
New Jersey Biotechnology Task Force

Final Report & Recommendations

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Executive Summary

The New Jersey Biotechnology Task Force, appointed according to P.L. 2016, Joint Resolution No. 5, is pleased to submit a final report of its activities, findings, conclusions, and recommendations for legislation or administrative action to retain and attract new biotechnology companies to New Jersey. The Task Force was created because of the pivotal role this industry plays in the state in terms of economic activity, jobs, and tax revenues.

Since the first meeting in December 2017, the Task Force met with and accepted testimony from representatives in the life sciences industry and in New Jersey's academic institutions. The compelling testimony focused on existing efforts related to industry collaboration and technology transfer (as well as gaps and challenges); government and private resources; and strategic partnerships that have been leveraged to support continued growth of the life sciences industry in New Jersey. This testimony provided a framework for the recommendations contained in this report.

It is important to note that many of those who presented to the Task Force gave evidence of the strength of the industry in New Jersey. Since many of these strengths have been well-documented in prior research and evaluation reports, the Task Force chose to focus its recommendations on improvements that are needed in five key areas that are especially important in moving New Jersey forward. These five areas and the related recommendations summarized below represent key priorities for action and investment in New Jersey's life sciences ecosystem:

- **Translational Research Culture**

- Restore the Commission on Science and Technology
- Provide Support to Better Compete for Small Business Innovation Research (SBIR) and Small Business Technology Transfer Program (STTR) Funding
- Establish a Tax Credit for Private Investment into University Technology Advancement Funds and State Match of Investments from Technology Advancement Funds into Intellectual Property

- **Entrepreneurial Culture and Capital**

- Increase Availability of Technical Assistance by Scaling Existing Programs across New Jersey Incubator/Accelerator Network
- Support Executive Spin-Outs
- Increase and Enhance the Technology Business Tax Certificate Transfer Program (NOL)
- Incentivize Investment into New Jersey Venture Funds
- Enhance the Angel Investor Tax Credit Program
- Increase Funding for Edison Innovation Fund and NJ CoVest Fund

- **Workforce**

- Support the I-Corps Model and Specialized Training and Mentoring to Help Bring Discovery to Marketplace

- **Workforce (continued)**

- Create New Jersey Talent Retention Internships Program
- Restore the Technology Fellowship Program
- Provide State Match of Non-Profit Research Grant Funding

- **Infrastructure**

- Support Biomanufacturing & Biobanks
- Create an Inventory of Multi-Tenant Operators and Increase State Support for Innovation Districts
- Establish a New Jersey “Orphan Drug” Tax Credit
- Enhance the Research & Development Tax Credit
- Adopt a State-level Section 1202 Incentive
- Develop a Capital Gains Incentive Program

- **Ecosystem**

- Coordinate Marketing Efforts Surrounding Existing Resources and New Jersey Brand
- Create and Support New Jersey Centers for Excellence
- Create a State-Supported Forum to Bring Physicians Together to Share Information about New Jersey-Based Clinical Trial Activity
- Create a Catalyst for New Jersey’s Life Sciences Innovation Ecosystem

By leveraging our strengths and addressing these recommendations, we believe that New Jersey can achieve its goal of revitalization and enhancement of the life sciences industry through strengthening of the state’s innovation capacity. It is an opportune time to take these important steps. Governor Phil Murphy’s commitment to growing New Jersey’s innovation ecosystem is noteworthy, and many of the recommendations contained within this report have already been put forward as legislation that is now moving through the Legislature. We believe that a deep understanding of the importance of the life sciences industry to New Jersey already exists.

In conclusion, we would like to thank all those who testified and provided input to the Task Force. We would like to offer special acknowledgement for extraordinary support:

- Dr. Susan Windham-Bannister, President and CEO, Biomedical Growth Strategies LLC.
- The staff of New Jersey Economic Development Authority
- Office of Legislative Services
- The staff of BioNJ

Introduction

Transformations in the global economy, the constant evolution of technology, and fast pace of competition have combined to increase the necessity and urgency that New Jersey invest in strengthening its innovation capacity – “the ability to produce and commercialize a flow of innovative technology, products and services over the long term.” States with high innovation capacity encourage entrepreneurship, support the growth of startup companies, attract new companies, compete successfully for investment capital, and grow their state’s economies. By building its innovation capacity, New Jersey has an opportunity to become a leading innovation hub -- igniting growth in the biopharmaceutical and medical device sectors, as well as developing the potential for growth in other innovation sectors.

New Jersey is respected globally for its strength in the biopharmaceutical and medical device industry sectors. The state is home to 13 of the world’s 20 largest pharmaceutical companies. These companies play a vital role in the state’s economy and their critical mass is an asset that can be highly leveraged in promoting innovation.

There is no “magic bullet” for becoming an innovation hub. Building innovation capacity requires a portfolio of activities and investments, including: accelerating the translation and application of academic research, encouraging a “culture of entrepreneurship” and the formation of new companies, providing access to investment capital for startup companies, investing in education and workforce development, enacting supportive policies and legislation, funding infrastructure (which includes an effective transportation system), and coalescing all key stakeholders into a mutually-reinforcing community (an ecosystem). To become a leading life sciences innovation hub, New Jersey needs a strategy for welcoming and enabling startup activity in biopharma as well as other sectors of the life sciences (medical technology, medical devices, bioinformatics, and medical diagnostics).

Timeline and Actions of New Jersey Biotechnology Task Force

In March 2016, the New Jersey Biotechnology Task Force was established pursuant to [P.L. 2016, Joint Resolution No. 5](#). The resolution created a nine-member Task Force that was charged with communicating with members of the biopharma industry and the academic community in order to identify opportunities to strengthen industry sectors. The mission of the Task Force is to develop policy recommendations that inform the state’s life sciences innovation strategy and propose action steps that will strengthen New Jersey’s life sciences sector. These findings and recommendations are detailed in this report, which will be presented to the Governor and the Legislature, that will strengthen New Jersey’s innovation capacity.

The Task Force was comprised of six legislative members, including Senator Linda Greenstein (Legislative District 14), former Senator Robert Gordon (Legislative District 38), Senator Robert Singer (Legislative District 30), Assemblyman Andrew Zwicker (Legislative District 16), Assemblyman Jack Ciattarelli (District 16), and Assemblyman Gary Schaer (Legislative District 36); two public members appointed by the Governor, Debbie Hart, President and CEO of BioNJ, and Daniel O’Connor, Chief Executive Officer of OncoSec Medical Incorporated; and Timothy Lizura, President and Chief Operating Officer of the New Jersey Economic Development Authority (EDA), serving in an ex-officio capacity. Assemblyman Christopher DePhillips (Legislative District 40) was named to the Task Force to replace Assemblyman Ciattarelli, whose term had expired. At its inaugural December 2017 meeting, the Task Force elected Debbie Hart as Chair and Assemblyman Zwicker as Vice Chair. The EDA served as staff to the Task Force.

About this Report

This report presents the recommendations for high priority, short- and long-term action steps and investments that Task Force members believe will be most impactful in laying the foundation for a New Jersey innovation-driven growth strategy. The report is intended to inform deliberations by the New Jersey Legislature and considerations of the Governor, and support policy formulation and investments that will boost our strength in biotechnology, as well as other life sciences sectors. In preparing our recommendations, we continually asked ourselves where New Jersey should focus its activities and investments to improve baseline innovation capacity. The recommendations in this report reflect those priorities.

Our recommendations are based upon in-depth and wide-reaching testimony collected during three public hearings, as well as submitted written testimony. Further research was conducted by Task Force members and EDA staff to identify opportunities to strengthen the state's life sciences innovation ecosystem and to make specific recommendations for legislative and State support to maximize its role in the state's economy. Many of the strengths that were identified by our work have already been well-documented in prior research and evaluation reports. These strengths are briefly summarized in this report because they make a clear case that New Jersey can take a strong leadership role in life science innovation.

But it is imperative that we take steps to achieve this possibility by addressing the important gaps that are hindering innovation in New Jersey despite our strengths. The Task Force has therefore chosen to focus our recommendations on improvements in five areas that are especially important to our goal of becoming a leading life sciences innovation hub:



The Task Force hopes that this report will contribute to New Jersey's success in making the best and most efficient use of public resources, enhancing the state's leadership in life sciences innovation, generating jobs for New Jersey residents, attracting investment capital, producing additional tax revenue, and driving economic development.

Appendix A contains a Glossary of the Terms used in this report.

Input to this Report

Pursuant to the resolution, the Task Force conducted public hearings on January 25-26, 2018 at the Commercialization Center for Innovative Technologies (CCIT) in North Brunswick, New Jersey and at the EDA offices in Trenton, New Jersey on April 3, 2018.

During the first day of hearings, the Task Force took testimony from invited guests and asked about commercialization opportunities at the state's academic institutions and collaborations between academia and industry. On the second day of hearings, representatives of New Jersey's biotechnology industry provided testimony and took questions from Task Force members about the enablers and challenges to growing their companies in New Jersey and opportunities for strategic partnerships.

Some of the key themes and findings that emerged from the two days' testimony included:

- New Jersey has an opportunity to better market its strengths as an innovative state with a highly-educated workforce.
- The biotech/biopharma industry remains a vibrant sector in the state's economy, but employment, investment, and growth have declined in recent years relative to peer states.
- New Jersey lags its competitor states in several key areas, including funding for early-stage companies and non-monetary support, such as technical and professional business assistance for academic spin-offs.
- Strengthening the biotechnology/pharmaceutical industry sectors and attracting new startups and spin-outs needs to be part of a comprehensive economic strategy that includes workforce development, and ways to attract millennials to locate and stay in the state.

A number of reports published in recent months were referenced during the hearings and were used as resources to shape the findings and recommendations presented later in this report. These reports include: [The New Jersey Biopharma Industry: A Prescription for Growth](#) (BioNJ, January 2018); [Reseeding the Garden State's Economic Growth: A Vision for New Jersey](#) (McKinsey, July 2017); [Research in Your Backyard: Developing Cures, Creating Jobs](#) (PhRMA, June 2017).

On April 3, 2018, Dr. Susan Windham-Bannister gave a presentation to the Task Force entitled "Accelerating Life Sciences Innovation: A Public-Private Partnership." Dr. Windham-Bannister, President and CEO of Biomedical Growth Strategies LLC, was the founding CEO of the Massachusetts Life Sciences Center (MLSC), an independent investment organization charged with administering the \$1 billion Life Sciences fund signed into law by the Massachusetts legislature in June 2008. The MLSC, a quasi-public authority governed by a Board of Directors, is the hub for all sectors of the Commonwealth of Massachusetts' life sciences community – biotechnology, pharmaceuticals, medical devices, medical diagnostics and bioinformatics. During her seven-year tenure at the MLSC, Dr. Windham-Bannister was responsible for the overall implementation of the initiative, including formulating the investment strategy for the fund. Under Dr. Windham-Bannister's leadership, the MLSC invested nearly \$700 million of the fund, leveraged another \$2+ billion in matching investment capital and made life sciences the fastest job-producing sectors of the Massachusetts economy.

Dr. Windham-Bannister presented data on how Massachusetts' \$750 million investment leveraged another \$2 billion in funds from other sources. Capital projects accounted for slightly more than half the State's investment, and tax incentives accounted for another 25 percent. At least \$43 million was invested in educational programs, internships, and K-12 STEM initiatives. She emphasized several themes, including:

- An innovation economy can be the outcome of focused, strategic investments.
- A rich pipeline of early-stage companies attracts large companies that anchor the ecosystem.
- Academic institutions and faculty benefit from actively participating in translational research, entrepreneurship and industry partnerships.
- Career opportunities are created for workers with a variety of skills and educational levels, including mid-skilled workers.
- Relying on the “wisdom of experts” to identify the relative best use of resources creates shared ownership and promotes a strong return on the investment of public dollars.
- Innovation-driven economic development is a viable goal for policymakers.

Transcripts for these hearings, including written testimony submitted by witnesses, are available on the [EDA's website](#).

