led by the Manufacturing USA institutes. The public-private partnerships at the institutes represent all the participants in the U.S. industrial base. Last year, the institutes collectively had more than 2,500 members, continuing the institutes’ steady membership growth of 7-12% annually. Approximately 63% are manufacturers, nearly 72% of which are small and medium-sized companies. Other members include community colleges, major research universities (representing 22% of members), and state and local economic development entities (15% of members). Together, institutes and their members work together to develop and advance new products, processes, and workforce skills.

⁸ *Manufacturing USA Strategic Plan*, Advanced Manufacturing National Program Office, p. 6 (November 2019), <https://www.manufacturingusa.com/sites/manufacturingusa.com/files/2021-01/2019%20MfgUSA%20Strategic%20Plan%2011-10-2020.pdf>.

| Table 2. Technology and Program Development Performance Metrics 16 Institutes | | | |
|--|---|----------------|----------------|
| Specific Metric | Unit of Measure | FY 2021 | FY 2022 |
| Metric Category 1 – Impact to U.S. Innovation Ecosystem | | | |
| Organizations with institute membership agreements | Total number of memberships | 2,320 | 2,572 |
| Diversity of member organizations | Number of large manufacturers (each with more than 500 employees) | 407 | 436 |
| | Number of small manufacturers (each with 500 or fewer employees) | 1,053 | 1,177 |
| | Number of academic members (universities, community colleges, etc.) | 516 | 568 |
| | Number of other entities (government members, government laboratories, not-for-profits, etc.) | 344 | 330 |
| Metric Category 2 – Financial Leverage | | | |
| Federal investment | Federal base funding in the fiscal year | \$127M | \$109M |
| Co-investment | Cost-share expended and federal funding not part of the base federal funding in fiscal year | \$314M | \$307M |
| Total expenditure | Total institute expenditures in fiscal year | \$481M | \$416M |
| Metric Category 3 – Technology Advancement | | | |
| Active research and development projects | Number of ongoing projects | 708 | 678 |
| Key project objectives met | Percentage of key project milestones met | 82% | 85% |

Institutes and their members and workforce development partners target diverse and underserved populations to bring opportunities to all Americans interested in manufacturing careers. They also develop curricula and certificate pathways in specific technology fields in response to and in collaboration with industry needs. In FY 2022, more than 116,000 workers (including veterans and those impacted by the pandemic), students, and educators participated in institute workforce programs – either virtually or through a hybrid approach.

| Table 3. Education and Workforce Development (EWD) Performance Metrics 16 Institutes | | | |
|---|---|----------------|-----------------|
| Metric | Units of Measure | FY 2021 | FY 2022 |
| STEM activities | Total number of students participating in institute projects or internship programs and training | 67,115 | 79229 |
| | Workers completing a certificate, apprenticeship, or training program | 14,676 | 23059 |
| Educators and trainers | Teachers or trainers completing institute-led training | 5,610 | 4037 |
| | Total number of EWD participants | 87,410 | 106,325 |
| | | | |
| Source of funding for institute EWD projects or activities | <u>Base-funded projects</u> : base federal funding from the original cooperative agreement or technology investment agreement | 87 | 43 |
| | <u>Commercial-funded projects</u> : support provided from industry, regardless of membership status | 9 | 22 |
| | <u>Federal agency-funded projects</u> : resourced from federal funding outside the base Cooperative Agreement (CA) or Technology Investment Agreement (TIA) funding | 44 | 44 |
| | <u>State- or locally-funded projects</u> : resourced from state or municipal government funding | 23 | 26 |
| | <u>Other funded projects</u> : resourced from philanthropic organizations, nonprofits, foundations, or associations | 29 | 19 |
| | Total number of EWD projects and activities operated by institutes* | | 192 |
| | | | |
| Funding amount expended for EWD projects and activities | <u>Base funding expended</u> : resourced by institute using base federal funding from the original CA or TIA | \$10.75 | \$8.7M |
| | <u>Commercial expenditures</u> : provided by industry, regardless of membership status | \$1.39M | \$2.3M |
| | <u>Federal agency expenditures</u> : resourced from federal funding outside the base CA or TIA funding | \$12.46M | \$22.3M |
| | <u>State or local funding expended</u> : resourced from state or municipal government funding | \$1.41M | \$4.9M |
| | <u>Other expenditures</u> : resourced from philanthropic organizations, nonprofits, foundations, or associations | \$1.66M | \$2.1M |
| | Total expenditures for EWD projects and activities | | \$27.68M |

* This represents individual projects and does not represent a summary. The information above illustrates projects that may be funded by multiple sources. Therefore, the total projects are less than the sum of the projects funded by each source.

