

Building the World's Pre-Eminent Bioeconomy: A National Innovation and Competitiveness Leadership Agenda

CONCEPT PAPER

Key Question

The \$4 trillion global bioeconomy is projected to grow to \$30 trillion by 2050. What must the U.S. public and private sectors do today to capture the benefits of innovation, expanded industry, and create jobs from this generational growth opportunity?

Stage Setting

The global bioeconomy, currently valued at \$4 trillion annually and is poised to revolutionize much of society—with widespread business, health, and environmental implications.¹ The bioeconomy is a vital sector for the United States' economic competitiveness and national security, with estimates that it contributes \$210 billion to the U.S. GDP, supports 644,000 domestic jobs, and generates \$49 billion in wages.²

A significant convergence of technologies—from AI, to advanced materials, to gene editing, to bioprocessing, to digital integration, to bioprinting—is unlocking remarkable new opportunities for the United States across nearly every sector of the economy. Platform technologies—the foundational tools of engineering biology—are highly shared, versatile, and scalable, enabling innovation in medicine, agriculture, consumer goods, and environmental applications. Biology-based platforms such as gene sequencing, gene editing, DNA synthesis, proteomics, and metabolomics accelerate product development, while automation and scale-up platforms

¹ [A Status of the Global Bioeconomy](#), World Bioeconomy Forum, 2023.

² [The Economic Impact of the U.S. Industrial Bioeconomy](#), Teconomy Partners, LLC, June 2024.

translate laboratory discoveries into commercial-scale production. Computation- and data-driven platforms enhance predictive modeling, large-scale data analysis, and design optimization, reducing research timelines and amplifying innovation impact. Together, these platforms magnify the United States' ability to capture value, create new industries, and generate high-quality jobs.

A surge in productivity across these technological platforms could position the bioeconomy for exceptional growth, with some projecting a global bioeconomy of \$30 trillion by 2050.³ With such high stakes, global competitors are emerging to capture their share in this opportunity.

To maintain its status as a global leader, the United States must act decisively and quickly to optimize every facet of the bioeconomy—from research and development, to production and commercialization. This complex, integrated, globe-spanning bioeconomy—dependent on innovation-driven growth—must also creatively leverage partnerships and collaboration to seize global opportunities and tackle global grand challenges.

The stakes are high for the world—and the pressing U.S. competitiveness questions are:

- How can the nation capture the innovation and value creation—with new industries, firms, and jobs—that the future bioeconomy promises?
- What are the best regulatory and standards frameworks to support smart, safe, and rapid growth?
- What sorts of physical and policy infrastructures are needed to power growth in the bioeconomy?
- In a world of abundant capital, how does the bioeconomy attract investment for projects that demand a different scale and timeframe of return compared to other highly innovative sectors?
- Does the nation have the talent necessary to support the growth of the bioeconomy – if so, how do we strengthen; and if not, how do we develop?
- And in a world of emerging and converging technology revolutions, how does the growing bioeconomy connect to and benefit from the explosion in transformative computing, advanced materials, etc.?

Answers to these strategic questions—and many more—are needed to ensure the United States stakes and maintains a global leadership role in the bioeconomy, bolstering its competitiveness, expanding domestic manufacturing, developing more resilient supply chains, and strengthening the country's national security and economic prosperity.

The Bioeconomy: A Driver of U.S. Competitiveness

³ [The Global Bioeconomy](#), Nature Finance, April 2024

In 2017, the Council on Competitiveness released [LAUNCH — Advancing U.S. Bioscience: Challenges and Opportunities in Sustainable Energy, Environmental Remediation, 21st Century Agriculture, Human Health & Biomanufacturing](#), providing a summary and analysis of the tremendous potential bioscience has to transform a broad swath of existing industries and to create new ones.

However, the study's finding was clear: To advance biomanufacturing and biotechnology to address grand scientific challenges for energy, the environment, human health, and agriculture requires a strategic, aggressive, focused, and coordinated effort to reduce silos among federal agencies, industry, academia, and the national laboratories.