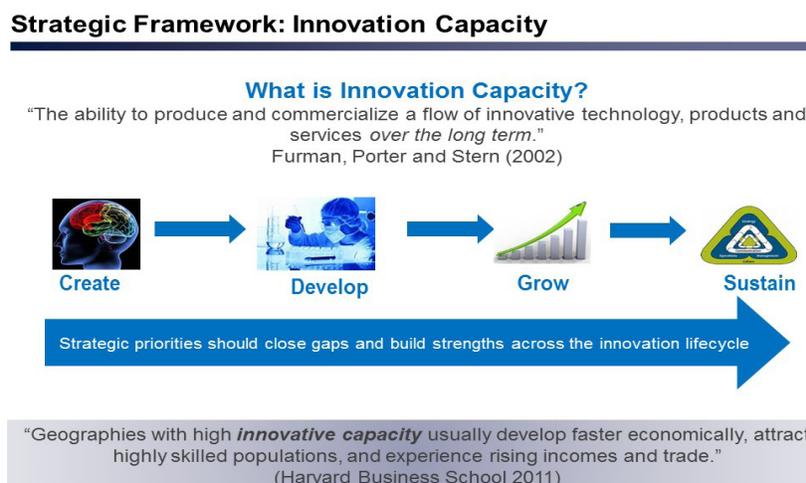
Strategic Framework: Innovation Capacity

Innovation is a process and has a lifecycle that includes “discovery” (or creation), development, growth, and finally, maturity and sustainability. If there are major gaps in the supporting platform that enables innovation to move across its lifecycle, then the process stalls, moves to a geography where it can find the enablers that it needs to progress or, worst of all, may never start at all. By addressing the issues that are most severely hampering our innovation capacity, New Jersey can become a state where a high volume of new companies start, grow and thrive, and where mature companies that rely on innovation want to have a significant presence.

As noted earlier in this report, there is no “magic bullet” for accomplishing this. Building innovation capacity requires a portfolio of activities and investments that are coordinated by a strategic framework. A flurry of uncoordinated, siloed activities and “rifle shots” is rarely effective in delivering impact. Even worse, this approach runs the risk of wasting significant investments of public and private dollars.

With this in mind, an Innovation Capacity framework, shown in the figure below, provides a strategic framework to set priorities and rationalize our decisions about the recommendations to include in this report.

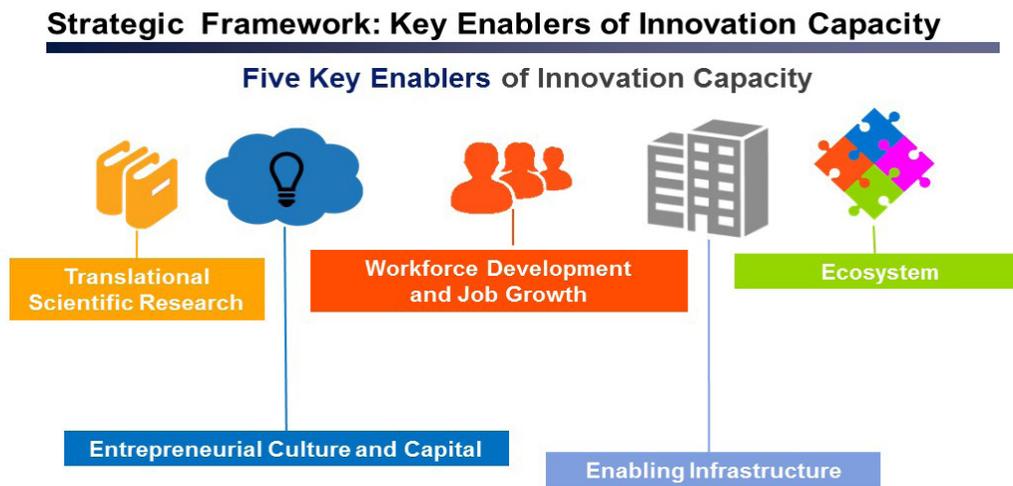
FIGURE 1 - INNOVATION CAPACITY FRAMEWORK



Proprietary to Biomedical Growth Strategies

Economists who study innovation capacity have shown that there are five key “enablers” of innovation:

FIGURE 2 - THE FIVE ENABLERS OF INNOVATION CAPACITY



The “enablers” of innovation capacity are interactive – each enabler affects the performance of others along the innovation lifecycle.

Proprietary to Biomedical Growth Strategies

The key enablers provide a framework that helps to understand which gaps and strengths make the greatest impact on innovation capacity and should therefore be the focal points for action and investment. In the context of the Task Force’s mission, the key enablers are useful in:

- **Synthesizing the findings from testimony and prior evaluation reports regarding New Jersey’s strengths and weaknesses** – Many strengths and gaps may be identified, but it is important to focus on gaps in the five key enablers of innovation that are most frequently reported. These gaps/strengths play an especially significant role in deterring the State’s ability to bolster its innovation capacity.
- **Determining where investments should be targeted for maximum impact** -- Legislation, funding or administrative action by the Governor, the Legislature and other key stakeholders should focus on the key enablers. What should be strengthened? Where should resources and investments be enhanced?
- **Setting priorities and staying focused** -- What actions and investments should form the basis of the State’s strategy to become a leader in biopharma innovation and job creation?
- **Increasing the potential leverage on activities and investments** – What activities and investments will respond broadly to the needs of multiple life sciences stakeholders, but will be sufficiently targeted to “make a difference?”

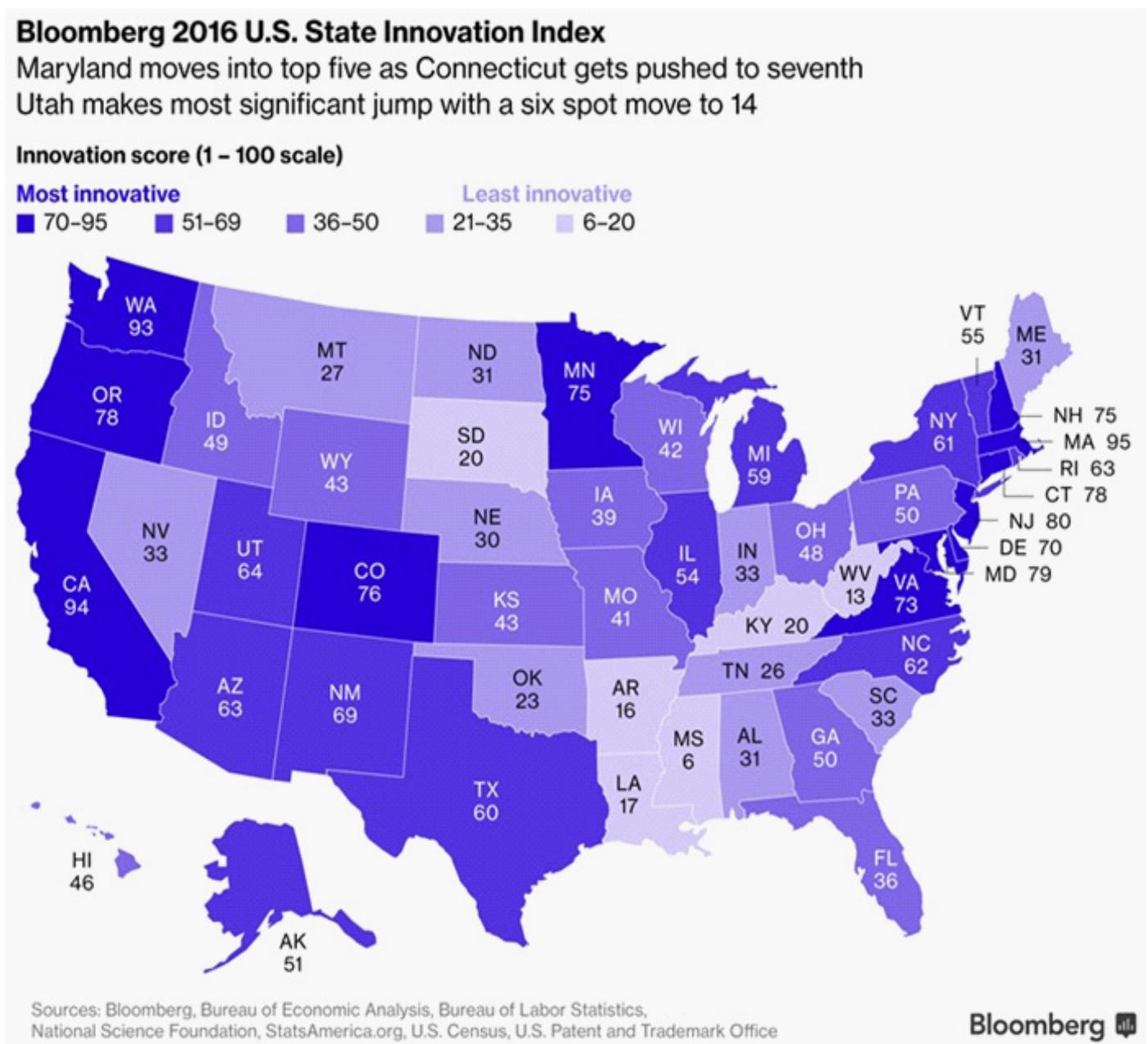
Appendix B contains further details on the key enablers and their importance in strengthening Innovation Capacity.

A Strong Base for Life Sciences Innovation: New Jersey's Existing Resources

For over a century, New Jersey has been considered the “Medicine Chest of the World,” owing to its robust health care and pharmaceutical industry, which began with the founding of Johnson & Johnson in New Brunswick in the 1880s. The state currently has more than 3,280 life sciences establishments that employ more than 117,000 people. Thirteen of these companies rank among the world’s top 20 biopharmaceutical companies (based on sales).

New Jersey also ranks high among U.S. states on the Bloomberg Innovation Index, which scores each of the 50 states on a 0-100 scale across six equally weighted metrics: R&D intensity; productivity; high-tech density; concentration of science, technology, engineering and mathematics (STEM) employment; science and engineering degree holders; and patent activity:

FIGURE 3 - BLOOMBERG 2016 U.S. STATE INNOVATION INDEX



Bloomberg 2016 U.S. State Innovation Index

2016 rank	2015 rank	Change	State	Total score	R&D intensity	Productivity	Tech company density	STEM concentration	Science & engineering degree holders	Patent activity
1	1	-	Massachusetts	94.82	2	5	4	3	5	2
2	2	-	California	93.80	4	7	3	6	3	1
3	3	-	Washington	92.73	5	9	7	1	2	3
4	4	-	New Jersey	80.17	12	10	5	15	10	12
5	7	+2	Maryland	78.95	3	13	19	2	4	26
6	6	-	Oregon	78.22	9	15	22	9	6	8
7	5	-2	Connecticut	78.17	8	4	24	12	12	7
8	8	-	Colorado	75.58	22	17	16	5	7	10
9	10	+1	Minnesota	75.00	15	19	10	8	23	4
10	12	+2	New Hampshire	74.75	10	39	2	14	9	6
11	11	-	Virginia	73.23	20	16	14	4	1	29
12	9	-3	Delaware	69.80	7	3	34	11	17	16
13	13	-	New Mexico	68.90	1	23	8	18	15	31
14	20	+6	Utah	63.50	14	34	12	13	28	13
15	19	+4	Arizona	62.80	16	42	6	10	24	17
16	14	-2	Rhode Island	62.55	18	26	1	25	21	24
17	16	-1	North Carolina	62.37	17	24	13	23	19	20

However, over the last two decades, the pharmaceutical footprint in New Jersey has contracted, affected by the patent cliff, the recession, mergers and acquisitions, research and manufacturing moving away from the State. The concentration of biopharmaceuticals has helped the state retain its position as a global hub for the medical sciences, but there is strong competition with other states and countries for startups and job creation.

Multiple resources currently support and work to grow biopharma in the state. Several membership associations advocate for the needs of the industry, including [BioNJ](#), [BIO](#), the [HealthCare Institute of New Jersey \(HINJ\)](#), and [PhRMA](#). Additionally, [Innovation New Jersey](#) is a diverse coalition of businesses, trade associations and higher education institutions established to strengthen and enhance the culture of innovation in New Jersey.

"[Choose New Jersey](#)", a 501c(3), markets the state to companies and entrepreneurs across the country and around the world. The [New Jersey Business Action Center \(BAC\)](#) is a "one-stop resource" for businesses that want to launch, expand, or relocate to New Jersey. [EDA](#) provides a continuum of support for the lifecycle of the biopharmaceutical company, beginning with early-stage seed money. The EDA operates the [Technology Centre of New Jersey](#) in North Brunswick, which includes the [Commercialization Center for Innovative Technologies \(CCIT\)](#), an incubator dedicated to life sciences and biotechnology startups, and the new [Biotechnology Development Center](#) offering expanded office and lab suites for growing research companies.

