Controlled environment agriculture: A case in strengthening inter-agency research collaboration in the United States government

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Shaping the Future of Science

Background

Today's greatest challenges, such as climate change, nutrition insecurity, disease, and global conflict, are increasingly multifaceted and interconnected. In order to adequately address these challenges, **there is a critical need for convergence across scientific disciplines and public, private, and non-profit institutions**.

Controlled environment agriculture (CEA) has the potential to address many societal challenges and contribute to a more resilient and sustainable food system. After several years of sustained growth and investment, the CEA industry (particularly commercial-scale vertical farms) is currently recalibrating from a period of adversity and high-profile closures. **Now is a crucial time to advance government sponsored and subsidized research supporting the CEA industry.**

Convergence and CEA

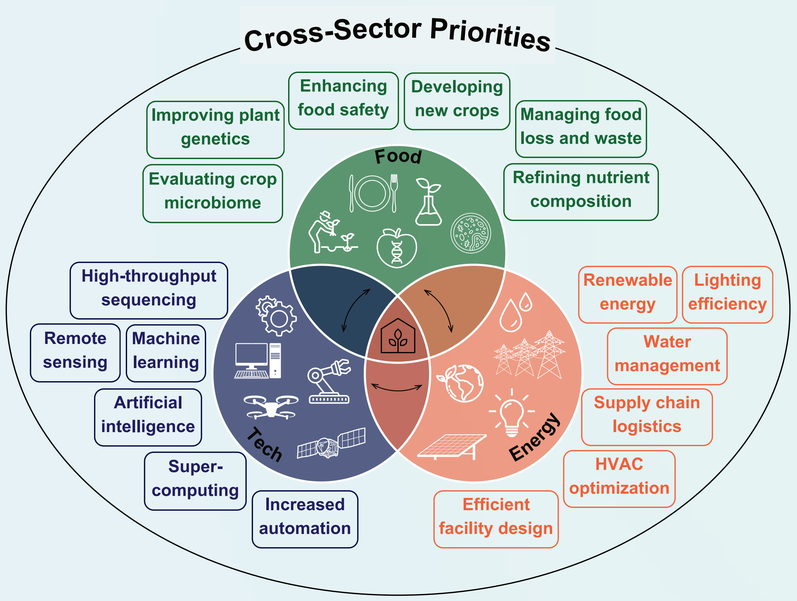
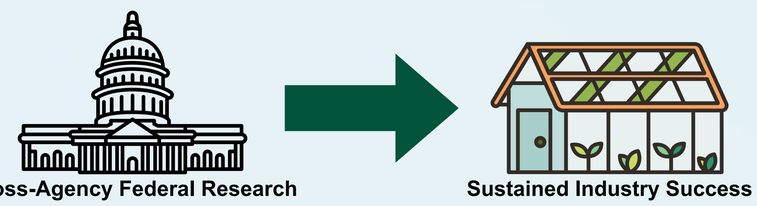


Figure 1. Illustration of food, technology, and energy sectors and examples of corresponding disciplines and research priorities. Controlled environment agriculture (CEA) is uniquely positioned at the nexus of these sectors.

CEA sits at the nexus of a number of industries and scientific disciplines (Fig. 1). **Research priorities extend beyond the scope of a single discipline or institution, making CEA an optimal case for cross-cutting, inter-agency collaborations**. Improving intra-government coordination will provide more comprehensive support to the CEA industry and expand federal research and programming to a wider range of stakeholders.



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SCAN ME
Resources

CEA and the U.S. Government

Several federal agencies have demonstrated interest and achievement in CEA, with early research performed by the U.S. Army in the 1970s. Since then, USDA, NASA, and DOE have been leaders in multi-agency CEA collaboration. Others, such as FDA, NIH, and EPA have relevant expertise that could be applied in the short-term (Fig. 2). **Agencies must coordinate more effectively across disciplines and locations to maximize impacts for the CEA industry and the American people.**

Expertise: horticulture, plant physiology, biology, nutrition, food science, animal science, pathogen and disease responses, food safety
Resources: ARS, ERS, NIFA, Climate Hubs, OUAIP, AgARDA

