



Bioeconomies Ecosystems and Society

A UIDP Academy Workshop
Jan. 11-12, 2022

Executive Summary



Strengthening
University-Industry
Partnerships

UIDP conducted this workshop on behalf of the NSF Biology Directorate to leverage top scientific minds to identify biotechnology research areas for strategic investments and acceleration.

Executive Summary

The bioeconomy ecosystem encompasses innovation, technology platforms, products, systems, and services, with implications for wide-ranging human-environment and societal issues, including health, climate, and food. Developing a successful bioeconomy ecosystem requires an understanding of unique features of bioeconomy, social, behavioral, and economic implications, translational opportunities and challenges, diverse workforce development paths, and consideration of local-regional aspects.

The National Science Foundation (NSF) is developing programs and partnerships to create and advance successful bioeconomy ecosystems by progressing science and by paving the way for the translation of research to benefit society. This workshop was convened to better understand the pathways for successful and sustainable bioeconomy ecosystems that incorporate societal, economic, and behavioral underpinnings, and to uncover the challenges and opportunities that arise within a bioeconomy ecosystem. The workshop explored the implications of these factors on innovation, entrepreneurship, and growth within the bioeconomy.

Over two days, a diverse group of more than 100 scientists and researchers participated in the conference, representing academia, industry, government, and nonprofit organizations. The participants provided input on eight topics:

- Development of bioeconomy ecosystem and innovation hubs;
- Diversity, equity, and inclusion;
- Implementation and adaptive management;
- Regional and geographic considerations in bioeconomy;
- Responsible and ethical scaleup;
- Risk assessments;
- Social challenges and opportunities that arise in a bioeconomy ecosystem; and
- Value chains and markets.

The workshop participants recommended that additional time, energy, and resources be devoted to :

- Creating better approaches to communicate the importance of science to the public;
- Defining bioeconomy and understanding how value is created in a bioeconomy ecosystem;
- Embedding social, behavioral, and economic sciences in all stages of bioeconomy ecosystem development;
- Engaging stakeholders earlier in the process;
- Incorporating diversity, equity, and inclusion in all aspects of bioeconomy, with emphasis on workforce development and entry points to the ecosystem; and
- Valuing human-centered design of bioeconomy ecosystems.

Purpose of the Workshop

The purpose of the workshop was to recognize and identify areas of importance in developing a successful and sustainable bioeconomy ecosystem that spurs innovation, creates economic growth and societal value, enhances diversity, equity, and inclusion, and provides an ethical translation of science to implementation. For the purpose of this workshop, the bioeconomy refers to the share of the economy based on products, services, and processes derived from biological resources (e.g., plants and microorganisms).¹ The workshop focused on several broad topics:

- Understanding the opportunities and challenges that arise within the bioeconomy ecosystem;
- Exploring how societal, behavioral, and economic factors promote a successful and sustainable bioeconomy and the implications of the bioeconomy for financial well-being and society at large;
- Considering regional and geographic aspects of the bioeconomy;
- Stakeholder engagement; and
- Incorporating diversity, equity, and inclusion in research and technology development.

Workshop Findings in Brief

- **The definition of bioeconomy** should be broad to give opportunities to different regions and ecosystems to define more narrow objectives within the greater definition and develop appropriate measures for the bioeconomy ecosystem.
- **Diversity, equity, and inclusion** should be a priority and embedded in bioeconomy ecosystem development in all aspects, including entry points and workforce development.
- **Risk assessment** should incorporate high-level strategy for a dynamic and sustainable bioeconomy and encompass barriers to translation by considering financial, societal, and informational challenges over different time horizons.
- **Societal, behavioral, and economic sciences** should be integrated into bioeconomy development early in the process to maximize its impact and avoid unintended consequences. Human-centered design should be embedded in this development.
- **Stakeholder engagement and communication** are crucial and should carry through all stages and through multiple channels, including early stages and during scaleup, to understand different views and objectives and to foster collaborations.
- **Team science and interdisciplinary collaborations** should be the driving force of bioeconomy research and translation.
- **Further understanding end-use perceptions** should be considered as research and programs translate from lab to consumer.
- **Workforce development efforts** should consider education in a broader framework (to include community colleges) and foster an entrepreneurial mindset to catalyze a vibrant, diverse, and equitable workforce in the bioeconomy.

Challenges and Opportunities

A range of challenges and opportunities arise in the development of a successful, sustainable bioeconomy.

Challenges:

- **The definition of bioeconomy** must be comprehensive to allow alternative ecosystems to develop more specific definitions and the corresponding metrics within this broader and interdisciplinary context.
- **Translational challenges** exist, including licensing and intellectual property rights, impacts of regulations, incentives for researchers to pursue goals-based product development, shared infrastructure, access to capital, and creating both economic and social value.
- **Varied perspectives** should be incorporated at all stages through stakeholder engagement, beginning at the start of bioeconomy ecosystem development and during scaleup.

Opportunities:

- **A broader concept of development** that considers social and behavioral factors in addition to economic growth along the value chain should be incorporated into bioeconomy ecosystem advancement.
- **Integration of diversity, equity, and inclusion** to bioeconomy ecosystem development provides opportunities for underrepresented groups to participate in an emerging field. This entails well-defined entry points and long-term partnerships to build a strong and diverse workforce that is closely aligned with industry needs.
- **Team science that incorporates social, behavioral, and economic research** can have valuable impacts, allowing grand challenges to be addressed holistically while avoiding unintended consequences.

Recommendations and Next Steps

Participants proposed actionable recommendations for developing high-impact bioeconomy ecosystems.

- **Create leadership and workforce development programs** that integrate diversity, equity, and inclusion to cultivate an emerging workforce and empower champions who can help build new initiatives via both nonprofit and commercial ventures.
- **Develop public engagement programs** in partnership with universities and other relevant organizations while considering how these efforts impact the views of stakeholders and scientists.
- **Design and plan major infrastructure investments**, including shared data and tools to enable access and innovation in the bioeconomy. These should consider different models (e.g., distributed or decentralized) with varying governance strategies.
- **Engage social, behavioral, and economic scientists and legal scholars** in envisioning the bioeconomy ecosystem. Foster collaboration between natural sciences/engineering and social sciences through funding initiatives and support universities and other organizations to encourage specific types of collaborations.
- **Invest in centers with equal influence between social scientists and natural science and engineering partners** to foster cross-directorate efforts in developing bioeconomy ecosystems and incorporate social, behavioral, and economic sciences beyond “broader impacts” in these engagements.

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