Governor Phil Murphy has made re-igniting New Jersey’s innovation economy a centerpiece of his stronger and fairer economic agenda. As noted in more detail throughout this report, several initiatives have already been introduced by Governor Murphy to expand New Jersey’s innovation capacity. This includes “The Hub” in downtown New Brunswick, which represents the opportunity for New Jersey to create incubator and research space for next-generation companies and academic research facilities and attract corporate entrepreneurial tenants, the STEM Loan Forgiveness Program and the NJ Career Accelerator Internship Program, which aim to encourage individuals in STEM fields to make a long-term commitment to building and maintaining a career in New Jersey, and an education policy that seeks to prepare every student for the 21st century with excellent and innovative public schools, including \$2 million in the Governor’s proposed Fiscal Year 2019 budget to support the “Computer Science for All” initiative, helping New Jersey high schools implement college-level computer science courses.

The Hub initiative, specifically, can serve as an important focal point for the resources necessary to support early-stage companies:

- Translational research/startup culture
- Access to faculty expertise
- Industry-academic collaborations
- Business plan competitions
- Workforce development
- Mentors and Role Models
- Experienced entrepreneurs (Entrepreneurs in Residence)
- Pre-seed capital, both grants and investments:
 - o University and other institutional grants
 - o State agencies
 - o Philanthropists and Foundations
- Bringing together sources of investment capital for more mature startups:
 - o Angel networks
 - o Venture capital funds
- Accelerator and Incubating space

The Hub project, supported by its key stakeholders, can serve as a support system for startup companies that harnesses the knowledge and experience of faculty, volunteer alumni and other business leaders. One focus of this collaboration should be to help prospective entrepreneurs learn what they need to know to begin and sustain a business. The Hub also can serve as a focal point for investors to get an early look at technology that is emerging from the university. Essentially, the Hub can catalyze a life sciences ecosystem in New Brunswick, establishing a model that may have the potential to be replicated by other New Jersey academic research partners for other key innovation industries in other parts of the state.

Another important effort is being undertaken through the New Jersey Assembly where, in January 2018, Assembly Speaker Craig Coughlin created a new Assembly Science, Innovation and Technology Committee, naming Assemblyman Andrew Zwicker as chair. The new Committee, whose work is ongoing at the time of this report, is charged with helping to build a better and stronger New Jersey by focusing on the state’s science and innovation ecosystem as a source of jobs and economic development and finding new and innovative solutions to boost the economy.

Under Governor Murphy’s leadership, EDA has also taken recent steps to help New Jersey reclaim its position as the center of invention and innovation. This includes the creation of a new Office of Economic Transformation, which is charged with developing and implementing initiatives that will enhance the state’s long-term economic competitiveness within key strategic sectors, including life sciences,

technology, clean energy, and advanced manufacturing. Through this office, the EDA will partner with industry, labor and workforce development leaders, entrepreneurs, and government stakeholders to analyze and remove bottlenecks to growth and support new business formation and expansion.

The EDA also worked with the Office of the Secretary of Higher Education (OSHE) and leaders of the state’s private and public universities to launch [Research with New Jersey](#), a free database which will showcase thousands of experts in science, technology, engineering and mathematics (STEM) as well as their professional backgrounds, publications, and achievements. [ResearchwithNJ.com](#) will help businesses and entrepreneurs identify and collaborate with our top universities and experts. It will also help users learn about the research departments and specializations of the five participating universities: New Jersey Institute of Technology, Princeton University, Rowan University, Rutgers University, and Stevens Institute of Technology.

With the state’s key job creation and retention tax credit incentive, Grow NJ, set to expire in July 2019, the Governor has indicated that comprehensive tax credit reform provides New Jersey with an opportunity to identify ways to focus in on support of innovative, high-growth companies.

The illustration below details the range of programs, including financing mechanisms, technical assistance, and academic partnerships that currently support growing the biotechnology industry in the state, and how these resources align with the innovation capacity framework demonstrated in Figure 1. Following this illustration is a brief description with more detail on each of the existing resources.

FIGURE 4 - EXISTING NEW JERSEY RESOURCES ACROSS THE INNOVATION CAPACITY FRAMEWORK

		Create	Develop	Grow	Sustain
Existing State and Industry Resources	Access to Financing & Incentives		Angel Investor Tax Credit Program		
				NJ CoVest Fund	
			NOL Program		
				Edison Innovation Fund	
				Grow NJ	
			University Technology Advancement Funds		
		NJ Commission on Cancer Research Fellowships			
			New Jersey Research & Development Tax Credit		
	Workforce Development & Talent			New Jersey’s Life Sciences Talent Network	
	Entrepreneurial Infrastructure				Research with New Jersey database
				Incubator, Accelerators, Hubs & Research Parks	
				NJ Founders & Funders	

Seed Stage Assistance and Programs (Create/Develop)

New Jersey Founders & Funders

The [New Jersey Founders and Funders](#) program is a series of events, hosted bi-annually by EDA, that directly connect entrepreneurs with multiple investors in a “speed-dating” environment. New Jersey Founders and Funders enables early-stage New Jersey businesses to meet with investors in 10-minute, one-on-one sessions to discuss strategy, business models and funding opportunities.

New Jersey Commission on Cancer Research

The [New Jersey Commission on Cancer Research \(NJCCR\)](#) promotes significant and original research in New Jersey into the causes, prevention, treatment and palliation of cancer and serves as a resource to providers and consumers of cancer services. NJCCR offers research fellowships and bridge funding to advance research related to the causes, prevention, survival and treatment of cancer.

Incubators, Accelerators, Hubs and Research Parks

As outlined below, New Jersey is home to a number of incubators, accelerators and research parks from which New Jersey biotechnology companies are operating. A notable incubator within New Jersey is the [Commercialization Center for Innovative Technologies \(CCIT\)](#) which is dedicated to biotechnology companies. Many successful companies have graduated from CCIT, including Advaxis, Amicus Therapeutics, Chromocell, GENEWIZ, and more. Notable post-incubation space includes the [Biotechnology Development Center \(BDC\)](#), which offers intermediate lab and office space for emerging life sciences companies that have outgrown incubator space and other early-stage companies looking to expand. Both CCIT and BDC are located in North Brunswick, New Jersey.

FIGURE 5 - NEW JERSEY INCUBATORS, ACCELERATORS & OTHER LAB/OFFICE SPACE

Life Sciences Incubators						
Incubator Name	Sponsor	Location	Sector	SF	Contact Name	Contact Email
Princeton Biolabs	Princeton University	Princeton, NJ	Life Sciences	30,000	Nishta Rao	nishta@biolabs.io
Celgene Incubator	Celgene	Summit, NJ	Life Sciences	16,000	John Anthes	janthes@celgene.com
Commercialization Center for Innovative Technologies (CCIT)	NJ Economic Development Authority	North Brunswick, NJ	Life Sciences	46,000	Lenzie Harcum	lharcum@nieda.com
Institute For Life Science Entrepreneurship	Kean University	Union, NJ	Life Sciences	6,000	Harvey Homan	hhoman@ilsebio.com
New Jersey Biotechnology Development Center	NJ Economic Development Authority	North Brunswick, NJ	Life Sciences	46,000	Lenzie Harcum	lharcum@nieda.com
NJIT Enterprise Development Center	New Jersey Institute of Technology	Newark, NJ	Technology / Life Sciences	40,000	Jerry Creighton	jerry.creighton@njit-edc.org
South Jersey Technology Park	Rowan University	Mantua, NJ	Technology / Life Sciences	45,000	Jeanne Nevelos	nevelos@rowan.edu

Other Selected Lab/Office Space		
Site Name	Location	Description
ON3 Site	Nutley, NJ	Former former Hoffmann-LaRoche campus: >1.5M sf lab/office under development. 116-acre former Roche campus will be home to Hackensack Meridian Health and Seton Hall University in 477,000-square-foot and 16 acres on the campus. ON3 also includes two immediately available office buildings: the site's iconic, 15-story, 300K sf tower and a 7 story, 255K sf Class A facility and a 5 story 155K sf R&D/Lab building.
Center of Excellence	Bridgewater, NJ	~ 850K sf lab/office — home to Nevakar, Kashiv and Nestle Health Sciences.
Technology Centre of NJ	North Brunswick, NJ	~ 330K sf lab/office/incubator — home to Chromocell, Allergan, Merial, Orthobond, the CCIT Life Sciences Incubator and the Biotechnology Development Center (BDC)
Cedarbrook	Cranbury, NJ	~ 300K sf lab/office — home to Amicus, Endo Pharma and Purdue Pharma.
Princeton Corporate Plaza	Monmouth Junction, NJ	~ 250K sf lab/office — 250K sf plus a new 60Ksf lab/office building is under construction. Home to 80 biopharma tenants including TYRX and Cytosorbents.
College Road East	Princeton, NJ	~ 275K sf lab/office R&D space - home to Sungen, Dr. Reddy's Labs, Princeton Biolabs.

Early-Stage Assistance and Programs (Develop/Grow)

University Technology Advancement Funds

Several of New Jersey's higher education institutions administer technology advancement funds which provide funding to faculty and students to help advance technologies toward commercialization. These funds serve as a catalyst during a stage at which capital can be difficult to obtain through conventional means and increase the likelihood that the technology will receive follow-on funding from private investors.

A few examples of University technology advancement funds include: [Rutgers TechAdvance](#), [Princeton University Intellectual Property Accelerator Fund](#), and [Rowan University Venture Fund](#).

Angel Investor Tax Credit Program

The [Angel Investor Tax Credit Program](#), jointly administered by the EDA and the New Jersey Department of Taxation, provides refundable tax credits against New Jersey corporation business or gross income tax for 10 percent of a qualified investment in an emerging technology business with a physical presence in New Jersey that conducts research, manufacturing, or technology commercialization.

NJ CoVest Fund

Launched in 2017 by the EDA, the [NJ CoVest Fund](#) provides up to \$250,000 in seed funding to New Jersey technology and life sciences companies to further commercialize their technology and scale revenues. The program is aimed at capital efficient, early-stage companies with proprietary intellectual property that have attracted investors and have previously raised some financing.

Edison Innovation Fund

The EDA's [Edison Innovation Fund](#) is a suite of financing instruments designed to develop, sustain, and grow technology and life sciences businesses in New Jersey that are at the revenue stage. The Edison Innovation Fund is structured as subordinated convertible debt, where emerging technology and life sciences companies can access growth capital to directly fund uses such as hiring key staff, product marketing and sales.

EDA Investments in Venture Funds

The EDA helps increase available capital for emerging tech companies by investing as a limited partner in numerous venture capital funds that invest in New Jersey-based businesses. Gains resulting from these investments are utilized to offer new funding opportunities to support New Jersey businesses. Cumulatively, these partner funds have invested approximately 6x the EDA's investment into New Jersey early-stage technology and life science companies.

Next Stage Assistance and Programs (Grow/Sustain)

Research & Development Tax Credit

The [New Jersey Research & Development Tax Credit](#) administered by the New Jersey Division of Taxation provides a tax credit against the entire net income component of the Corporate Business Tax. It provides a credit of 10% of the excess qualified research expenses over a base amount plus 10% of the basic research payments.

Technology Business Tax Certificate Transfer (NOL) Program

The [NOL Program](#) administered jointly by the EDA and the New Jersey Division of Taxation enables qualified, unprofitable New Jersey-based biotechnology and technology companies to sell a percentage of net operating losses (NOL) and research and development (R&D) tax credits to unrelated profitable corporations for cash. This program provides unprofitable corporations with a path to securing working capital that can be critical to funding growth, operations, and research, and has been particularly valuable to the life sciences sector as it provides a “patient” source of annual cash flow relief that reflects the long lead time for commercialization and clinical trials inherent to the industry.