APPENDIX B: SUMMARY AND ASSESSMENT OF THE NIIMBL REPORT TO THE SECRETARY OF COMMERCE

Institutes established under the Manufacturing USA statute are required to submit a detailed report to the Secretary of Commerce, with a summary and assessment of that report included in the Manufacturing USA Annual Report to Congress.⁹ Currently, NIIMBL is the only institute funded under Manufacturing USA's legal authority¹⁰ and this section is a summary and assessment of the NIIMBL 2021-22 Annual Report to the Secretary of Commerce. A public version of this report, without the financial reporting data was released in July 2022.¹¹

NIIMBL launched operations on March 1, 2017, to promote U.S. global leadership in biopharmaceutical manufacturing innovation and to ensure that U.S. inventions become products made in America. The institute's success will promote economic development, with additional impacts on national security and public health, by strengthening the domestic supply chain and advancing the rapid scale-up of bio-manufactured therapies. NIIMBL's annual report submitted to the Secretary of Commerce covered a summary of accomplishments during Year Five (March 1, 2021, through February 28, 2022).

NIIMBL reports that, in its fifth year, the institute has:

- Demonstrated an 11% increase in membership, which now includes over 200 members, including 20 large industry manufacturers and suppliers and more than 80 small to medium-sized manufacturers
- Catalyzed a greater than 3:1 non-federal co-investment for each federal dollar invested in the institute to support the technology and workforce development portfolio, with cumulative value over \$80 M
- Launched 32 pandemic response projects with multiple organizations across the U.S. through \$83 M in America Rescue Plan (ARP)¹² funding from NIST for R&D and testbeds to prepare, prevent and respond to coronavirus public health threats
- Launched the Vaccine Manufacturing Center of Excellence at NIIMBL headquarters to support continued evaluation and wide-spread adoption of innovations for analytical technologies for characterization of vaccines, including mRNA-based products
- Advanced NIIMBL-led programs in process intensification, big data analytics and vector manufacturing to support ecosystem-wide innovation, as well as innovator access to current and future state-of-the-art equipment and industry-relevant materials for biomanufacturing biopharmaceutical manufacturing
- Expanded awareness of and access to high-paying biopharmaceutical manufacturing jobs through workforce development programs, such as NIIMBL eXperience, that connects underrepresented students and transitioning service members with industry networks and industrially relevant hands-on training opportunities. As of summer 2022, a total of 39 students have participated in the program; over 30% resulted in internships/jobs in the industry.

NIIMBL's performance continues to demonstrate commitment to strengthening U.S. leadership in biopharmaceutical manufacturing to support the economy, speed patient access to the best available therapies, and ensure our national prosperity.

