AGRINOVUS
Velocity

BIOINNOVATION

PROBLEM STATEMENT

Develop technology focused on the use of novel microorganisms, biological transformations, and biomolecules that unlock powerful markets that are bio-based products, sustainable bio inputs, as well as biofuels and alternative energy which impact both the agriculture industry and the broader economy as a whole.

AGRINOVUS RESOURCES

Accelerate 2050: A Vision for Indiana Agbioscience identifies Indiana's economic performance across food, animal health, plant science, agtech and production agriculture and defines priority opportunities to position Indiana's agbioscience economy for differentiated growth amid future uncertainty. According to the study, Indiana's three key opportunities include: farmer-focused innovation, food is health and bioinnovation.

Download the full report here.

Bioinnovation

Bioinnovation creates the enabling infrastructure, financing, and partnerships needed to advance all scales of biotechnology product, platform and process development—from early-stage R&D to pilot-scale trials to commercial-scale operations. Importantly for Indiana, this opportunity leverages the agricultural sector as primary market for biotechnology products (i.e., bioinputs) and a supplier of the raw materials needed for the industrial biomanufacturing industry.

Indiana has the opportunity to become the premier destination for bioinnovators and biomanufacturers to research, commercialize, and scale biotechnology processes, platforms, and products.

Opportunity in Context

Biotechnology and AI are powerful platform technologies that hold wide possibilities for the agbioscience economy, especially in terms of accelerating the discovery and development of novel microorganisms, biological transformations, and biomolecules. This potential boon in early-stage innovations is converging with an unprecedented demand for bio-based products in the United States and globally. Governments increasingly look to alternative fuel options such as biofuel to enable transportation and energy sector transitions. Growing consumer demand for more sustainable and bio-based products ranges from packaging to cosmetics. In the agriculture sector, expanding use of regenerative agriculture practices opens opportunity for complementary bioinputs (e.g., biopesticides and biofertilizers) to reduce synthetic input use.

This convergence of accelerated scientific discovery and growing demand for bio-based products presents a sizable opportunity to more readily advance early-stage discoveries into commercial pipelines, but only if the requisite infrastructure, capital, and partnerships are in place to support this translation to commercially viable bioproducts. Current U.S. shortages of mid-scale bioreactors have forced some biomanufacturing companies to look internationally to scale their operations.[20,21]

Critical Components to Capture the Opportunity

- **Biological technology platforms** leveraging tools like AI, advanced omics, high-throughput screening, and gene editing
- **Optimized bioconversion processes (e.g., feedstocks, microorganism strains, bioreactors)** that can serve commercial interests at different scales and for different products
- **Strong linkages** between academic institutions and early-stage start-ups at the forefront of Bioinnovation and the industrial biomanufacturing sector to bring the innovations to commercial scale
- **Different scales of retrofitted or new biomanufacturing infrastructure** and modular, flexible equipment
- **Shared infrastructure and collaborative mechanisms to translate foundational assets** (e.g., data sets, computation tools) across the agbioscience ecosystem
- **Available capital to support mid-stage companies** operating at demonstration and first commercial scale
- **Formalized co-locations or circular systems** that valorize agricultural waste streams into high-value (e.g., specialty ingredients) or commodity outputs (e.g., chemical feedstocks)

Indiana Strengths to Build Upon

In addition to the strengths identified in the Current State section (pages 11–19), the following are opportunity-specific strengths from which Indiana is well-positioned to build:

- **Abundant feedstock.** Indiana is the fourth largest producer of soybeans and fifth largest producer of corn in the United States.[22] Corn and soybeans are important biomanufacturing feedstocks, providing companies a strong pull to the state.
- **Existing bioprocessing industry.** Major agriculture processors, such as Cargill, ADM, Bunge, and Primient, have invested in wet and dry mills and soybean processing facilities across the state. Available feedstocks and bioprocessing infrastructure can be leveraged for higher value-added products, such as biofuels, and bio-based replacements for other petroleum petroleum products.
- **Mix of established leaders and new entrants.** Indiana's agbioscience economy boasts global industry leaders like Corteva Agriscience, which develops bio-based crop protection products among other products, and new ventures like AgroRenew, a start-up that aims to repurpose watermelon, cantaloupe, and pumpkin waste into bioplastics.
- **Established and growing green energy production.** Indiana is home to ethanol companies, such as POET, Central Indiana Ethanol, and Verbio/South Bend Ethanol, which have corn-based ethanol plants across the state. Louis Dreyfus Company manufactures biodiesel in Claypool, Indiana.
- **Regional Technology and Innovation Tech Hub designation focused on U.S.-based bioproduction.** In 2023, the U.S. Economic Development Administration recognized Indiana as a region poised to ensure U.S. global competitiveness in domestic bioproduction. Led by Heartland BioWorks, the effort brings together partners such as Purdue University, IU, and BioCrossroads (a complementary CICP initiative) to grow Indiana's biotechnology manufacturing ecosystem.[23,7]
- **New investment in precision fermentation infrastructure.** Biomanufacturing start-up Liberation Labs broke ground on a precision fermentation facility in Richmond, Indiana, in 2023. The facility aims to "fill a pressing need among food companies for animal-alternative ingredients."[24]

"The opportunities ahead are bigger now than Indiana has seen in many many years."