New Jersey’s Life Sciences Talent Network

New Jersey has a highly educated workforce that makes it easy for companies to recruit top talent. In fact, many pharmaceutical and biotech companies choose New Jersey specifically for its concentration of specialized talent in the areas of R&D and commercialization – the highest concentration in the country. In addition to the State’s experienced workforce, a steady stream of students graduate from elite higher education institutions in New Jersey each year and join that talent pool. Six of those universities, including Princeton University, offer additional graduate and post-graduate degrees in the biomedical and healthcare fields. The [Life Sciences Talent Network](#) is intended to facilitate training and related programs to ensure that New Jersey’s talent retains its excellence.

Some key statistics include (Source: Choose New Jersey):

- 225,000 Scientists and Engineers (The world’s highest concentration)
- #2 State for Biochemists and Biophysicists
- 22,000 Life Sciences Graduates Annually

Assistance for Mature Companies (Sustain)

Grow NJ Assistance Program

[Grow NJ](#) is New Jersey’s primary job creation and retention incentive program. Businesses that are creating or retaining jobs in New Jersey may be eligible for tax credits on a per job, per year basis, with bonuses for businesses in the life sciences and technology industries, including businesses operating within a qualified incubator facility and businesses conducting collaborative research with a New Jersey college or university. Per statute, the Grow NJ Program is set to expire in July 2019.

Investing to Strengthen Life Sciences Innovation in New Jersey: Recommendations and Strategic Priorities

The Task Force's work, as well as prior evaluation reports, indicates important gaps that should be prioritized as targets for investment and action to strengthen New Jersey's innovation capacity. Below, we present opportunities and recommendations that should be considered in the development of a comprehensive strategy to build New Jersey's leadership in life sciences innovation. Many are cost-effective activities that can be implemented in the near term.

We have organized our recommendations to target important gaps in the five key enablers of innovation capacity:



Because the enablers of innovation are inter-related and mutually reinforcing, efforts to strengthen innovation capacity must be holistic, organized into an overarching strategy and part of a portfolio of coordinated interventions. The Governor and Legislature should work together with the state's industry and academic leaders to develop this comprehensive strategy, which must include building a culture of innovation and entrepreneurship.

Key Enabler #1: Translational Research Culture

Gap(s) Being Targeted:

We need to foster an academic culture that encourages translational research, along with basic research, in New Jersey's academic institutions. Translational research (also referred to as "applied research") is concerned with facilitating the practical application of scientific discoveries to the development and implementation of new ways to prevent, diagnose, and treat disease. By comparison, basic research -- also called pure research or fundamental research -- aims to improve scientific theories for improved understanding or prediction of natural or other phenomena. Translational research is the starting point for innovation and attracts industry partners and capital for infrastructure at academic institutions. Academic institutions with faculty and students who are actively engaged in translational research are key providers of next generation entrepreneurs and the talent needed to grow young companies.

Innovation hubs usually have a high volume of startups and spin-outs from their universities and this is instrumental in generating excitement in the national and international innovation communities. An academic culture that encourages both basic and translational (applied) research is an important starting point.

Task Force Recommendations:

Restore the Commission on Science and Technology

When considering what steps are necessary to accelerate life sciences innovation in New Jersey, the Task Force recommends, as an initial step, the creation of a catalyzing organization whose primary mission is to serve as the coordinating entity for a public-private life sciences partnership, and to house capabilities, funds and other resources that coalesce a strong life sciences ecosystem. The concept of a catalyzing organization, along with the benefits of establishing such an organization and successful models undertaken by other states are addressed in further detail in the “Ecosystem” section of this report, but a re-established Commission on Science, Innovation and Technology is the ideal entity to serve as this organization.

For over two decades, the Commission on Science and Technology promoted industry-university collaborations with the goal of accelerating commercialization of new technologies and supporting the emergence of science and technology-based businesses to create economic opportunity and job growth.

The Commission provided a number of benefits to the biotechnology industry including:

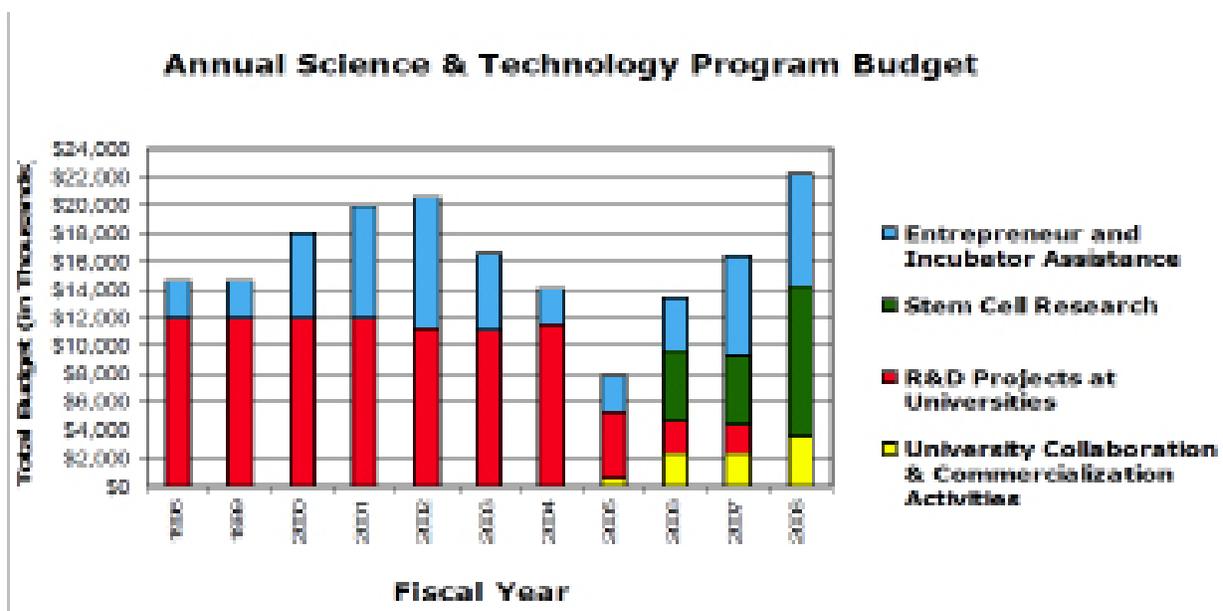
- Technology assistance programs, including programs to better position New Jersey businesses to qualify for SBIR/STTR funding.
- Entrepreneur assistance programs, including technology and entrepreneurial fellowships.
- Technology incubator programs.
- Collaboration with higher education, including University intellectual property programs.

A range of New Jersey biotechnology companies benefitted from Commission programs. This includes 3D Biotek LLC, which graduated from the Commercialization Center for Innovative Technologies (CCIT) life sciences incubator in 2011. Now based in Hillsborough, 3D Biotek is focused on commercialization of novel 3-dimensional (3-D) cell culture devices for use in stem cell, cell biology, tissue engineering, drug discovery, and medical device fields. The company took advantage of the Technology Fellowship Program, employing three fellows between 2008 and 2010, and also received assistance under the Incubator Seed Fund. Of the grants provided by the Commission, 3D Biotek said it helped the company develop a new product line and enhance development of another novel technology.

The Commission was de-funded in the 2010 budget, but technically still exists. There is currently a bill in the Legislature to support the re-establishment/revival of the New Jersey Commission on Science and Technology as the Commission on Science, Innovation, and Technology. The chart on Figure 6 illustrates prior annual program budgets for the Commission.

While the Commission will work closely with EDA to encourage and facilitate science and technology innovation project, the creation of a singularly focused catalyzing organization is critical to coalescing a strong life sciences ecosystem. The Commission had historically served that role in New Jersey and can again serve as the state’s “innovation catalyst.”

FIGURE 6 - NJCST ANNUAL PROGRAM BUDGET: FY1998 - FY2008



Source: NJ Commission on Science and Technology - 2008 Annual Report

Provide Support to Better Compete for Small Business Innovation Research (SBIR) and Small Business Technology Transfer Program (STTR) Funding

The [Small Business Innovation Research \(SBIR\)](#) and the [Small Business Technology Transfer Program \(STTR\)](#) are highly competitive three-phase award programs, which provide qualified small businesses with opportunities to propose innovative ideas that meet the specific research and development needs of the Federal Government. Per BioNJ’s 2018 [The New Jersey Biopharma Industry: A Prescription for Growth](#) report, New Jersey has attracted lower amounts of federal biotech investment from these programs than peer states. Between 2010 and 2015, New Jersey companies received only 186 Small Business Innovation Research (SBIR) awards totaling \$89 million, as compared to Massachusetts companies which received 949 awards totaling \$422 million. To help New Jersey become more competitive in this area, incentives, training or other measures to increase the number of SBIR applications from our state must be made available. Specifically, programs formerly administered by the New Jersey Commission on Science and Technology helped New Jersey better compete for this funding, and a re-established Commission should resume these programs, as well as administer technical assistance tailored specifically to the SBIR/STTR application process.

One example of funding administered by the Commission was bridge grants that provided funding to bridge businesses between the SBIR and STTR programs. The purpose of the funding was to increase the success and maximize the growth of small New Jersey companies in moving from Phase I to Phase II. This program provided \$50,000 grants to entrepreneurs who have both applied for Phase II funding and who have been identified as potential Phase II SBIR/STTR awardees. This grant funding sustained small businesses through the funding gap that occurs between completions of the Federal Phase I SBIR/STTR grants and the initiation of a Phase II SBIR/STTR award. In Fiscal Year 2009, the Commission supported a total of five companies under the SBIR Bridge Grant Program, totaling \$249,500. An additional \$42,240 was utilized for SBIR training.

The re-establishment of these SBIR/STTR bridge grants, along with a training or technical assistance component to help with the SBIR application process, is a critical step to positioning New Jersey to better compete for this federal funding. Additionally, a financial incentive to universities under which

spin outs apply for or are awarded SBIR funding, would engage higher education in the process and may place greater emphasis on resources to assist applicants with the process.

Establish a Tax Credit for Private Investment into University Technology Advancement Funds and State Match of Investments from Technology Advancement Funds into Intellectual Property

As noted previously, several of New Jersey's higher education institutions administer technology advancement funds which provide funding to faculty and students to help advance technologies toward commercialization. A powerful step New Jersey could take to support translational research activities and academic spin-outs is to empower these funds through the establishment of a tax credit to incentivize private investment into the funds, and a State match of a fund's investment into intellectual property.

A tax credit to private investors who invest in technology advancement funds, which would include corporate and individual investors, will support promising technologies by strengthening the benefits these advancement funds provide and cultivating an environment where New Jersey's higher education institutions can be the home to the next great discovery. These tax credit incentives could encourage corporate investors and alumni to become more engaged with the universities and better understand the research taking place and available for commercialization. As an investor, the individual and/or corporation would receive updates on the fund's activities, performance and engagement, thereby addressing the challenge of awareness.

A State match of an advancement fund's investment into intellectual property is another way to bolster the ability of the funds to advance New Jersey-fostered translational research efforts by providing a pathway for promising technologies to achieve commercialization and adding additional value to these technologies to make them more attractive to industry and private investors. State match of these technology advancement funds may also encourage other New Jersey colleges or universities to establish such funds, providing a wider availability of this funding throughout New Jersey higher education institutions.

Key Enabler #2: Entrepreneurial Culture & Capital

Gap(s) Being Targeted:

Entrepreneurship includes culture, capital, and the conditions and support systems that enable young companies to thrive. Innovation hubs are known for starting and growing in high volumes the next generation of companies that commercialize academic discoveries. Although securing funding is one of the most well-known and difficult challenges that a startup company will face in attempting to bring a discovery to the commercialization stage, there are additional challenges that biopharma entrepreneurs must be prepared to encounter in the process of building a business. Therefore, the availability of funding must also be accompanied by access to domain-specific training, mentoring and networking opportunities which can help aspiring entrepreneurs address other challenges and offer the best chance of success.

A rich pipeline of new companies attracts mature companies - which are heavily reliant on “external innovation” - and attracts investment capital and talent. New Jersey’s entrepreneurial culture needs to be strengthened: startup activity needs to be encouraged and the state needs to attract more venture capital to support our startup companies.

The Task Force acknowledges that Governor Murphy recently directed the Jobs and Economic Opportunity Council (JEOC) to create a Strategic Plan for reclaiming New Jersey’s innovation economy. The members of JEOC include the Lieutenant Governor; State Treasurer; Commissioners of Labor, Workforce Development and Banking and Insurance; the Secretary of Higher Education; EDA Chief Executive Officer; the Director of the John J. Heldrich Center for Workforce Development; and the Governor’s Chief of Staff, Chief Counsel, Chief Policy Advisor, and Deputy Chief of Staff for Economic Growth.