In 2020, the Council's first report from its flagship National Commission on Innovation and Competitiveness Frontiers, [Competing in the Next Economy — The New Age of Innovation](#), painted a picture of America at a crossroads, in dire need of a tenfold (10X) increase in its innovation capacity and capabilities. The report called for a new strategy to re-invent America by amplifying our ability to *imagine*, gain *insight*, express *ingenuity*, create cutting-edge *inventions*, and develop and deploy *impact* at home and around the world.

The *Competing in the Next Economy* report served as a clarion call for a renewed approach that enables the United States to set the global pace in the emerging technologies that will shape the future. These technologies have the potential to profoundly transform the U.S. industrial base, economy, security, global competitiveness, and society — like the suite of technologies supporting the country's bioeconomy.

By harnessing the power of biology to replace traditional chemicals and chemical processes, the U.S. bioeconomy presents an unparalleled opportunity for sustainable economic growth, increased national security, revitalization of American manufacturing, enhancement of domestic supply chains, and improved human health and longevity. Consider the following points:

- Biomanufacturing and biotechnology are projected to generate a direct economic impact of \$4 trillion annually over the next decade.⁴
- Recent studies indicate that up to 60 percent of the physical inputs to the global economy could be produced biologically—one-third from biological materials and two-thirds through biological processes (e.g., bioplastics).⁴
- It is estimated that 45 percent of the global disease burden can be addressed using technologies now achievable through advanced biotechnology.⁴

The potential benefits of bio-innovation to human health and longevity are extraordinary. Personalized medicine, driven by genomics and biotechnology, is already enabling tailored treatments and therapies that enhance efficacy and minimize side effects for patients.

⁴ The Bio Revolution: Innovations Transforming Economies, Societies, and Our Lives, McKinsey Global Institute, May 2020.

Regenerative medicine and tissue engineering facilitate the repair of damaged tissues, promoting recovery and longevity. The development of biopharmaceuticals, including biologics and vaccines, enhances disease prevention and treatment. Additionally, the exploration of nutraceuticals, microbiome research, and agricultural biotechnology is showing many promising innovations that will lead to improved nutrition and well-being. Innovations in disease monitoring via biosensors and wearables allow for real-time health management and improve access to care, while synthetic biology paves the way for novel therapies and diagnostics.⁵

Furthermore, expanding the U.S. bioeconomy would transform and grow the labor market and strengthen communities across the country, particularly in the heartland and rustbelt. The widespread transition to the bioeconomy would revitalize a diverse range of industries—growing, renewing, and re-shoring the U.S. production of biopharmaceuticals, fuels, chemicals and polymer monomers, electronics, optics and photonics, materials, food and fiber, personal care, and even national security industrial base.

Due to its importance across sectors, the Council on Competitiveness is not the only organization focused on the incredible competitiveness challenges and opportunities presented by the bioeconomy. And over the past two decades, policymakers across the aisle have demonstrated support for efforts that aim to coordinate better, and strategically plan and invest in bioeconomy opportunities across agencies, industry, national laboratories, and academia. For example:

- [The 2012 National Bioeconomy Blueprint](#), which outlined a strategy to leverage biological research innovations to address national challenges in areas like health, food, energy, and the environment.
- [The 2013 Brain Research through Advancing Innovative Neurotechnologies \(BRAIN\) initiative](#), a partnership between Federal and non-Federal partners with a common goal of accelerating the development of innovative neurotechnologies in collaboration with HHU, NSF, and DARPA.
- [The 2015 Precision Medicine Initiative](#), which presented a new model of patient-powered research focused on accelerating biomedical discoveries.
- [The 2016 National Microbiome Initiative](#) focused on advancing the study of microbiomes across diverse ecosystems.

And more recently:

- [President Trump's 2019 Executive Order](#) to accelerate biotechnology research and development.