—AgriNovus Board Member

What might success look like?

NanoSynth Solutions, established from the acquisition of a pharmaceutical company's R&D facility in Indianapolis in 2025, revolutionizes biomanufacturing with its rapid microbial evolution platform. The platform speeds up the microbial engineering process from months to minutes. NanoSynth can screen billions of genetic variations in the matter of minutes, unleashing the potential for near-instantaneous development of custom solutions for an unlimited number of possible food and agriculture applications. NanoSynth chose Indiana due to its rich agricultural resources that feed its fermentation platform and for Indiana's unapparelled biomanufacturing workforce that brings the complimentary skillsets needed to operate and maintain its platform, from strain optimization and engineering to fermentation process design and scale-up to downstream processing.

This is a hypothetical, fictional company.

Recommended Ecosystem Actions for Bioinnovation

From early-stage research and product development to scale-up to commercial operations, biotechnology is ripe with potential for innovation and scaled impact. Pathways to economic growth through the Bioinnovation economy could take several forms. RTI recommends that the next steps for the Bioinnovation opportunity involve identifying focus areas to drive targeted growth activities.

Clarify industry-specific needs and challenges related to the development and scaling of Bioinnovation solutions. Whereas the long-term potential of Bioinnovation is clear, the near-term needs and specific opportunities vary by industry segment (e.g., the needs and near-term opportunities for sustainable aviation fuels are different from precision fermentation for food ingredients). Specific actions include the following:

- **Segment the Bioinnovation ecosystem** into its component biotechnology processes and platforms, from early-stage to commercial, to further describe discrete subopportunities (e.g., traditional fermentation, precision fermentation, microbial strain engineering, bioproduct discovery and characterization).

- **Identify industry needs across the Bioinnovation segments.** Consider the full breadth of bioproduct industries, including pharmaceuticals, enzymes, ingredients, oils, fats, textiles, plastics/polymers, fuel, pigments, and other specialty chemicals to understand the latent or underserved technology or innovation needs that could be addressed.

Identify priority focus areas of Bioinnovation R&D where Indiana can leverage its existing university and corporate R&D assets to become the global leader in accelerating discovery and development. This step will include clarifying Indiana's unique advantage in commercialization and scaling industrial biomanufacturing vis-à-vis other Midwest states. Gather intelligence to compare Indiana's commercialization infrastructure, crops, land or water assets, and other advantages (energy, waste treatment, business incentives) with those of other Midwest states (Iowa, Illinois, Nebraska). Research the return on investment for building out biotechnology infrastructure to understand which investments will generate the highest impact.

Explore building additional biomanufacturing infrastructure. Europe is leading the world in fermentation capacity. The U.S. government is investing in expanding domestic biomanufacturing infrastructure. Conduct additional research to evaluate the economic development potential of building out biomanufacturing infrastructure.

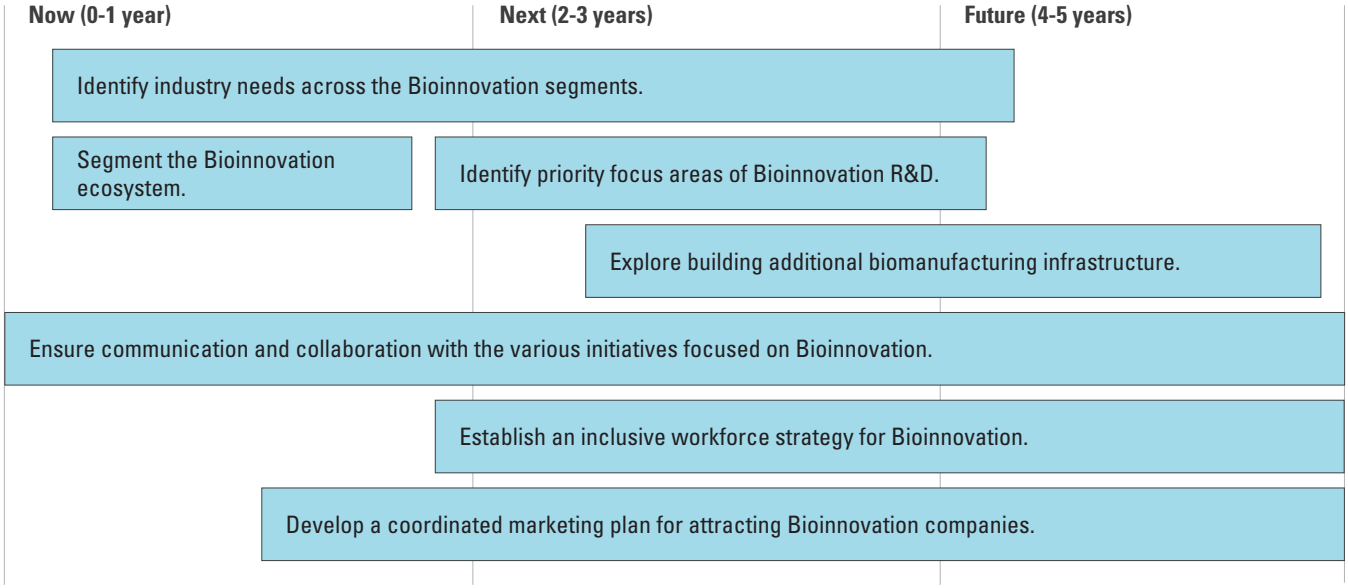
Ensure communication and collaboration with the various initiatives focused on Bioinnovation, including those in Indiana like Heartland BioWorks and BioCrossroads, and other regional or national groups like BioMADE. For example, BioLaunch, a strategic initiative of Heartland BioWorks, is targeting small and medium biotech innovators in the drug substances and drug products space, moving innovations from late-stage clinical development to manufacturing and distribution. Both the BioWorks consortium and the agbioscience biotechnology opportunity aim to accelerate the Bioinnovation lab-to-market pipeline by connecting stakeholders within advanced manufacturing and biotechnology.