Task Force Recommendations:

Increase Availability of Technical Assistance by Scaling Existing Programs across New Jersey Incubator/Accelerator Network

Testimony to the Task Force also illustrated that the availability of business coaching and expertise can be a valuable component of support that might lead a company to accept an investment or incentive from a competing state rather than New Jersey. New Jersey should bolster its efforts to attract and retain companies in the state by providing the types of strategic business planning and consulting that are needed during a business’s lifecycle.

New Jersey has several technical assistance programs in place, including some targeted to the biotechnology community, but they are offered in a fragmented way and have not been effectively scaled to businesses across the state.

For example, as a value add to its tenants, the CCIT Life Sciences Incubator in North Brunswick often hosts “office hours”, where a professional services provider with demonstrated experience in the biotech space will volunteer and advise tenants by appointment on a 1:1 basis.

The Commission could either use its expertise to establish technical assistance programs, or look at existing programs, like those offered through CCIT, and scale these across the New Jersey incubator and accelerator network by working with the various operators. Collectively, technical assistance programs packaged and presented with the availability of early-stage funding at the State-level would distinguish New Jersey's funding as smarter capital and provide a greater value proposition to businesses considering multiple public investment options and locations.

Support Executive Spin-Outs

As detailed in testimony to the Task Force, many of New Jersey's academic institutions have programs and support in place to encourage the development of "spin-out" companies, and several of these spin-outs have grown into successful New Jersey companies.

While spin-outs are often thought of as a startup business originating from innovation at the academic level, several successful companies have sprung out of research occurring in private industry, through executives or researchers that are seeking to turn a technology or innovation into a business. These startups can be better positioned than many to succeed because these executives have private industry experience and possess significant institutional knowledge about a particular technology, innovation, or other facet of the business.

Given the significant presence of large pharma companies in New Jersey, it would be beneficial to provide support for executive spin-outs to provide another avenue for startup biotech companies in New Jersey. This could serve the purpose of helping to retain this talent and technology in New Jersey, while also providing a way for New Jersey to attract talent and technology from out of state.

One resource that could benefit executive spin-outs is reduced rent within an incubator facility. EDA's CCIT Life Sciences Incubator partners with Rutgers University to offer discounted space for academic spin-off companies. A similar benefit could be established and scaled across New Jersey's incubator network for executive spin-out companies.

Increase and Enhance the Technology Business Tax Certificate Transfer Program (NOL)

The NOL Program continues to serve as a critical resource to biotechnology companies that are not yet profitable but need funding to continue research or operations. However, there are some changes to the program that can further enhance its value.

One change is an increase to the maximum lifetime benefit available to a single company under the program, which currently stands at \$15M. Based on studies conducted by the [Tufts Center for the Study of Drug Development](#), the cost of bringing a drug to market can exceed \$2 billion. Because the capital needs of early-stage biotech companies are so significant, it is reasonable to expect that a viable company may reach the existing \$15 million program cap and still have a need for the resources that the NOL Program offers. Given the time and cost to bring a drug to market, an increase in the lifetime cap to \$20M for life sciences companies would be meaningful and is recommended.

Another change would be to eliminate the single sales factor for this program, since its implementation limits the ability of biotechnology companies to fully monetize their net operating losses.

Per P.L. 1997, c. 334, NOL is authorized \$60 million annually. In Fiscal Year 2017, \$46.2 million was utilized.

Incentivize Investment into New Jersey Venture Funds

As a way to further support the development of private investment entities within the state, private investment into New Jersey-based venture funds could be incentivized, which would ensure that existing funds continue to grow and invest in New Jersey businesses, while attracting new investors to create venture funds within the state.

This could be structured as a tax credit for investments made by both private and corporate investors into New Jersey-based venture funds, with eligible venture funds based on criteria EDA uses in its own venture fund investment policy, including, among other things: strategic focus, geographic focus, performance strategy, and history of investing in New Jersey businesses.

For context, EDA has committed over \$48 million to 14 venture capital funds since 1999. Cumulatively, these partner funds invested approximately 6x the EDA's investment into more than 60 New Jersey early-stage life sciences and technology companies. Including other third party investors, companies in the EDA venture fund portfolio have received \$2.3 billion of funding and employed almost 2,000 full time employees as of December 31, 2016.

Enhance the Angel Investor Tax Credit Program

In its current form, the Angel Investor Tax Credit Program provides an angel investor with a tax credit of 10% of the qualified investment made in a New Jersey emerging technology business, up to a maximum allowed credit of \$500,000 for each qualified investment. While this is and continues to be an attractive incentive for the angel investor, a common critique among the life sciences and technology community is that the program could go further in providing a benefit to the business receiving the angel investment, as well as the investor.

A proposed enhancement to the program would increase the tax credit from its current level of 10% to a proposed level of 25% of the qualified investment, a portion of which (15% of qualified investment) would go to the angel investor as a tax credit and the remainder of which (10% of qualified investment) would go to the business as a refundable tax credit. The enhancement would increase the existing incentive to the angel investor, and the refundable nature of the tax credit would provide an asset that could be monetized for early-stage life sciences and technology companies that are in need of growth capital but are operating at a stage where it is difficult to obtain working capital by conventional means.

This increase would ensure New Jersey is able to remain competitive. Currently, Maryland offers a credit of up to 50%, Massachusetts offers a credit of up to 30%, and New York offers a credit of up to 20%. Given the time required for the investor to go through the application and approval process, the credit must be viewed as valuable, particularly in comparison to other states.

Another recommended step relates to the statutory requirement for 75% of employees to be qualified New Jersey employees at the time of investment. It is common for young companies to not put their employees on payroll until just after the first funding round occurs. A change should be made to the program to allow the EDA to measure employment up to 30 days post-investment.

Per P.L. 2014, c. 14, the Angel Investor Tax Credit Program is authorized \$25 million annually. In Fiscal Year 2017, \$11.17 was utilized due to the difficulty in qualifying.

Increase Funding for Edison Innovation Fund and NJ CoVest Fund

The Edison Innovation Fund is a suite of financing instruments designed to develop, sustain, and grow technology and life sciences businesses in New Jersey. Through the Edison Innovation Angel Growth, VC Growth and Growth Stars funds, which are structured as subordinated convertible debt, emerging technology and life sciences companies are provided growth capital to directly fund uses such as hiring key staff, product marketing and sales.

Equally as significant as creating jobs and leveraging private capital, EDA's investments through the Edison Innovation Fund have served as a pathway to commercializing significant technologies that have emerged into some of New Jersey's leading companies in the industry.

The NJ CoVest Fund provides seed funding to New Jersey life sciences and technology companies to further commercialize their technology and scale revenues. Through the NJ CoVest Fund, \$100,000 - \$250,000 is available in the form of convertible notes with warrants. The CoVest Fund was just recently launched in 2017 with a \$3 million investment from EDA and has received a significant amount of interest to date.

Only biotechnology companies that can demonstrate commercial revenue would be eligible to apply, as opposed to the NOL Program which only applies to companies that are not yet profitable.

Key Enabler #3: Workforce

Gap(s) Being Targeted:

It is often assumed that a pool of strong STEM talent is sufficient to support innovation. However, the founders of young companies also need access to seasoned talent with experience in commercialization and raising capital. At a certain point in their growth, young companies need to hire executives who possess significant business knowledge and the ability to raise capital or other facets that drive company growth. A dearth of operating and executive talent is frequently a concern for investors, who will pressure the companies they fund to move to geographies where this talent is more readily available.

Entrepreneurs also often struggle to find entry and mid-level workers who are willing to work in early-stage (“risky”) companies. Part of this risk aversion is attributable to concerns about lack of other options if startups fail. Entrepreneurs generally are willing to train entry level staff to work in commercial settings. Academic institutions can be valuable partners if they provide students with exposure to courses on entrepreneurship, even for STEM majors, but entrepreneurs are dependent on academic institutions to prepare students who have the right skills and are workforce ready.

Task Force Recommendations:

Support the I-Corps Model and Specialized Training and Mentoring to Help Bring Discovery to Marketplace

The National Science Foundation offers the [I-Corps program](#), which provides real-world, hands-on, immersive learning about what it takes to successfully transfer knowledge into products and processes that benefit society. Through I-Corps, NSF grantees learn to identify valuable product opportunities that can emerge from academic research, and gain skills in entrepreneurship through training in customer discovery and guidance from established entrepreneurs. New Jersey should fully support the I-Corps program and examine the model to consider best practices for incorporating into workforce development and higher education programs throughout New Jersey.

There are currently eight I-Corps nodes nationwide, with two in New York. There is currently a solicitation from I-Corps, with proposals due in March 2019. “Through this solicitation, the National Science Foundation is seeking to expand and sustain the network of Innovation Corps Nodes that work cooperatively to support the development of innovations that will benefit society. NSF plans to build upon the established National Innovation Network (consisting of I-Corps Nodes and Sites) to further support the needs for innovation research, education and training. The interconnected nodes of the network are expected to be diverse in research areas, resources, tools, programs, capabilities, and geographic locations - providing the network with the flexibility to grow or reconfigure as needs arise.” The State should lead the effort to respond to the solicitation and work to successfully establish New Jersey’s first I-Corps node.

Based on available data, and for context, the I-Corps program estimated providing 100 awards in Fiscal Year 2012 with an anticipated funding amount of \$5 million (award size does not exceed \$50,000).

Create New Jersey Talent Retention Internships Program

As mentioned above, talent retention and development are critical components of building and sustaining a vibrant biotech industry in New Jersey. An increased number of highly skilled students of New Jersey colleges or universities have recently been migrating out of New Jersey to pursue internships and other opportunities in other states, resulting in a “brain drain” in New Jersey.

One way to counteract this is to grow and maintain a robust offering of biotech internships within the State by providing a financial incentive for New Jersey companies to host New Jersey residents for in-state internships. The increased availability of internships within the state will encourage students to participate in summer internships within the New Jersey business community rather than leaving the state to pursue these opportunities.

Parameters could be placed on this to ensure that the internships benefit New Jersey residents. For example, eligible participants could include New Jersey residents who attend in- and out-of-state colleges/universities but have New Jersey residence, with the ultimate goal of helping New Jersey talent secure permanent employment following graduation with a New Jersey business.

Governor Phil Murphy announced two initiatives in his Fiscal Year 2019 budget message that support talent retention and development – the STEM Loan Forgiveness Program and the NJ Career Accelerator Internship Program. The STEM Loan Forgiveness Program will encourage those in high-growth STEM occupations to work in New Jersey by reducing their student loan obligations. After certification that an employee has worked for at least four years in a designated high-growth STEM occupation in New Jersey, the New Jersey Higher Education Student Assistance Authority (HESAA) will redeem eligible student loan expenses for up to four years. The State would provide eligible employees with \$1,000 annually to defray outstanding loans and employers would be required to at least match this award – or otherwise partner with the State – to provide a total benefit worth at least \$8,000. The NJ Career Accelerator Internship Program, a paid internship program to be administered through the New Jersey Department of Labor and Workforce Development, will target first-time interns enrolled in New Jersey high schools, colleges, and universities with offers in STEM industries such as IT/Software, Life Sciences and Healthcare, and Energy. Participating employers will be reimbursed for up to 50 percent of wages paid to new interns for up to \$1,500 per student. The STEM Loan Forgiveness Program is contingent on the introduction and passage of legislation.

Restore the Technology Fellowship Program

In addition to providing access to financing and incentives, an equally critical component of establishing an environment where the biotech industry can grow and thrive in New Jersey is addressing the issue of talent acquisition, development and retention in this highly specialized industry.

Through the Technology Fellowship Program, which was formerly administered by the New Jersey Commission on Science and Technology, NJCST paid the first two years of salary for recent doctoral graduates to work in small New Jersey biotechnology companies, providing companies with new talent and expertise.

Under the former program, the salary funding level for Technology Fellowships was \$65,000 for the first year (competitive) and \$75,000 for the second year. Funding for the second year was non-competitive but based on approval of the first year’s progress reports by the Commission’s Research

Collaboration Committee. The second-year salary was \$75,000 – of which, the applicant company was required to pay \$25,000 and the remaining \$50,000 was provided by NJCST.

