2021 New Hampshire University Research and Industry Plan

Executive Summary

The 2021 New Hampshire University Research and Industry Plan was commissioned by NH EPSCoR and guided by the NH Research and Industry Council, which serves as the jurisdictional EPSCoR steering committee.

This plan was formally adopted by the NH Research and Industry Council on September 24, 2021.

It was developed by Keen Point Consulting (KPC), LLC, a technology-based economic development consulting firm located near Cleveland, OH, and its partner, Research Triangle Incorporated (RTI), a non-profit research and consulting firm headquartered in Research Triangle Park, NC.

Support was provided by the UNH Office of Research, Economic Engagement, and Outreach, Dartmouth College, and the University System of New Hampshire. Cover design by Aachal Ghimire, UNH class of 2022. Graphic design by JBrackett Creative LLC.

Letter from NH EPSCoR

Colleges and universities play a key role in transforming new ideas into economic activity directly through local workforce education and production of intellectual property, and indirectly through basic research activities. Although research expenditures often directly support the local economy, commercialization often lags discovery and innovation. Nevertheless, over time through partnerships and strategic investments they provide the foundation to develop innovative products and services that drive economic development.

Many areas in the nation, including New Hampshire, struggle to compete with neighboring high-growth regions because they lack investments in asset resources and capacity-building support. New Hampshire has a solid base of research and talent but it has several gaps, including the lack of venture capital investments and diversification.

The 2021 New Hampshire University Research and Industry Plan (NHURIP) provides a data-driven analysis of research and innovation assets and gaps to guide investment decisions that will strengthen the state's innovation capability. The plan identifies key industry platforms and targeted research areas aligned with those industry strengths for potential collaborative opportunities and sets forth goals and strategies to meet those goals.

The 2021 NHURIP was commissioned and guided by the New Hampshire EPSCoR program. The Established Program to Stimulate Competitive Research (EPSCoR) provides federal funding to develop research infrastructure in smaller or rural states like New Hampshire to support research-based economic development. NH EPSCoR investments have built world-class research facilities, educated hundreds of highly skilled undergraduate and graduate students now in the workforce, and trained teachers in K-12 STEM education.

The plan was formally adopted by the NH Research and Industry Council on September 24, 2021. The NH Research and Industry Council is composed of leaders from the state's business and industry sectors, legislative and executive branches of state government, the public sector, and higher education and provides oversight to NH EPSCoR.

On behalf of the NH EPSCoR program and the NH Research and Industry Council, we present this plan as evidence of our commitment to advance our state's competitiveness in science and engineering and foster partnerships with technology-based businesses that enhance job creation and economic development.

Marian McCord, Ph.D.
State Director, NH EPSCoR

Sr. Vice Provost for Research, Economic Engagement, and Outreach, University of New Hampshire

Kevin Carroll
Chair, NH Research and Industry Council

Patent Attorney at Grossman, Tucker, Perreault & Pfleger, PLLC

Executive Summary

America's economy relies on innovation sectors, which leverage university research and innovation to create and advance high-tech industries through human capital development, translation of intellectual property, and development of infrastructure (including as specialized equipment and facilities). However, innovation sectors have historically been concentrated in the nation's dynamic "superstar" metropolitan areas, such as Boston, San Francisco-San Jose, and Seattle. In order to maintain our nation's lead in science and technology, more regions will need to make investments to build their asset resources (including research, talent, and infrastructure), and support provider organizations, which drive innovation growth and cluster development.

New Hampshire is often overlooked from an innovation standpoint. While its overall university research funding is less in comparison to many other states and it lacks a "superstar" metropolitan area, NH does have a solid base of research, intellectual property, and talent to drive high-technology industry development.

However, New Hampshire still needs to fill several gaps including the lack of venture capital investments and diversifying its base of SBIR/STTR awardees to further strengthen the state's innovation capability.