⁵ [Structural Drivers of the Future, Technology Trends: The Future of Biotech](#). Office of the Director of National Intelligence, April 2021

- [The 2021 National Security Commission on Emerging Biotechnology](#), which focused on the intersection of biotechnology and national security.
- [President Biden's 2022 Executive Order](#) that called for funding advanced biotechnology and biomanufacturing across several federal agencies.
- [In 2023, the U.S. Department of Defense increased the BioMADE \(Bioindustrial Manufacturing and Design Ecosystem\) budget by \\$450 million](#) to unite more than 175 organizations to rapidly develop and deploy biomanufacturing innovations at scale.
- [The 2024 formation of the National Bioeconomy Board](#), which works to align public-private interests to enhance societal and economic well-being via the bioeconomy.

Arguably, the most comprehensive recent policy initiative in the bioeconomy is the 2022 National Security Commission on Emerging Biotechnology (NSCEB), which explores the intersection of biotechnology and national security. The Commission is co-chaired by Senator Todd Young (R-IN), who has emerged as a leading voice in shaping a federal framework for U.S. bioeconomy leadership. Under his co-leadership, the Commission released the landmark May 2024 report, *Biotechnology and American National Security: A Framework for Action*, which advocates for a White House Office of Biotechnology and a coordinated national strategy. In April 2025, the final report was released, identifying biotechnology as a foundational 21st-century technology and warns that the United States risks falling behind adversaries such as China, which has committed over \$100 billion through its Five-Year Plan to scale biomanufacturing and synthetic biology. The final NSCEB report recommends expanding regional biomanufacturing hubs, targeted investments in a national biotechnology workforce, and supply chain security measures to reduce reliance on foreign precursors.

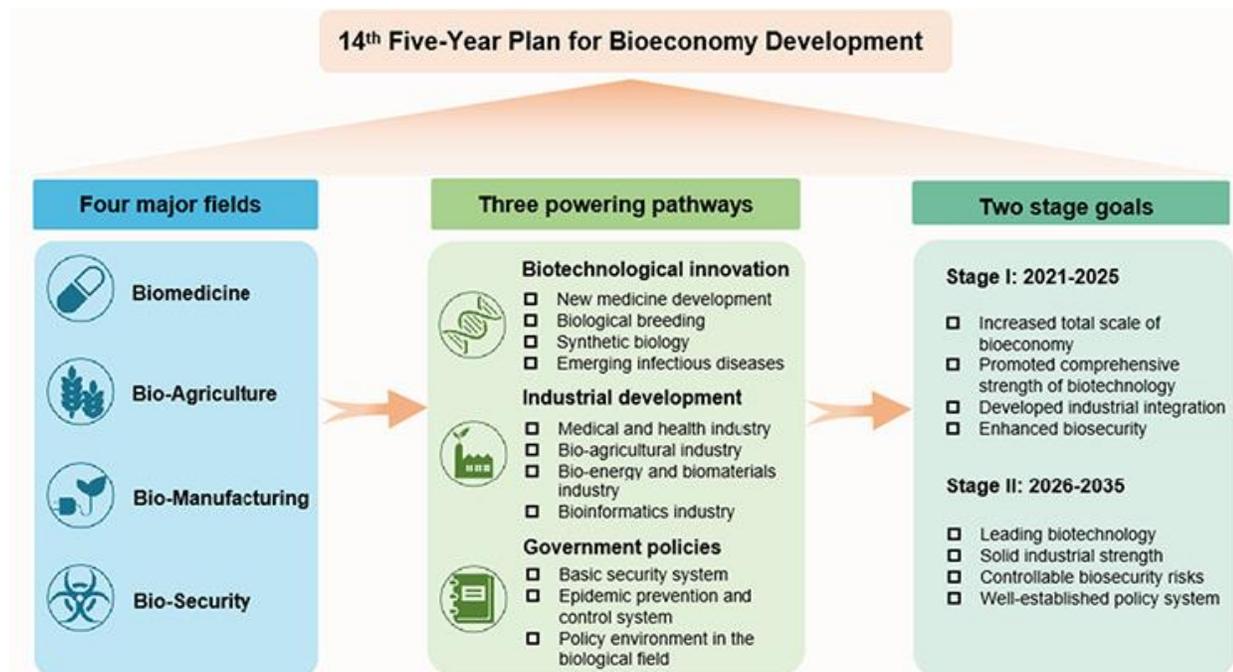
In addition to his work on national strategy, Senator Young has also been instrumental in advancing biofuel policies that strengthen domestic production. In July 2024, he joined a bipartisan group of 50 colleagues in urging the U.S. Department of the Treasury to issue timely guidance on the 45Z Clean Fuel Production Credit — which was extended through December 31, 2029, as part of the One Big Beautiful Bill Act (OBBBA) — and consolidates several expiring fuel-related credits and is designed to increase domestic biofuel production.