In order to be eligible, the recipient must be prepared to receive a Ph.D. degree within six months or have just received a Ph.D. degree within the past six months from any university. Graduates from a New Jersey university or New Jersey residents graduating from universities outside New Jersey are given preference. The Fellowship recipient must continue to live in New Jersey while he or she holds this position. These Fellowships were created to position small, emerging companies to attract talent. For a company to be eligible for the program, it must meet these qualifications: be principally located in New Jersey; 75% of employees must live in New Jersey; total revenue of less than \$10 million; minimum of two full-time employees; primary business must be the provision of a scientific process, product or service; must own, have filed for or have a license to use protected, proprietary intellectual property; must be organized as a C Corp or LLC with a business plan; and cannot be a home-based operation.

In Fiscal Year 2009, the Commission supported a total of nine technology fellowships, totaling \$590,000.

Provide State Match of Non-Profit Research Grant Funding

The State should provide matching funds to any projects receiving grant funding through non-profit organizations to further the impact of the funding, which generally goes to early-stage companies.

One example of non-profit research grant funding that supports biotech is through the [New Jersey Health Foundation](#) - a 501(c)(3) not-for-profit organization that awards grants and investment funding to support health-related research and education programs in New Jersey. The Foundation provides funding opportunities through its Research Grants and Innovation Grants Programs.

The Research Grants Program provides grants of up to \$35,000 each for research projects that demonstrate exciting potential and help applicants qualify for larger grants from other organizations to advance their research.

Through the Innovation Grants Program, grants of up to \$50,000 each are available to researchers at New Jersey academic institutions affiliated with the Foundation who have promising ideas that may lead to developing patents or other intellectual property.

Funding for both programs must be used to fund only direct program costs, and cannot be used to fund overhead, tuition indirect or investment management fees. Full-time faculty members and personnel at these organizations affiliated with the Foundation are eligible to apply for both programs: Kessler Foundation, Princeton University, NJIT, Rowan University, Rutgers University and Stevens Institute of Technology.

Key Enabler #4: Infrastructure

Gap(s) Being Targeted:

To achieve a vibrant biotech community, multi-tenant facilities are a key part of the necessary infrastructure. Examples of these facilities include incubators, accelerators, centers for excellence, and research parks.

Incubators are programs that help new and startup companies to develop by providing services such as management training or office space. Accelerators provide similar services, but for companies that have advanced beyond the startup phase. Centers for Excellence are shared facilities that provide leadership, best practices, research, support and/or training for a specific focus area. Research parks are strategically planned, purpose-built work environments designed to locate in close physical proximity to university, government and private research bodies involved in a specialized field.

The common benefit shared by these facilities is the ability to maximize office and lab space by providing a facility where multiple companies can work in close proximity, sometimes sharing space and/or resources. This proximity naturally allows for networking, collaboration, and sharing of ideas among tenants. In the case of incubators, this office/lab space is provided at an affordable rate that nurtures promising research and technologies into commercialization and growth stages.

Recent changes in the New Jersey biotech landscape within the past year have enabled more frequent development of incubators and accelerators as academic institutions and private entities have taken greater interest in establishing these types of facilities within the state (see attached listing of resources). As mentioned in testimony to the Task Force, New Jersey should be making its best effort to ensure that the commercial real estate market has facility opportunities available for businesses through all stages of innovation. As these types of facilities increase, there is currently a gap in the marketplace for graduate or “tweener space”, defined as space for incubator/accelerator graduates or companies that have outgrown incubator space, but still require some degree of support and are not yet ready to commit to a traditional long-term lease. An insufficient inventory of commercial laboratory space can also be an impediment to growing companies in the life sciences.

Another issue concerns biomanufacturing. The McKinsey & Company report, [Reseeding the Garden State's Economic Growth: A Vision for New Jersey](#), determined that biomanufacturing employment in the State has shrunk 3.6 percent during a recent period in which competing states' employment in that sector has grown.

Testimony to the Task Force emphasized the importance of building a strong and sustainable biomanufacturing ecosystem that will enable established companies to stay and grow in New Jersey, allow for the development and growth of new biomanufacturing companies, and attract and retain a workforce that will populate this rapid growth.

In addition, a state's tax code and regulations can positively or negatively impact innovation. Representatives from Rutgers University testified to the Task Force about the challenges that they face as a public university trying to commercialize technology and create startups. Public universities

generally face greater restrictions compared to private academic institutions. However, Rutgers University is also competitively disadvantaged relative to the public universities in other states. Enabling legislation has provided Rutgers University with greater flexibility to facilitate spin-out companies, but the University needs even greater flexibility to commercialize its technology and support spin-outs led by faculty members. New Jersey public universities should identify any limitations, such as these identified by Rutgers, and revisit them with New Jersey legislators for discussion and, hopefully, resolution.

Task Force Recommendations:

Support Biomanufacturing & Biobanks

Interest has been expressed in different proposals to leverage existing biopharma industry in the state to create a biomanufacturing facility to be used by multiple companies doing pilot manufacturing of their product. The Task Force fully supports this initiative.

One effort spearheaded through the [New Jersey Innovation Institute \(NJII\)](#) formed an Innovative Medicines Manufacturing Institute to serve as a lead facility supporting pilot scale biomanufacturing operations, technology development projects and chemical and biological characterization labs with a focus on three key areas: small molecule, biologic and cell/gene therapy manufacturing.

Another innovative idea was presented to the Task Force through testimony of Dr. Stephen Suh, Director of the Genomics and Biomarkers Program at Hackensack Meridian Health. Dr. Suh highlighted to the Task Force that a significant opportunity for advancing biotechnology and pharma in New Jersey is to eliminate the discarding of patient samples and data, especially as the effectiveness of personalized medicine as a treatment option becomes clearer.

These patient samples are extremely valuable, as the availability of high quality samples is critical to personalized medicine and the development of innovative drug discoveries. Because there has been no coordinated effort to establish an infrastructure to retain these patient samples, important information that could aid in the discovery of new drugs is not retained.

A biobank could be established in New Jersey where patient samples and related clinical data would be preserved, stripped of patient health information, and made available to biotech and pharma companies for their research.

Create an Inventory of Multi-Tenant Operators and Increase State Support for Innovation Districts

Recommendations on initiatives to help spur the development of new, multi-tenant facilities include a State match of federal funding available to Centers of Excellence, funding for feasibility studies regarding the development of new incubators, and other tax credits to incentivize the development of multi-tenant facilities.

Establish a New Jersey “Orphan Drug” Tax Credit

Recent changes to Federal tax law have impacted tax credits available to biopharma companies. Specifically, there was a reduction in the tax credits available to companies involved in clinical testing

of drugs for rare diseases.

Prior to the new law, under the "Orphan Drug Tax Credit", companies could claim a 50% tax credit for qualified clinical testing expenses incurred in testing certain drugs for rare diseases or conditions, generally referred to as "orphan drugs," affecting fewer than 200,000 persons in the US. Under the new law, that tax credit has been reduced to 25% of qualified clinical testing expenses.

Given the prominence of rare disease companies in New Jersey, New Jersey should establish a matching tax credit of up to 25% of qualified clinical testing expenses to New Jersey-based companies claiming the Orphan Drug Tax Credit, to help to offset the reduction of federal resources to this area. This will serve as an attraction tool for rare disease companies.

Enhance the Research & Development Tax Credit

The New Jersey Research & Development Tax Credit provides a tax credit against the Corporate Business Tax. It provides a credit of 10% of the excess qualified research expenses over a base amount plus 10% of the basic research payments. Qualified research is limited to scientific experimentation or engineering activities designed to aid in the development of a new or improved product, process, technique, formula, invention, or computer software programs held for sale, lease, or license, or used by the taxpayer in a trade or business.

Modifications to this program, such as making the tax credit a rebate against payroll taxes, should be implemented to provide startups more access to capital.

Adopt a State-level Section 1202 Incentive

Section 1202 of the Internal Revenue Code provides an incentive for non-corporate taxpayers to invest in small businesses by allowing for small business stock that has been held for at least five years before it is sold to have a portion, or all of its realized gains excluded from federal tax. New Jersey should adopt a version of this as part of the New Jersey Tax Code but targeted specifically for investments made in small biotechnology companies as another way to generate and incentivize private investment in this industry.

Develop a Capital Gains Incentive Program

The State should develop an incentive program that would target founders and employees of biotech companies that have a presence in the state through a significant capital gains reduction. If companies have a liquidity event (e.g., an IPO, acquisition by another firm), the founders and employees would pay reduced state taxes on the capital gains of their income.

Key Enabler #5: Ecosystem

Gap(s) Being Targeted:

One of the most important enablers of innovation capacity is the presence and strength of an innovation ecosystem. Innovation leaders often confuse a “cluster” with an “ecosystem” -- but the physical presence of the resources and institutions required for innovation (a cluster) does not mean that they are working well together as an ecosystem to support the translation of new science and technologies into commercialization. The different components must come together, collaborate and see themselves as having both individual and mutually reinforcing goals to function as an ecosystem. The tools for building an innovation system are described in greater detail in Appendix C.

When the organizations and resources that are present in a cluster do not work as a system, the innovation lifecycle suffers. A good analogy is the drivetrain of a motor vehicle: if the group of gears and components that deliver power to the drive train don't mesh well, there will be no (or limited) forward progress. Testimony and prior research suggest that stakeholders in New Jersey have not yet demonstrated the level of collaboration that characterizes a well-coalesced ecosystem.

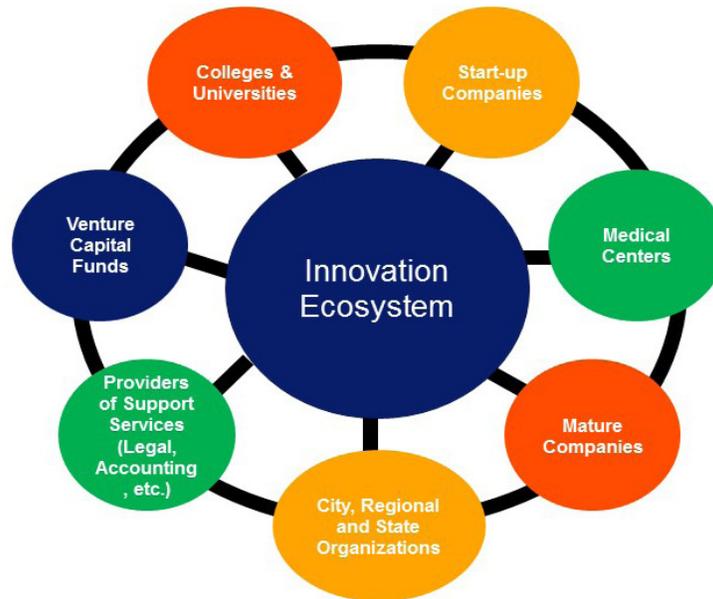
A loosely coalesced innovation ecosystem sub-optimizes the potential for innovation in the state, despite its current strengths and resources:

- **Leverage on resources, investments and current strengths** – When activities and investments that support innovation are disaggregated, this reduces and sub-optimizes the leverage on the state's resources, investments and current strengths.
- **Access** – A loosely coalesced community makes it difficult for entrepreneurs to identify and access the resources they need, including seasoned talent and investors who can serve as mentors, advisors and coaches. Greater access to coaching, mentoring and support increase the overall chances of success for startups.
- **Business culture** – States with vibrant innovation economies have morphed and blended their business cultures to incorporate the different business models of their legacy industries and their innovation sectors.
- **Integration** – Without an ecosystem, it can be difficult for new market entrants to gain traction.
- **Attractiveness to Capital** – A weak ecosystem also can make a geography relatively less attractive to capital than other geographies that are innovation “hubs.” This may explain why more venture capital is not available to startups in the state.

As referenced in BioNJ's [“Fueling Entrepreneurship: Advancing Innovation and the Life Sciences Ecosystem”](#) report, New Jersey has a significant number of advantages to offer companies at all stages of growth. However, the public perception does not align with these advantages and, as testimony to the Task Force reinforced, there is a lack of awareness and clarity in the marketplace of the advantages and resources the State of New Jersey has available to biotechnology companies, which prevents New Jersey from being at top of mind when key decision makers are considering where to locate and grow their company.