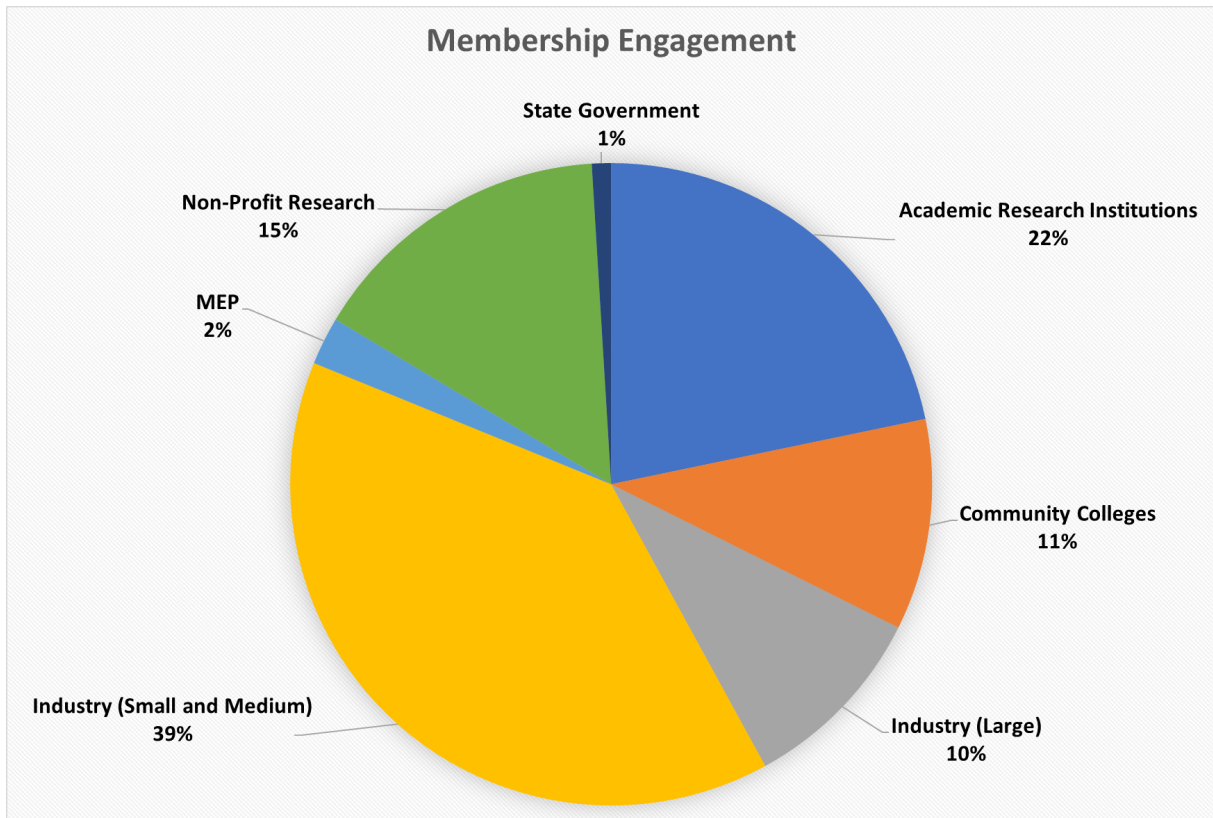
⁹ 15 U.S.C. § 278s(j). [http://uscode.house.gov/view.xhtml?req=\(title:15 section:278s edition:prelim\)](http://uscode.house.gov/view.xhtml?req=(title:15 section:278s edition:prelim)).

¹⁰ 15 U.S.C. § 278s(e). [http://uscode.house.gov/view.xhtml?req=\(title:15 section:278s edition:prelim\)](http://uscode.house.gov/view.xhtml?req=(title:15 section:278s edition:prelim)).

¹¹ 15 U.S.C. § 278s(j). [http://uscode.house.gov/view.xhtml?req=\(title:15 section:278s edition:prelim\)](http://uscode.house.gov/view.xhtml?req=(title:15 section:278s edition:prelim)).

¹² American Rescue Plan (ARP) Act of 2021 (Pub. L. 117-2)

At the end of NIIMBL's fifth year of operation (2021-2022), performance reflects strong industry and public sector engagement, resulting in more than three non-federal dollars coinvested for each Federal dollar invested. NIIMBL has made substantial contributions to the technical and workforce capabilities of the biopharmaceutical industry and the larger bioeconomy.



APPENDIX C: ADVANCED MANUFACTURING NATIONAL PROGRAM OFFICE INTERAGENCY WORKING TEAM PARTICIPANTS

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Frank Ledbetter
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Jenn Smith

U.S. Department of Agriculture

World Nieh (Sponsor)
Daniel Cassidy

APPENDIX D: FEDERAL AGENCIES PARTICIPATING IN MANUFACTURING USA

Department of Commerce

The U.S. Department of Commerce (DOC) mission is to create the conditions for economic growth and opportunity for the nation. DOC more broadly increases regional and national capacity for innovative manufacturing through partnerships with state and local governments, academic institutions, and the private sector. Through its convening power, regional economic-development programs, and statistical and economic analysis, it empowers industry-driven solutions to the shortage of in-demand skills. Finally, DOC supports research and development leading to transformative changes in technology and promotes intellectual-property policy that supports and protects innovation. By all these means, the DOC helps accelerate technology development and strengthen the nation's position in the global competition for new products, new markets, and new jobs.