International Competition

The United States is not alone in recognizing the power and potential of optimizing its economy around a bio-driven future. Nations — strategic allies and others — are investing heavily in biomedicine, bio-agriculture, biomanufacturing, biosecurity, and the sequencing of genomes. China, for example, has made the bioeconomy a key element in several of its national plans for science, technology, and strategic emerging industries.⁶ Consider the

⁶ China's Hybrid Economy: What to Do about BGI? Anna Puglisi, Center for Security and Emerging Technologies, February 2024.

following graphic of China's 14th Five-Year Plan (2021–2025) for its bioeconomy development.⁷



The Chinese government's investments in biotechnology research and development have significantly bolstered its domestic biotech companies and clusters, enhancing the country's food security and health science capabilities. Currently, China represents 30 percent of the global gene sequencing capacity and is at the forefront of international collaborations aimed at increasing its global competitiveness in this vital sector.⁸

Beyond sequencing, China is a highly competitive, low-cost producer of fermentation-based products — including amino acids, vitamins, and organic acids — leveraging advanced infrastructure and a skilled workforce. The country's fermentation technology market is projected to reach \$6.28 billion by 2030, growing at a compound annual growth rate of 5.3 percent from 2024 to 2030.⁹

Chinese companies are increasingly commercializing products that rely on technologies initially funded and developed in the United States. This includes a growing number of

⁷ [The Roadmap of Bioeconomy in China](#). National Library of Medicine, November 2022.

⁸ China's Hybrid Economy: What to Do about BGI? Anna Puglisi, Center for Security and Emerging Technologies, February 2024.

⁹ Grand View Research, China Microbial Fermentation Technology Market Size & Outlook, 2025. <https://www.grandviewresearch.com/horizon/outlook/microbial-fermentation-technology-market/china>.

biologics, gene therapies, and other high-value pharmaceuticals that originated from U.S.-based research institutions and biotechnology firms. In the first quarter of 2025, China accounted for 32 percent of out-licensing biotech deal value, up from 21 percent in 2024.¹⁰ This increase demonstrates that Chinese firms are not merely participating in licensing deals but are actively acquiring U.S.-originated technologies to bring products to market, reflecting a deliberate strategy to leverage foreign-developed innovations to strengthen their domestic biotech capabilities and accelerate commercialization.

But China is not the United States' only competitor striving to lead the global bioeconomy race.

In January 2025, the European Association for Biotechnology, EuropaBio, released a report advocating for the EU Biotech Act.¹¹ This initiative aims to establish a next-generation ecosystem approach to enhance the continent's bioeconomy, fostering competitiveness, sustainability, health, and strategic autonomy. The plan is built upon three key pillars:

- **Accelerated and Expanding Financing:** Launching the 'Biotech for Europe Initiative' to secure rapid and scalable funding from both public and private sectors for the development and deployment of next-generation biotechnology innovations.
- **Regulatory Streamlining:** Establishing a more straightforward and predictable legislative framework for biotechnology and biomanufacturing that guarantees intellectual property protection and serves the interests of all citizens.
- **Ecosystem Development:** Strengthening regional and global value chains by cultivating a skilled and diverse workforce across EU Member States, while enhancing accessibility and connectivity to promote innovation in products and processes.

While China and the EU are leading competitors in the bioeconomy, more than 50 nations have put bioeconomy plans into action.¹²

¹⁰ GeneOnline, "Chinese Biotechs Account for 32% of Out-Licensing Deal Value in Early 2025," July 2025. <https://www.geneonline.com/chinese-biotechs-account-for-32-of-outlicensing-deal-value-in-early-2025/>

¹¹ [The EU Biotech Action — EuropaBio Vision Paper](#). EuropaBio, January 2025.