Part of this lack of awareness is because New Jersey's resources have not fully been catalogued and clearly communicated to the marketplace. This places New Jersey at a competitive disadvantage against competing locations such as Cambridge, Massachusetts, and Silicon Valley, California, that have established highly coalesced ecosystems in what are perceived as centralized locations. As a result, these states have built well-known brands and gained awareness within the market. In reality, "Silicon Valley" covers 180 square miles and "Cambridge" has been generalized to include Boston, Waltham, Lexington and a host of other cities and counties in Massachusetts.

FIGURE 7 - A "CLUSTER" OR AN "ECOSYSTEM" ?



A "cluster" is a collection of assets – universities, medical centers, companies, investors, service providers, etc.

An innovation "ecosystem" has a high degree of connectedness and collaboration - all members of the cluster work well individually and together

Task Force Recommendations:

Coordinate Marketing Efforts Surrounding Existing Resources and New Jersey Brand

New Jersey needs a unified story that celebrates the many good things that are happening in technology innovation in New Jersey. The story needs to be told within and outside of New Jersey, celebrating the successes wherever they are in the state to:

- Create more awareness of New Jersey's strengths and successes
- Help strengthen the ecosystem in New Jersey
- Bolster everyone's awareness of the exciting things that are happening in the State
- Give a sense of unity and the importance of innovation and entrepreneurship

An initial and clear step that New Jersey can take to better position itself relative to its competition is to fully catalogue the resources available in New Jersey and reposition the State's marketing focus to take a more aggressive and organized approach in marketing these resources to the biotech community within the state, as well as nationally and abroad.

As part of the overall State campaign, consideration should be given to geographic hubs within New Jersey where academic and industry strengths are most highly concentrated. Additionally, the State should utilize all its marketing partners and resources, including BioNJ, the New Jersey Business Action Center, EDA and Choose NJ to evangelize the strategic location of the state between the regulatory and financial capitals of Washington, DC and New York City, its high quality of life and talented workforce.

To best reinforce this message to the marketplace and ensure that New Jersey's story is being told nationally and globally to the decision makers in the biotech industry, New Jersey's participation in the annual [BIO Convention](#) is critical. Currently, financial support for New Jersey's participation at the convention is generally under \$200,000, depending on the location of the conference, and is dependent on the availability of sponsorships. By allocating funding for this conference on an ongoing basis, New Jersey can put forth the best possible presentation and ensure that global decision makers are aware of what New Jersey has to offer.

Create and Support New Jersey Centers for Excellence

A need that was frequently communicated to the Task Force in testimony was the availability of seed funding and branding/marketing around a defined cluster. One way to address these challenges on a larger scale is to explore the model of Biotechnology Centers of Excellence, which could be built out over time in New Jersey. A Center of Excellence would operate as a shared facility that provides leadership, best practices, research, support, talent development and workforce training for the biotechnology industry.

An inaugural Center could be established through an initial investment. Funding for additional Centers, such as profit sharing agreements, could then be explored. To establish clusters, these proposed Centers would be based on sites in proximity to universities and awarded through competitive RFPs.

The State's investment in these centers should attract private investment, which naturally lends itself to support in the form of monitoring and training from the investor. The Centers would require contributions from all parties: State, university and center manager. The market respondents would determine the final site and the sector focus, focusing on a market-driven approach.

Create a State-Supported Forum to Bring Physicians Together to Share Information about New Jersey-Based Clinical Trial Activity

According to a 2016 BioNJ study, New Jersey's clinical trial activity supports 3,750 jobs on an annual basis with direct wages of \$142 million and a GDP impact of \$337 million. New Jersey's clinical trial activity is above the national average in oncology, infection and inflammatory diseases. The creation of a State-supported forum bringing together industry and the physician and academic communities in-person to discuss New Jersey's overall clinical trial activity, as well as specific trials, could facilitate interaction, further develop that activity, and assist the physician community in understanding the clinical trials being conducted in New Jersey as well as the value to them, to patients and to New Jersey. This would be intended to increase both physician and patient participation in New Jersey-based clinical trials and the resulting research and development activity around the trials, contributing to the improvement of patient population health and to New Jersey's economy.

Create a Catalyst for New Jersey’s Life Sciences Innovation Ecosystem

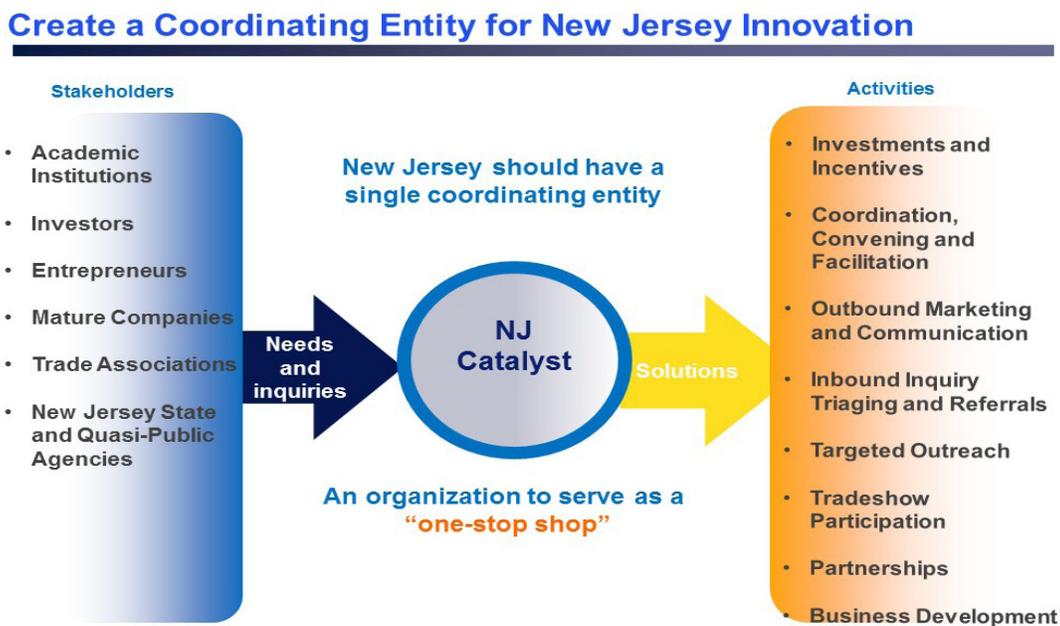
To accelerate life sciences innovation in New Jersey, the Task Force recommends the creation of a catalyzing organization whose primary mission is to serve as the coordinating entity for a public-private life sciences partnership, and to house capabilities, funds and other resources that coalesce a strong life sciences ecosystem. As detailed earlier in the report, the Commission on Science, Innovation and Technology could serve as this organization, provided that it is well funded and independent in a manner that allows the achievement of its goals, such as was achieved through the structure of the Mass Life Sciences Center.

The experiences of highly successful innovation hubs such as Massachusetts, with the establishment of the Mass Life Sciences Center have shown that a key ingredient in building successful innovation ecosystems is an independent coordinating and catalyzing entity or “innovation catalyst”. The creation of a catalyzing organization would send a strong, highly visible signal that New Jersey is committed to becoming a major player in commercial life sciences. It is critical that the organization have independence, as this was a key factor in Massachusetts’ success

The staff of the organization will be dedicated to building a true ecosystem and creating value for all of the state’s life sciences stakeholders. The mission of a single organization that serves as the innovation catalyst will be to ensure that New Jersey has a collaborative, highly coalesced ecosystem that encompasses all aspects of the state’s life sciences cluster. The organization will do this by encouraging and incentivizing the development of a highly connected community of the state’s researchers, entrepreneurs, industry leaders, venture capitalists and government officials who are all dedicated to the success of life sciences. Beyond a coordinating role, the organization will build selected funds, capabilities, talents, and resources to accelerate the pace of commercial life sciences activity; focusing especially on the growth and retention of startup companies.

Having one “go to” organization that is accepted by the broader community will lessen the possibility of fragmentation of efforts in innovation and entrepreneurship. It also will enable the State to build and promote a unified marketing message and brand. A potential concept for a New Jersey Innovation Catalyst is shown in the figure below:

FIGURE 8 - A COORDINATING ENTITY FOR NEW JERSEY’S INNOVATION ECOSYSTEM



The coordinating entity should have the capabilities and resources to directly address stakeholder needs but also should play a major role in promoting collaborations and making referrals to other organizations and agencies with capabilities and resources to meet stakeholder needs.

Summary and Conclusions

Historically, New Jersey has been a leading hub in biopharma research and discovery – the “Medicine Chest” of the world. The life sciences sectors (biotech, pharmaceuticals, medical devices, diagnostics and bioinformatics) are poised for significant growth, and are major contributors to the global innovation economy. New Jersey is positioning itself to build its leadership in, and capture the momentum of, these innovation sectors.

This report is another important step in moving New Jersey toward these goals. The Task Force has proposed what we believe are key priorities for action and investment to boost the state’s life sciences innovation capacity. Perhaps first and foremost is the creation of an ecosystem, bringing together the array of activities and initiatives from around the state to partner and collaborate.

For easy reference, our recommendations are summarized in the figure below:

FIGURE 9 - THE ROADMAP: A STRATEGIC INVESTMENT PORTFOLIO

The Roadmap: A Strategic Investment Portfolio



Through targeted actions and a collaborative effort between and amongst industry, academia and government, New Jersey can become a major hub for life sciences innovation and entrepreneurship. Creating early wins and publicizing the state’s success stories will build our brand as a focal point for innovation. This will not happen overnight. However, by leveraging its strengths and addressing the recommendations presented in this report, New Jersey can achieve its goal of revitalization in life sciences innovation. And by building the state’s innovation capacity, other areas of technology innovation will emerge and thrive as the marketplace in New Jersey evolves.

The State’s success would be furthered by sustained financial support from the State of New Jersey. This could take the form of a dedicated revenue stream, higher education bonding for capital projects, or a strategic fund that takes advantage of the new Opportunity Zone program allowing for investment into eligible companies through equity or real estate capital. The tax credit enhancements recommended in this report take advantage of underutilization of the annual Angel Tax Credit program cap of \$25 million and the Technology Transfer Net Operating Loss Program cap of \$60 million.

Appendix A - Glossary of Terms

Academic (or University) spin-off: A company created for the exploitation of products or services that are developed using knowledge or technologies generated by academic research.

Accelerator: Accelerators are programs, tools or facilities for rapid-growth companies that offers many of the same services that incubators offer to startup companies, including office space, technical assistance, management training and networking opportunities. While there may be overlap between accelerators and incubators in terms of services offered, the difference is that incubators are viewed as a tool for the “childhood” of a startup, while accelerators can guide entrepreneurs from “adolescence to adulthood.”

Angel investor: An angel investor (also known as a business angel, informal investor, angel funder, private investor, or seed investor) is an affluent individual who provides capital for a business startup, usually in exchange for convertible debt or ownership equity.

Basic research: Any one of the sciences (such as anatomy, physiology, bacteriology, pathology, or biochemistry) fundamental to the study of medicine. Basic science research—often called fundamental or bench research—provides the foundation of knowledge for the translational research that follows.

Biopharmaceuticals: Any pharmaceutical drug products manufactured in, extracted from, or semi synthesized from biological sources.

Biotechnology: The exploitation of biological processes for industrial and other purposes, especially the genetic manipulation of microorganisms for the production of antibiotics, hormones, etc.

Center of Excellence: A center of excellence (CoE) is a team, a shared facility or an entity that provides leadership, best practices, research, support and/or training for a focus area.

Clinical trial: Clinical trials are research investigations in which people volunteer to test new treatments, interventions or tests as a means to prevent, detect, treat or manage various diseases or medical conditions. Some investigations look at how people respond to a new intervention* and what side effects might occur.

Commercialization: The process of introducing a new product or production method into commerce—making it available on the market.

Ecosystem: A highly coalesced group of organizations, programs, activities and relationships working together to enable innovation.

- o All of the necessary ingredients working together to support the production and diffusion of new knowledge, products and services

Entrepreneurship: The process of starting a business that offers (an innovative) product, process or service.

- o The willingness to take risks (and fail) to bring new ideas into application.
- o Culture, human capital, investment, connections, support systems and places to grow new businesses.