The NIST Office of Advanced Manufacturing (OAM) helps to coordinate outreach in advanced manufacturing. The office works in partnership with other federal agencies to support the acceleration of U.S. innovation and to increase U.S. competitiveness in industrially relevant, cross-cutting advanced manufacturing products and resources. OAM is the headquarters and convener for the interagency Advanced Manufacturing National Program Office, coordinating with advanced manufacturing offices in the Department of Defense, Department of Energy, National Aeronautics and Space Administration, National Science Foundation, and the Departments of Education, Agriculture, Health and Human Services, and Labor to extend the impact of Manufacturing USA. Within NIST, OAM manages external outreach and provides federal financial assistance for ecosystem building initiatives such as technology roadmaps and public service awards for the Manufacturing USA network, and oversees the NIST-sponsored Manufacturing USA institute, NIIMBL.

National Institute of Standards and Technology

The DOC's National Institute of Standards and Technology (NIST) is the only research laboratory in the U.S. Government specifically focused on enhancing industrial competitiveness; its robust research portfolio is concentrated on the technical challenges associated with advanced manufacturing. NIST's mission is to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life. In addition, the Manufacturing Extension Partnership National Network is a critical resource for engaging small and medium-sized manufacturers to develop new products, expand into global markets, and adopt new technologies, such as those being developed at the Manufacturing USA institutes.

Department of Defense

DoD provides a staffed, trained, and equipped military force needed to deter aggression and protect the security of our nation. To transition DoD science and technology advances into production, the Department must have access to a robust and responsive U.S. industrial base equipped with advanced manufacturing technologies that deliver critical products and systems affordably and rapidly. The DoD established nine Manufacturing Innovation Institutes (DoD MIIs) through the Office of the Secretary of Defense Manufacturing Technology Program to help develop the technology and manufacturing

ecosystems needed to support the Department of Defense's mission. Unlike the other manufacturing institutes, the DoD-sponsored institutes have the additional mission to develop innovative technologies that will ultimately aid the warfighter.

The DoD MII's address commercial and defense manufacturing needs via public-private partnerships with active participation and support from the military departments and defense agencies. The institutes' flexible business models and focus on highly collaborative research and development catalyze important new organizational relationships across government, industry, and academia. Under the leadership of the Under Secretary of Defense for Research and Engineering, DoD continues to foster long-term engagement with its institutes to support the DoD critical technology areas. Already, the institutes have shown progress in support of cybersecurity for manufacturing, microelectronics, biotechnology, hypersonics, and autonomy, among other critical technology areas.

The DoD intends to continue strategic partnerships with their institutes to further enable the development of defense-critical technologies into affordable, domestic defense products. Continued engagement helps to maintain and enhance manufacturing innovation ecosystems. By fostering Department engagement, these public-private partnerships help ensure domestic and defense manufacturing needs can be met while protecting intellectual property and providing overmatching technology to the warfighter. The DoD institutes further the Department's vision for a national technology innovation base and help ensure that key advanced technologies that are invented in the U.S. are manufactured in the U.S.

Department of Education

The mission of the U.S. Department of Education is to promote student achievement and preparation for global competitiveness by fostering educational excellence and ensuring equal access. The Department of Education's Office of Career, Technical, and Adult Education (OCTAE) administers the Carl D. Perkins Career and Technical Education Act, the purpose of which is to develop more fully the academic and career and technical and employability skills of secondary education students and postsecondary education students who elect to enroll in career and technical education programs. OCTAE also administers Title II of the Workforce Innovation and Opportunity Act, the Adult Education and Family Literacy Act (AEFLA), the purpose of which is to help adults obtain the foundational skills they need to be productive citizens and enter and advance in the workforce. While playing a critical role in adult attainment of a secondary school diploma, AEFLA also supports adult learners to transition into postsecondary education and training through the use of career pathways.