Establish an inclusive workforce strategy for Bioinnovation. Today, industrial biomanufacturing lacks a trained workforce—one that blends high-science skills with advanced manufacturing and trade labor. Creating a workforce strategy can signal to prospective companies that Indiana is committed to building the skilled talent pipeline required to grow its footprint. Anchoring the strategy in the principles of inclusive workforce development can ensure that economic growth benefits both rural and urban communities and promotes diversity of talent within the biomanufacturing field.

Develop a coordinated marketing plan for attracting Bioinnovation companies. As place-based Bioinnovation hubs in Indiana like Heartland BioWorks and the LEAP Lebanon Innovation District mature, the ecosystem should create a coordinated plan to monitor the landscape of relevant start-ups, and build the pipeline of prospective companies. Example activities within this plan could include the following:

- Promote the existing industrial biotechnology industry in Indiana as anchor facilities to attract new companies.
- Expand relationships with Indiana bioprocessors who have relationships with emerging companies that are nearing commercial production.
- Monitor domestic commercialization pipeline of de-risked companies to identify and connect with prospects.
- Work with biomanufacturing Initiatives to identify funding sources.
- Assemble consortium partners that act as market uptake actors creating agreements with new companies.

Figure 16: Recommended Ecosystem Actions for Bioinnovation



INDUSTRY RESOURCES

BioMADE

- **Key Areas:** Accelerates the commercialization of modern biotechnology products and identifies domestic supplies of important materials by focusing on the pilot-scale Manufacturing Readiness Levels
    - Data and design
    - Scale-up
    - Downstream processing
    - Testing and evaluation
    - Resilient bioindustrial manufacturing ecosystem
    - Commercial readiness

  Source: BioMADE

- Mid-level pilot scale biological innovation that brings novel tech to our ecosystem/country – fermentation, genomics, synthetic biology, probiotic, etc

  Source: BioMADE

- Project Call 5.0

  Source: BioMADE

Download the full report here.

2. Project Call Overview and Focus Areas

BioMADE is pleased to issue Project Call 5 which includes the opportunity for NSF researchers to participate as part of an integrated project team. Proposers will choose whether they are applying for BioMADE funding or for joint BioMADE and NSF funding as an integrated proposal. This packet describes the purpose, process, and eligibility criteria for this funding opportunity.

Project Call 5.0 focus areas are topic-specific and focus on advancing bioindustrial manufacturing by developing underlying tools and technologies to support diverse applications.

The focus areas are:

- **Data Acquisition for AI/ML Predictive Modeling**
- **Reducing Drivers of Cost**
- **Standardization of TEA Guidelines**

Successful proposals will describe in detail how the project aligns with the focus area(s) and the BioMADE Technical Roadmap. Version 3.0 of the Technical Roadmap will be available when the white paper submission portal opens. Proposals must also fall within BioMRLs 4–7, described in Appendix E, with justification included that details the current BioMRL state and plan to advance BioMRL status for each bioproduct or process.

Integrated projects should include both NSF fundable basic research and BioMADE fundable MRL 4-7 research. Proposals should align with participating NSF programs and with the BioMADE project call focus areas. While BioMADE portions of the project must comply with relevant BioMADE membership and cost share requirements, the NSF funded portion of the project, designated as the MRL 1-3 level work, has no requirements for cost share or BioMADE membership. PIs are encouraged to reach out to a BioMADE Program Manager to discuss project viability and alignment to the Project Call. It is strongly recommended that PIs contact the director of the targeted NSF program prior to submission to determine relevance.

Details on the project call focus areas and instructions on how to submit a proposal can be found in Guidelines for Successful Proposals.