¹² [Bioeconomy National Strategies in the G20 OECD Countries: Sharing Experience and Comparing Existing Policies](#), EFB Bioeconomy Journal, Volume 3, November 2023



With global competition growing, the United States must act decisively to maintain its leadership position, which requires a comprehensive, cross-sector strategic roadmap for enhancing the U.S. bioeconomy. Failing to establish a leadership position in the bioeconomy could jeopardize the nation’s economic security and diminish its standing on the global stage.

Writing the Next Chapter of the U.S. Bioeconomy

The bioeconomy is now poised to enter a new era characterized by rapid expansion and economic and manufacturing transformation. Today, the convergence of affordable gene sequencing with advanced computing, automation, and artificial intelligence has fueled innovations in synthetic biology, genomics, and biomanufacturing. Due to this convergence of technologies, for the first time, the United States can rely on secure, domestically produced bio-based production methods that use feedstocks such as corn, sugar, and soybeans to replace traditional industries and manufacturing processes. This transition will drive significant economic growth, foster the creation of new businesses, and enhance security and prosperity for all Americans.

However, this vision is only attainable with the right policies and investments. Maintaining U.S. leadership in biotechnology and biomanufacturing will depend on expanding access to sustainable feedstocks, supporting infrastructure for bioprocessing, incentivizing innovation in bio-based materials, and cultivating a skilled workforce capable of advancing these emerging industries.

Looking ahead, how can the United States maintain its global leadership in biotechnology and biomanufacturing to tackle major challenges in health, energy, food security, and national

security? And what policy, regulatory, talent, technology, investment, and infrastructure challenges need to be addressed to ensure the U.S. remains a global leader in the bioeconomy?

Proposal Overview

The Council on Competitiveness — a non-partisan, non-profit CEO-level leadership organization dedicated to strengthening U.S. competitiveness and innovation — recognizes the transformative potential of the bioeconomy to drive sustainable economic growth, reinvigorate domestic manufacturing, add resilience to supply chains, improve sustainability, and enhance public health. The Council's membership comprises key leaders from industry, academia, and labor; and the Council benefits from the support of many of the U.S. Department of Energy National Laboratories. This diverse representation of national leaders allows the Council to mobilize effectively the resources and expertise to identify challenges and opportunities for expanding and strengthening the U.S. bioeconomy.

This proposal outlines an initiative led by the Council on Competitiveness to shape the future of the U.S. bioeconomy and establish the United States as a global pacesetter in next-generation materials and manufacturing. Achieving this vision necessitates a comprehensive national strategy that leverages the country's strengths in research, agriculture, transportation, talent, technology, investment, and innovation to accelerate the bioeconomy's growth.

Initiative Objectives

1. **Cross-sectoral Leadership Formation:** Secure industry, university, U.S. Department of Energy National Laboratory, and labor co-chairs for the initiative, as well as an active senior steering committee composed of authorities from across these sectors and government leaders to guide the project and develop a unified vision for the U.S. bioeconomy.
2. **Stakeholder Engagement:** Ensure diverse stakeholder involvement, from private sector leaders to policymakers, fostering collaboration and innovation.
3. **Strategic and Actionable Recommendations:** Formulate actionable recommendations to promote U.S. leadership and resilience across the bioeconomy.
4. **Promulgation of Recommendations:** Elevate the recommendations made within the bioeconomy strategic roadmap to policymakers and influencers to educate them on core issues and opportunities, as well as inspire competitiveness-friendly policies.

Conclusion

Expanding the U.S. bioeconomy presents a vital opportunity to tackle significant national challenges, including enhancing competitiveness, securing supply chains, strengthening domestic manufacturing, and increasing access to high-value jobs. However, with growing international competition to lead the bioeconomy, the stakes are considerable. We must act decisively. By rallying resources from a wide range of stakeholders and adopting a strategic, collaborative approach to bioeconomy advancement, this Council on Competitiveness initiative will not only strengthen the U.S. position in the global economy but also boost productivity and improve the prosperity of all Americans.