Department of Energy

DOE has two offices within the Office of Energy Efficiency & Renewable Energy (EERE), the Advanced Materials and Manufacturing Technologies Office (AMMTO) and the Industrial Efficiency and Decarbonization Office (IEDO), dedicated to improving the energy and resource efficiency of manufacturers across the industrial sector. Effective and efficient use of energy, water, and material resources in manufacturing is essential for the nation's energy security, economic competitiveness, and environmental stewardship.

AMMTO provides planning, management, and direction necessary for a balanced program of research, development, demonstration, technical assistance, and workforce development to support domestic manufacturing that is critical to achieving a clean, decarbonized economy. While IEDO provides investments

across a variety of activities including direct funding opportunities, knowledge-sharing consortia, funding to national labs, and prizes. By addressing energy related manufacturing challenges and reducing risk through merit-based research and development, adoption of AMMTO and IEDO- developed technologies can save energy and lower expenses for industry, reduce emissions, industrial waste, materials, and water usage, and improve the life cycle energy of manufactured goods.

Department of Health and Human Services

The mission of the U.S. Department of Health and Human Services (HHS) is to enhance and protect the health and well-being of all Americans. The Department achieves this mission by providing for effective health and human services and fostering advances in medicine, public health, and social services. The HHS considers robust manufacturing to be critical to public health security and resilience in the U.S.

The Food and Drug Administration (FDA), an operating division within the HHS, is responsible for protecting public health by ensuring the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation. The FDA continues to support development of new tools, standards, and approaches to evaluate the advanced manufacturing of FDA-regulated products. The FDA also has several Working Groups that monitor the technology landscape and work closely with Manufacturing USA Institutes. Promising technologies 5 to 10 years in the future are explored by the FDA Emerging Sciences and Technology Working Group. Technologies that are ready for implementation and adoption are considered by the FDA Advanced Manufacturing Technologies Working Group. Furthermore, the FDA awards projects through the FDA's Broad Agency Announcement to support emerging and enabling technologies for advanced manufacturing. Several of the FDA product centers also have programs to facilitate and foster use of advanced technologies in medical products.

Department of Labor

The U.S. Department of Labor's (DOL) Employment and Training Administration (ETA) is the principal workforce development agency in the federal government. ETA supports sustainable economic growth through leadership and a national investment portfolio that develops workforce skills necessary to support the jobs of today and is positioned to support the jobs of tomorrow, to the benefit of American job seekers and job creators. This portfolio includes significant investments in employment and workforce development solutions for diverse applicant types, including institutes and their partners.

ETA oversees a diverse portfolio of programs and services provided by the public workforce system, a network of federal, state, and local government-funded agencies and programs. The public workforce system delivers quality job opportunities and assistance in acquiring skills and credentials to workers and connects businesses with skilled workers to meet their workforce needs. Partnerships at the federal, state, and regional levels connect employers, educational institutions, the public workforce system, and economic development partners to address the workforce needs of industry sectors, such as advanced manufacturing. These partnerships ensure that job creators have the talent they need to grow and thrive and provide job seekers the opportunity to develop in-demand skills through work-based learning and Registered Apprenticeships and to earn industry-recognized credentials.

ETA supports and is part of the Manufacturing USA Interagency Working Team and the Manufacturing USA Education and Workforce Subcommittee. The agency continues to engage in partnerships, share tools and resources, and identify funding opportunities and strategies that can be leveraged to expand

pathways into good manufacturing jobs and to support the Manufacturing USA institutes. To foster strategic alliances nationally, ETA also works with DOL's Veterans' Employment and Training Service (VETS), the federal government's principal agency for service members, veterans, and military spouse employment. VETS' recent support of the Defense Industrial Base (DIB) Initiative and numerous member organizations, academic members, and training partners across the 16 institutes that comprise the Manufacturing USA ecosystem led to greater visibility of program initiatives, employment opportunities, and training opportunities within advanced manufacturing.