Incubator: A company or program that helps new and startup companies to develop by providing services such as office space, technical assistance, management training and networking opportunities.

Infrastructure: The basic, underlying framework or features of a system or organization; the fundamental facilities and systems needed to support the innovation lifecycle.

Innovation: The set of activities required to translate an idea or invention into a product or service that creates value for which customers will pay.

- o Good ideas translated out of the research space and into the hands of caregivers and the bodies of patients.
- o The pace and volume of job creation, capital investment and economic development accelerates as we move from research (ideation and invention) to application and commercialization or research (innovation).

Innovation capacity: The ability to produce and commercialize a flow of innovative technology, products and services over the long term. Innovation capacity framework includes:

- o Create: The formation of a good idea or discovery translated out of the research space.
- o Develop: The development and early marketing of that idea into a new product that is introduced to the market. At this stage, a new business is created to enable the production and proliferation of the new idea. Businesses that operate at this stage tend to be unprofitable, because expenses are incurred to develop and market the offering, but revenues are still low.
- o Grow: The market has come to understand the value of the new offering, and demand may grow rapidly Profits usually are not a priority, as companies continue to spend on research and development or marketing. Businesses at this stage may experience rapid growth and geographic expansion.
- o Sustain: Period during which growth slows, focus shifts toward expense reduction and achieving economy of scale. At this stage, market share and profitability become the primary goals of the company now that growth is relatively less important.

Innovation district: Geographic areas where leading-edge anchor institutions and companies cluster and connect with startups, business incubators and accelerators.

Innovation economy: Theory of economics is based upon the idea that knowledge, entrepreneurship, innovation, technology and collaboration fuel economic growth.

Innovation hub: Innovation hubs are social communities or work space or research centers that provide subject-matter expertise on technology trends, knowledge and strategic innovation management, and industry-specific insights.

Investment capital: Funds invested in a firm or enterprise for the purpose of furthering its business objectives.

Life sciences: Companies in the fields of biotechnology, pharmaceuticals, biomedical technologies, life systems technologies, nutraceuticals, cosmeceuticals, food processing, environmental, biomedical devices, and organizations and institutions that devote the majority of their efforts in the various stages of research, development, technology transfer and commercialization.

Patent cliff - The phenomenon of patent expiration dates and an abrupt drop in sales that follows for a group of products previously capturing high percentage of a market.

Research Park: A property-based development that accommodates and fosters the growth of tenant firms that are affiliated with a university (or a government and private research bodies) based on proximity, ownership, and/or governance. This is so that knowledge can be shared, innovation promoted, and research outcomes progressed to viable commercial products.

Seed stage - The first stage of venture capital financing. Seed-stage financings are often comparatively modest amounts of capital provided to inventors or entrepreneurs to finance the early development of a new product or service. During this early-stage, entrepreneurs approach investors including friends, family, and angel investors to find financial support for their concept or product.

STEM: Science, Technology, Engineering and Mathematics

Spin-off: A spinoff is the creation of an independent company through the sale or distribution of new shares of an existing business or division of a parent company.

Translational research: (Medical) research that is concerned with facilitating the practical application of scientific discoveries to the development and implementation of new ways to prevent, diagnose, and treat disease. By comparison, basic research -- also called pure research or fundamental research -- is scientific research aimed to improve scientific theories for improved understanding or prediction of natural or other phenomena. Applied research, in turn, uses scientific theories to develop technology or techniques to intervene and alter natural or other phenomena.

Venture capital: Financing that is provided by firms or funds to small, early-stage, emerging firms that are deemed to have high growth potential, or which have demonstrated high growth (in terms of number of employees, annual revenue, or both).

Workforce development: Training to produce more workers with the right skill mix. Includes the supply, distribution and inclusiveness of the workforce. Ability to attract and retain the talent needed to start and grow companies.

Sources:

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Appendix B - The Five Key Enablers of “Innovation Capacity”

FIGURE 10 - STRATEGIC FRAMEWORK: KEY ENABLERS OF INNOVATION CAPACITY

Strategic Framework: Key Enablers of Innovation Capacity

Five Key Enablers of Innovation Capacity



The “enablers” of innovation capacity are **interactive** – each enabler affects the performance of others along the innovation life cycle

1. Translational Scientific Research: (Medical) research that is concerned with facilitating the practical application of scientific discoveries to the development and implementation of new ways to prevent, diagnose, and treat disease. By comparison, basic research -- also called pure research or fundamental research -- is scientific research aimed to improve scientific theories for improved understanding or prediction of natural or other phenomena. Applied research, in turn, uses scientific theories to develop technology or techniques to intervene and alter natural or other phenomena.

Why is this important?

- * Is the starting point for innovation and the formation of new companies (“Discovery”).
- * Attracts investment capital.
- * Attracts the interest of mature companies who are looking to find innovation opportunities externally (vs. engaging in extensive and costly research internally).
- * Helps build entrepreneurial culture by promoting interest in starting new companies and reinforces entrepreneurship as a viable and attractive career path.

2. Entrepreneurship (Culture, Capital, Ability to Thrive) - The process of starting a business that offers new/improved products, process or services. The willingness to take risks (and fail) to bring new ideas into application. Entrepreneurship includes culture, human capital, investment capital and support systems. Entrepreneurial culture refers to a mind-set characterized by innovation,

creativity, calculated risk-taking and empowerment.

Why is this important?

- * Creation of the next generation of companies that commercialize academic discoveries.
- * Mature companies are heavily reliant on “external innovation” -- A rich pipeline of new companies is a magnet for mature companies.
- * Attracts investment capital.
- * Attracts talent.
- * Creates a “buzz.”

3. Workforce development - Training to produce more workers with the right skill mix. Includes the supply, distribution and inclusiveness of the workforce. Ability to attract and retain the talent needed to start and grow companies.

Why is this important?

- * Workforce is a draw for both mature companies and entrepreneurs.
- * Ensures that there is alignment between company needs and workers’ skills – not just research skills.
- * Investors in startup companies pay special attention to the availability of talent to grow the young companies in which they invest.
- * Enables (mature) companies to locate “wherever” it makes the best business sense for them.
- * Promotes ability to compete for life sciences jobs for residents of New Jersey who wish to pursue them.
- * Can create pathways into the life sciences for mid-skilled workers.

4. Enabling Infrastructure - The basic, underlying framework or features of a system or organization; the fundamental facilities and systems needed to support the innovation lifecycle.

Why is this important?

- * Cutting-edge facilities for research institutions supports discovery and may provide unique resources that can be found only in New Jersey.
- * Basic infrastructure helps New Jersey compete to host companies.
- * Can promote expanded economic regional development.
- * Business incubators provide places for young companies to develop their new products and services; Accelerators provide facilities for companies to grow.
- * Convening spaces support collaboration and ecosystem.
- * Web-enabled tools promote collaboration and ecosystem.
- * Transportation, quality of schools, housing stock make the State attractive to the highly skilled talent needed for an innovation economy.

5. Ecosystem - A highly coalesced group of organizations, programs, activities and relationships working together to enable innovation. All of the necessary ingredients working together to support the production and diffusion of new knowledge, products and services.

Why is this important?

- * Collaboration, new models of partnership and "connecting the dots" accelerates the pace of innovation (1+1=11).
- * Increases the leverage on investment dollars.
- * Enables easy entry to the community for newcomers -- access to people, organizations, skills, people.
- * Attracts mature companies who want "expedited" access; Encourages young companies to remain and grow jobs.
- * Includes professional service companies and other supporting players.
- * Active partnerships with state agencies enable the development and implementation of successful economic development strategies.

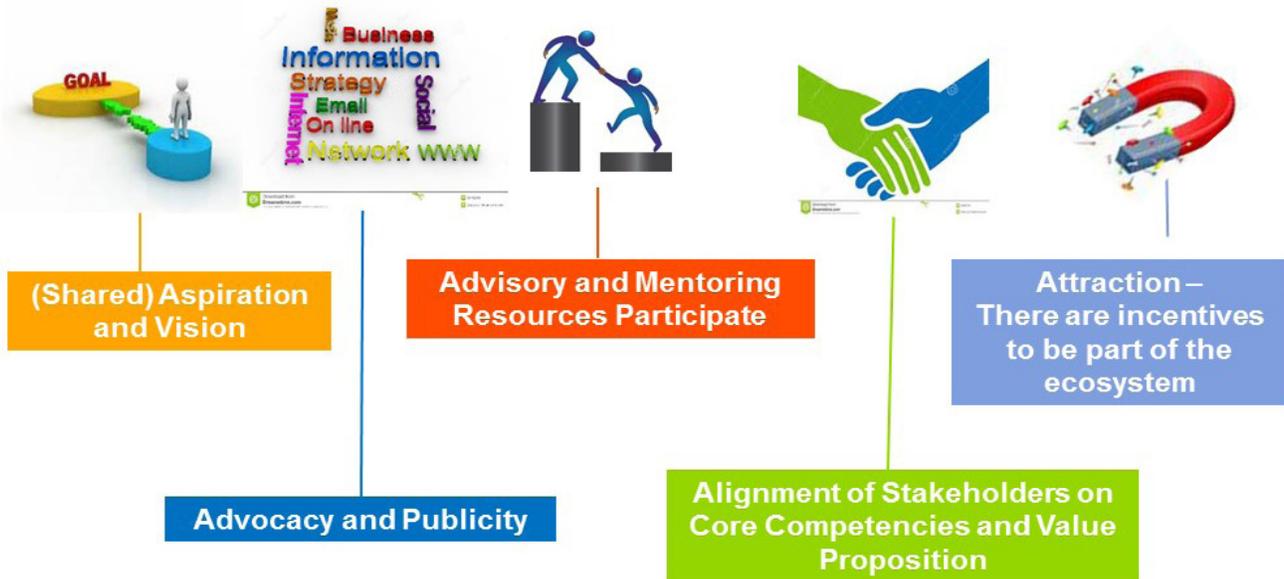
Appendix C - Building an Ecosystem: Tools and Assessment Criteria

Shown in the figure below are indicators that can be used to assess whether an ecosystem exists and, if so, how strongly it is coalesced:

FIGURE 11 - ASSESSING AN ECOSYSTEM

Diagnostic Framework: Ecosystem Assessment

Five “A’s” of Ecosystem Creation and Effectiveness



Proprietary to Biomedical Growth Strategies

The individual indicators are described below:



Aspiration and Vision

- Is there an overarching and well-articulated vision that coalesces the innovation activities and strengths across stakeholders?
- Is there a strategy that aligns with the vision?
- Were stakeholders involved in developing the strategy and are they committed to supporting its execution?
- Is there a single entity that advocates for innovation in New Jersey – either statewide or by industry sector – and “owns” the responsibility for publicizing it?
- Is there a specific “innovation story” that is consistently told and actively marketed?
- Are communications a key element of the innovation strategy – both within and outside the state/geography?



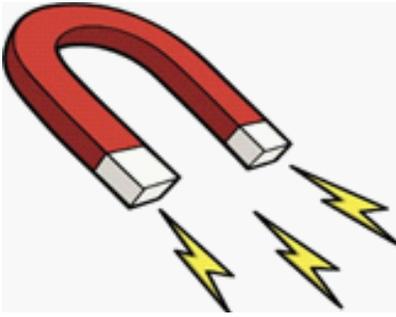
Advisory and Mentoring Resources – Local and Virtual

- Have investors, support, coaching and mentoring service providers, and other professional resources organizations been included in the ecosystem?
- Do these advisory services providers recognize their value as members of the ecosystem?



Alignment of Core Competence and Value Proposition with Stakeholders

- Is the value proposition for actively participating and investing in an innovation ecosystem well-articulated? Industry, academic and government partnerships are created based on individual needs and interests (“one-offs”), but should also be coalesced to build the State’s innovation capacity.
- Are individual activities “aligned” with an overall strategy to build innovation capacity across the State?
- Is there a strategy to increase and sustain partnerships at all levels – academic, industry and public sector?



Attraction of an Ecosystem: What are the Incentives?

- Provide a basis for monitoring and measuring the “success” of innovation initiatives?
- Support a strong business case for building and being part of an innovation ecosystem (“what are the incentives?”)?
- Demonstrates the compelling reason for stronger linkages among the academic institutions, investors, policymakers, industry leaders and other stakeholders to transform the cluster into an “ecosystem?”