New Hampshire has a solid foundationas an innovation-intensive state

- 46% higher level of university research than the nation adjusted for size of economy
- Ranked 7th in the nation for Patents Awarded per 1,000 Individuals in Science and Engineering (S&E) Occupations in FY19 (30 for NH vs. 23 for the US)
- One of the top five states for R&D expenditure growth (academic, industry, government) from FY2000-2016
- 12% higher share of high-tech industry employment than the nation

But gaps still need to be filled within its innovation ecosystem

- Lagging venture capital investment relative to the size of its economy: $1.14M for NH vs $6.0M for nation in FY18
- Exaggerated national ranking (ranked 19th) in SBIR/STTR awards – 50% of these SBIR/STTR awards have gone to one company

The New Hampshire University Research and Industry Plan (NHURIP) is the state's Science and Technology Plan. It provides a roadmap to guide innovation and investment in critical research areas where NH has the capacity to grow. A rigorous quantitative and qualitative data analysis was guided by three areas of inquiry:

1. How have New Hampshire's three target industry platforms performed over the past 5 years?
2. What are existing and emerging research strengths on which New Hampshire should build? Which criteria should New Hampshire use to select these?
3. How can New Hampshire leverage its existing strengths, maximize federal investment opportunities, and address gaps to increase its competitiveness in these research areas?

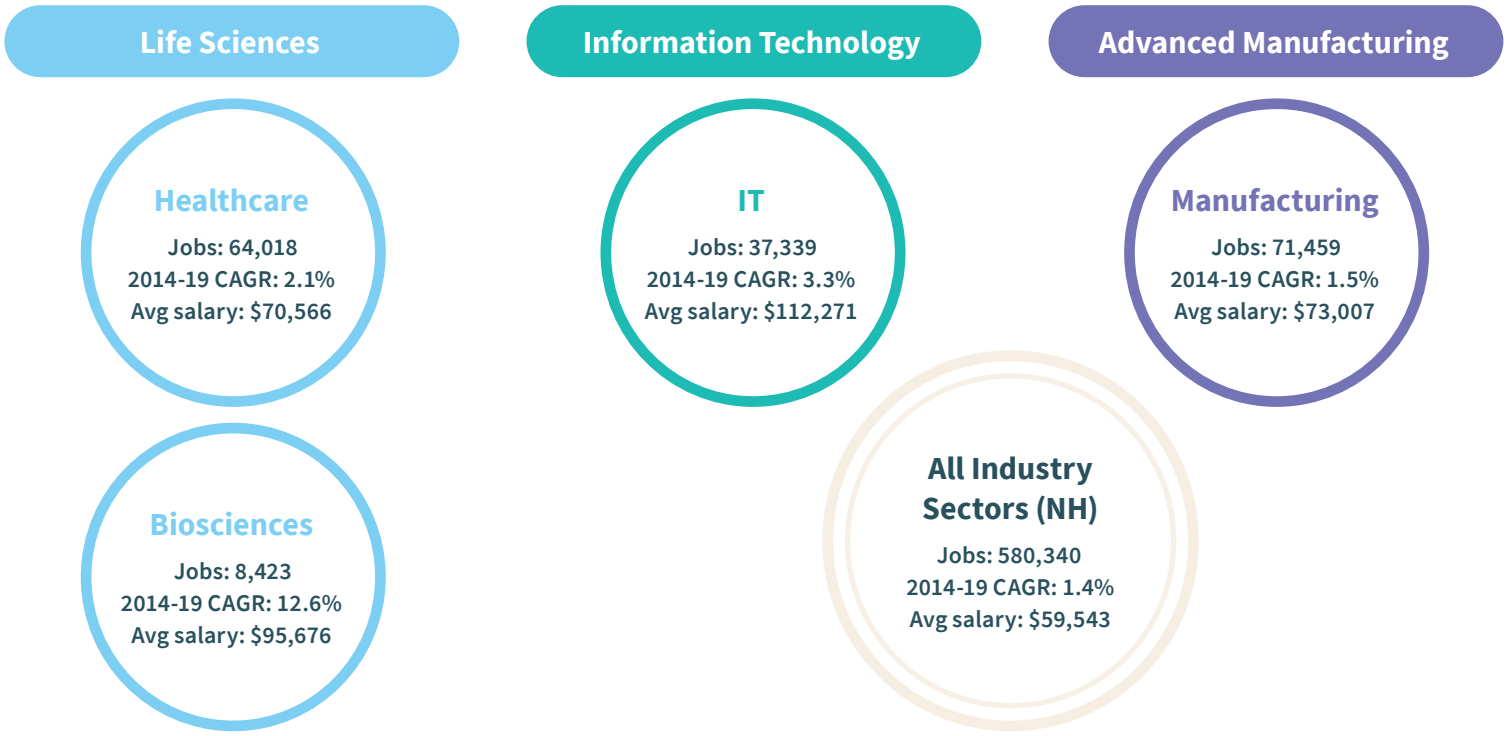
The NHURIP was initiated by the New Hampshire Established Program to Stimulate Competitive Research (NH EPSCoR) program. The New Hampshire Research and Industry Council (RIC) which includes leaders from NH's academic, industry state government and non-profit sectors provided oversight and guidance. The plan was developed by Keen Point Consulting (KPC), LLC, a technology-based economic development consulting firm located near Cleveland, OH, and its partner, Research Triangle Incorporated (RTI), a non-profit research and consulting firm headquartered in Research Triangle Park, NC.