National Aeronautics and Space Administration

The National Aeronautics and Space Administration is the United States government agency responsible for aeronautics, space exploration, space technology, space, and earth science. NASA contributes to our nation's economic competitiveness, fueling growth in American industry and supporting quality, high-paying jobs across the country. NASA emphasizes leadership in climate change, as a leading provider of Earth systems science and data. NASA also inspires young explorers, scientists, and technologists who will lead our nation's skilled STEM workforce.

The Space Technology Mission Directorate (STMD) is the NASA organization most closely related to Manufacturing USA. STMD invests in transformational technologies that help offset future mission risk, reduce cost, advance capabilities that enable NASA's missions, and support space industry growth and high-quality job creation. STMD identifies and promotes research and technology development, demonstrates applicability, and supports the infusion of these technologies into NASA's exploration and science missions as well as commercial space activities.

Advanced manufacturing research and development within STMD is focused on several areas, including in-space manufacturing, additive manufacturing, advanced materials, polymer matrix composites, metals processing and joining, digital transformation, and other technology development areas critical to achieving NASA's missions. Research and development are conducted through a combination of in-house activities at NASA centers, competitively funded research with universities and industry, and collaborations with other agencies. The rapid infusion of advanced manufacturing technologies into mission applications is a major emphasis of NASA's technology investment strategy.

National Science Foundation

The National Science Foundation (NSF) works to promote the progress of science and maintain our nation's scientific leadership and global competitiveness. It supports basic research and education in all fields of fundamental science and engineering to create knowledge that transforms the future.

NSF supports fundamental advanced manufacturing research, education, and workforce training through awards from almost all its Directorates and Offices. The most targeted support is provided through the Advanced Manufacturing Program, and through the Future Manufacturing solicitation. NSF also promotes advanced manufacturing innovation through a variety of use-inspired and translational research programs, including the NSF Regional Innovation Engines (NSF Engines), Convergence Accelerator, Innovation Corps (I-Corps™), Partnerships for Innovation (PFI), Small Business Innovation Research (SBIR), and Small Business Technology Transfer (STTR) programs in its new Directorate for Technology, Innovation, and Partnerships (TIP), the Grant Opportunities for Academic Liaison with Industry (GOALI) program, and by partnering with industry, state/local/tribal government organizations and other agencies.

Advanced manufacturing is also supported through the Engineering Research Centers (ERC), Industry-University Cooperative Research Centers (IUCRC), and Advanced Technological Education (ATE) programs. With an emphasis on two-year colleges, the ATE program focuses on the education of technicians for the high-technology fields that drive our nation's economy. NSF strives to encourage the full participation of all Americans in STEM and to remove barriers to their doing so.

All NSF programs welcome the submission of proposals to collaborate with Manufacturing USA institutes on cutting-edge research and educational projects, and it is expected that the incorporation of the resources, expertise, and experience of the institutes and their member companies will increase the competitiveness of such proposals in merit review.

U.S. Department of Agriculture

The U.S. Department of Agriculture (USDA) provides leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on public policy, the best available science, and effective management.

USDA focuses on collaborative science which aligns work in fundamental and applied research funded through extramural and intramural research programs and recognizes that manufacturing is part of value-added innovations that have an important role in maximizing the benefits of a sustainable rural economy. Of specific interest is the expansion of the bioeconomy, which has the potential for the sustainable harvest and use of substantial renewable biomass in the U.S. to support existing food, feed, forest product, and fiber markets while creating new jobs. The bioeconomy is supported by innovation in biomanufacturing, biotechnology, and bioproduct development. Innovation in scaling up biomanufacturing can improve technology to more efficiently and sustainably process biological materials to produce high-value bioproducts. Biotechnology can create new or improved biomaterials, and engineer forestry and agriculture crops to adapt to vulnerabilities from climate change to sustain the production of food and non-food products.

USDA supports research, development, and deployment of forest and agricultural feedstocks to produce biobased products such as biofuels, industrial chemical intermediates, performance polymers, and finished higher-value products, as well as biotechnologies to support new markets, such as cellular agriculture, alternative proteins, and precision nutrition.