Expertise: Engineering, life sciences, innovation, tech transfer, remote sensing
Resources: NASA Technology Transfer Program, STEM Engagement programs and funding

Expertise: energy efficiency, renewable power, policy analysis, decarbonization, building and materials sciences, air quality, water reuse, optimization, control
Resources: EERE, CEA Accelerator, funding, ARPA-E, NAWI, National Laboratories

Expertise: food safety, nutrition, extension, policy
Resources: regulatory and safety information, notices of outbreaks, investigations, reports, FSMA

Expertise: biomedical science, nutrition, environmental health sciences, extension, outreach
Resources: grants and funding, health information, NIH Intramural Research Program, ARPA-H

Expertise: environmental science, extension, outreach, policy
Resources: regulatory information, Office of Agricultural and Rural Affairs (OARA), Agriculture Advisor's Office

Figure 2. Summary of CEA-related expertise, resources, and programming across the United States Government

Recommendations

I. Organize Personnel and Resources

Directory

Resource database

II. Leverage Existing Multi-Agency Convenings

Formal debriefs

Regular check-ins

III. Engage New Federal Collaborators

Climate change

International Development

Future Outlook

Implementation of the proposed recommendations may differ based on the research topic and desired outcomes. Based on current priorities for the CEA industry, an example of how agencies could organize research strategies is shown in Fig. 3.

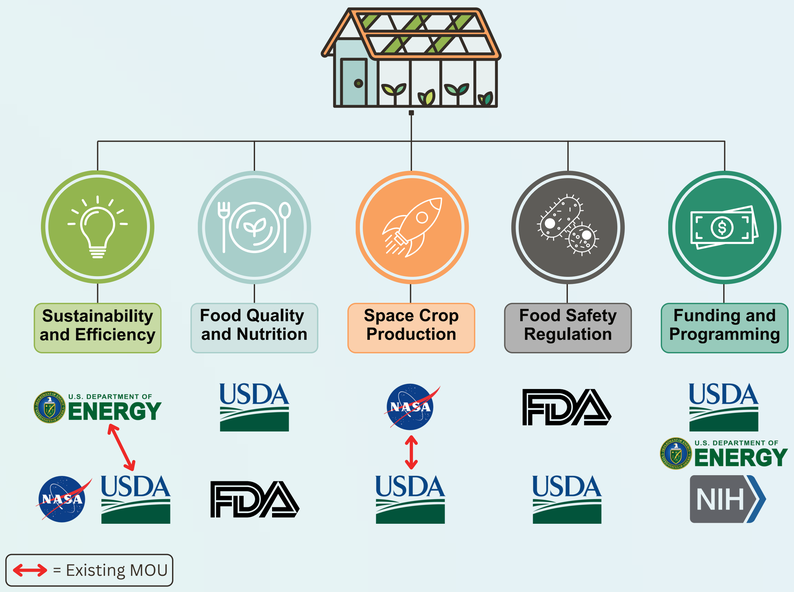

Figure 3. Illustration of current priorities in CEA research and development. This framework proposes that different federal agencies serve as lead researchers on certain priorities, while others serve in a secondary or supporting role. Red arrows indicate agencies that share existing MOUs to advance these and other priorities.

Robust and agile federal research collaborations for CEA will generate valuable technical support for all aspects of the industry. This will also make CEA research more adaptable to new challenges or shocks to the industry. Improved intra-government research networks will facilitate collaboration with other public, private, and non-profit partners. **Ultimately, a whole-of-society approach to CEA will lead to greater benefits for people and the planet**.

Conclusion

There is an urgent need for convergent approaches to today's societal challenges. CEA is a timely example of an industry in need of cross-cutting, transdisciplinary, multi-agency research support. The recommendations in this poster **build upon existing collaborations and identify new pathways to transform federal research approaches for CEA**. These recommendations are not limited to CEA; we encourage researchers working on complex and emerging technologies to adopt similar approaches. By strengthening cross-agency collaborations and public-private partnerships, the **U.S. will solidify itself as a global leader in science and innovation**, leading to opportunities for further collaboration.

Acknowledgements

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