NH Industry Platforms

An assessment of industry employment, job growth, average annual salary, and innovation data from 2014-2019 showed that Life Sciences, Information Technology, and Advanced Manufacturing remain[1] as the leading drivers of economic growth in NH (Figure ES-1), with compound annual growth rates (CAGR) and average salary higher than the state values.

These three industry platforms also align with three of New Hampshire Division of Economic Development's target industry sectors in its Economic Recovery and Expansion Strategy (ERES) Plan, which is the state's framework for long-term economic growth and success.

Figure ES-1: NH Industry Platforms



1 TEConomy Partners and Keen Point Consulting, "New Hampshire University Research and Industry Plan: A Roadmap for Collaboration and Innovation" (2016). New Hampshire EPSCoR. https://www.nhepscor.org/nh-university-research-industry-plan

New Hampshire Targeted Research Areas

Targeted research areas were identified through an analysis of university and industry research and development (R&D) activity, patenting activity, start-up, and venture capital activity from 2011-2019 and university and industry stakeholder interviews.

Nine targeted research areas (Figure ES-2) were selected based on meeting two or more of the following criteria:

- Growing research/education activities (e.g., major centers, star faculty, etc.)
- Alignment with New Hampshire's target industries and workforce needs
- High-priority areas for federal research investment

Additionally, these research areas were mapped to the three targeted platform areas as shown in Figure ES-2 below based on alignment of assets or potential collaborative opportunities.

The following key factors were analyzed to determine the research opportunities and resources needed for NH to be competitive in each of the nine targeted areas:

- Strengths to build on from a university and industry standpoint
- Weaknesses or gaps that may hinder New Hampshire's progress in this area
- Research opportunities for potential growth and advancement
- Competition with other states in terms of research/infrastructure
- Assets like research capacity, major centers, and industry leaders
- Research funding outlook

Next, the previous analysis was used to perform a relative assessment of major assets and potential funding for each of nine research areas for New Hampshire (Figure ES-3) to help prioritize and gauge which resources are currently available and those that may need to be developed in the future.

Figure ES-2: NH's Targeted Research Areas and Platforms

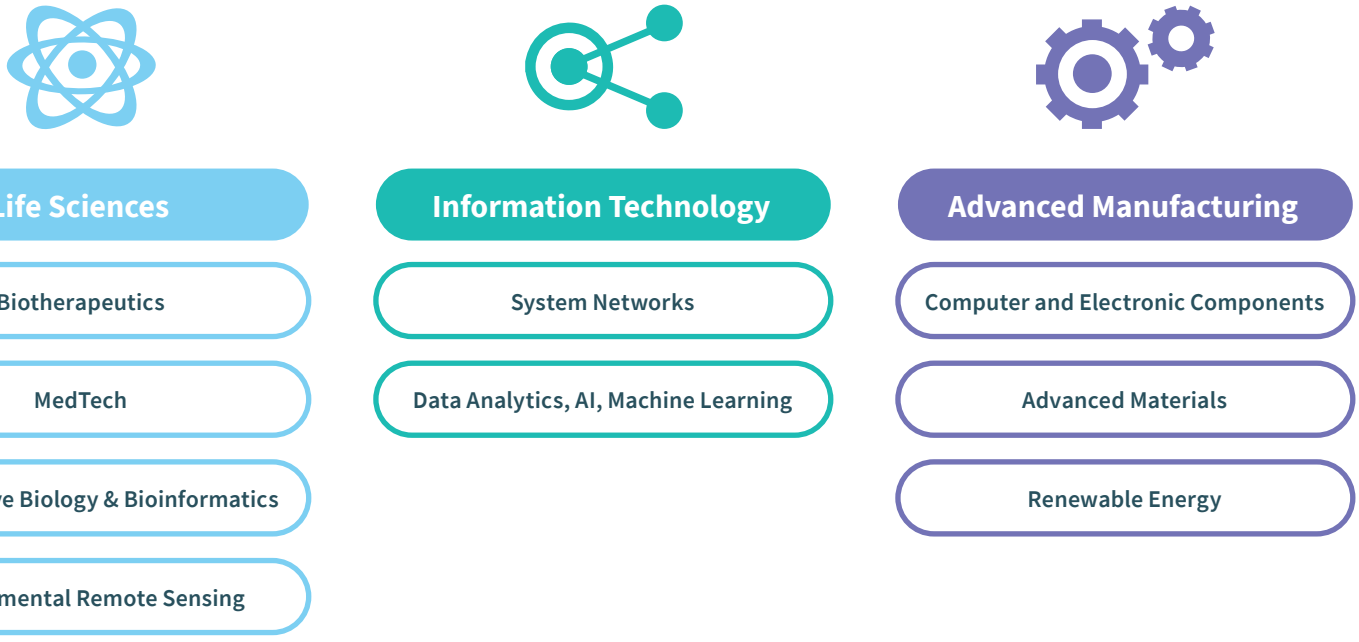


Table 2: Relative Assessment of Assets for New Hampshire Research Areas

RESEARCH AREA	CATEGORY: Early Career Faculty	Major Facilities/ Specialized Equipment	Industry Presence	4 NSF FY22 Funding Outlook
	○ No Early Career Faculty ◔ Minimal: 1-2 Faculty ◑ Emerging: 3-4 Faculty ● Established: 5+ Faculty	○ No Major Facilities/ Spec. Equip. ◔ Minimal: 1-2 Facilities/Equip. ◑ Emerging: 3-4 Facilities ● Established: 5+ Facilities	○ No Presence ◔ Minimal: No growing employment and/or few notable employers ◑ Emerging: Growing employment and/or some notable employers ● Established: High employment and/or multiple notable employers	○ No NSF Funding ◔ Minimal: <$350 M ◑ Emerging: $351-$700 M ● Established: $700 M+
Biotherapeutics	◔	◑	◑	◔
MedTech	◑	●	◑	◔
QuantitativeLife Sciences & Bioinformatics	◔	●	◔	◑
Environmental Remote Sensing	◔	●	◔	●
System Networks	◔	●	◑	◔
Data Analytics, AI & Machine Learning	●	◔	◑	●
Advanced Materials	◑	◑	●	◑
Computer and Electronic Components	◔	◑	●	◔
Renewable Energy	◔	◑	◔	◑

Goals, Strategies, and Metrics for the NHURIP

The 2021 New Hampshire University Research and Industry Plan goals focus on the important role of university research and development in growing NH's innovation economy. They are informed by and align with New Hampshire's target industry sectors and economic development strategy.

By 2026:

- Expand R&D activities and expenditures in target research areas by 10%
- Grow New Hampshire's skilled workforce-ready population with a focus on underrepresented groups in STEM by 5%
- Increase Infrastructure and capacity needed to expand R&D in targeted research areas by 10%

New Hampshire's government, industry, higher education institutions, and non-profits all play a role in advancing these state-level goals. However, the proposed strategies included in Table ES-1 are focused on actions within the purview of the state's higher education institutions and NH EPSCOR. Target percentages will be measured using the indicator metrics included for each goal.

Table ES-1: Proposed Strategies

GOAL 1

Increase R&D activities (projects, publications) and expenditures in target research areas by 10% by 2026

Strategies

- Pursue large grant opportunities
- Prioritize faculty hires
- Increase industry-sponsored research and licensing
- Create collaborative partnerships with stakeholders (primarily undergraduate institutions, state agencies, industry, non-profits)
- Create comprehensive portal of SBIR/STTR proposal technical support across NH
- Fill gaps in SBIR/STTR proposal development funding support (Phase 0 funds, Phase 1 and 2 match)
- Advocate for state supported fund to contribute required match support for large federal grants

Indicator Metrics

- State R&D expenditures
- Growth in faculty/researcher community
- Success of early-career researchers
- Industry sponsored research
- Funded projects
- New or expanded infrastructure
- Increase in SBIR/STTR proposals and projects
- Publications
- New or expanded partnerships
- State support to leverage federal research funding

GOAL 2

Increase NH's skilled workforce-ready population with a focus on underrepresented groups in STEM by 5% growth by 2026

Strategies

- Increase internships and applied research experiences, especially for underrepresented students
- Expand universal articulation agreements between USNH institutions and the community colleges focused on STEM disciplines
- Increase awareness and use of existing Universal Pathways (universal articulations/course equivalencies) with critical stakeholders (faculty, staff, parents, teachers, guidance counselors and students)
- Increase transfer student population through recruitment onboarding, ongoing support, tracking metrics, and scholarships
- Strengthen partnerships between NH's higher education institutions and industry to align workforce development efforts
- Leverage partnerships between NH's higher education institutions and industry to co-develop curriculum and programs that address STEM workforce needs
- Increase awareness and access to professional degrees, certifications, and badges that align with STEM workforce skillset needs

Indicator Metrics

- Two-year and four-year STEM degrees conferred
- MS/PhD degrees conferred
- Research experiences and internships
- Companies participating in internship programs
- Demographics of students in STEM programs, internships, and research experiences
- Number of transfer students in STEM programs at four-year institutions
- Success of transfer students in STEM programs
- Curricula, badges, certificates, degree programs aligned with workforce/skillset needs
- New or strengthened partnerships between higher education institutions and industry focused on alignment of workforce development efforts

GOAL 3

Increase infrastructure and capacity needed to expand R&D in targeted research areas by 10% by 2026. For the purposes of this plan, infrastructure includes the talent, centers, projects, physical spaces, partnerships, equipment, and instrumentation needed to grow R&D in the targeted areas

Strategies

- Increase grant funding for the purchase of new equipment and instrumentation
- Expand usage of equipment and instrumentation across the state and region
- Provide seed funding and other supports to build multi-stakeholder (faculty, industry, state agencies, non-profits) collaborative project teams
- Prioritize the development of physical spaces and centers focused on targeted research areas
- Prioritize cluster hires
- Partner with industry and state government to leverage support for infrastructure

Indicator Metrics

- Equipment and instrumentation supported by state and federally funded grants aligned to R&D and workforce goals
- Shared use of core facilities
- New or strengthened partnerships between academic institutions, industry, state government that support growth in targeted research areas
- Number of:
  - Publications
  - Proposals submitted
  - Funded projects
  - Equipment and instrumentation acquired or included in proposals and funded projects
  - Centers developed or under development
  - Physical spaces allocated or created
  - Faculty hires completed or included in funded projects
  - Collaborative teams developed
  - State or federal support for new or expanded infrastructure