

Appendix B: Innovation Assessment

N² INNOVATION CORRIDOR ECONOMIC DEVELOPMENT STRATEGY & MARKETING PLAN

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Executive Summary

As edge cities and suburbs of Boston, Newton and Needham enjoy the benefits of the strong innovation and entrepreneurial ecosystem in the region. However, to fully implement the N² Corridor vision, Newton and Needham need to have some elements of the ecosystem resident in the Corridor itself. This analysis seeks to understand what innovation assets exist in the region in early 2016.

Our findings are that Newton and Needham are home to many innovators, but that the vast majority of their work is assigned to companies and institutions that are outside the two municipalities. There are some Newton- and Needham-based companies that have patents or Small Business Innovation Research (SBIR) grants or have raised venture capital, but only a small number are based in the N² Corridor itself. Of the companies that are in the Corridor, most are larger, and growing.

We found that only a handful of Newton and Needham innovators that have assigned their patents to a start-up, or to SBIR, seed- or angel-funded companies, are still in the municipalities; and virtually none are in the Corridor. This confirms the generally held belief that start-ups in the Boston metro area are converging downtown and in Cambridge.

Similarly, some of the most productive Newton and Needham inventors work at the region's institutions of higher education and/or medical schools and teaching hospitals, but not in the N² Corridor or at the schools within five miles of the Corridor.

On the other hand, certain data regarding self-employment in key industry sectors, and regarding patenting activity that is not associated with larger institutions, point to potential for entrepreneurial activity.

These findings set the stage for further recommendations for the Corridor.

Introduction

Starting in the post-World War II era, economists started undertaking research about how knowledge affected economic growth.¹ By the 1980s, many recognized that new knowledge was as important to economic growth as labor and capital,² leading countries and states to consider science- and technology-based strategies to promote further economic development. These strategies have evolved over the years, but generally include focus on five elements of an innovation-based economy:

- Sources of innovation, such as universities, federal labs and non-profit research entities;
- Companies—entrepreneurial, small and large—that can bring new ideas to the market;
- Skilled knowledge workers with expertise in science, technology, engineering and math disciplines;
- Infrastructure that supports these entities, such as high-speed broadband connections, intellectual property protection, and equity capital markets; and
- Community, the connective tissue that links these elements into an ecosystem.

In the past three years, a paper by the Brookings Institution on innovation districts³ added a new dimension: geography. The authors described a relatively new phenomenon of urban places with consolidated innovation activity. Motivated in part by the influence of Millennials (those born after 1980) for a live, work and play lifestyle

¹ Solow, Robert W. 1956. "A Contribution to the Theory of Growth." *The Quarterly Journal of Economics*.70 (1): 65-94.

² Romer, Paul. 1986. "Increasing Returns and Long-Run Growth."94 (5): 1001-1037.

³ Katz, Bruce and Wagner, Julie. 2014. *The Rise of the Innovation District: A New Geography of Innovation in America*. Brookings Institution: Washington, DC. <http://www.brookings.edu/about/programs/metro/innovation-districts>.

in an urban setting, entrepreneurs and then larger firms began locating in urban settings, often co-located with research universities, medical schools and other sources of innovation. Examples often cited are Kendall Square, Cambridge, MA, located adjacent to the Massachusetts Institute of Technology; and University City, PA, next to the University of Pennsylvania and Drexel University. Soon, cities around the country started thinking about how to revitalize their cities with an innovation district strategy, and places like the Seaport District in Boston and Roosevelt Island in New York were transformed by activist mayors that attracted research entities, seeded the development of entrepreneurial support systems, and created public spaces that support community and the types of “happy collisions” that encourage creativity, entrepreneurship and innovation.

Research parks across the country have responded to this trend as well. The oldest research park, Research Triangle Park in Durham, NC, is re-inventing itself from a sprawling, suburban park to one with a higher-density urban core, adding retail and housing for the first time in fifty years. Other new developments on the edges of major cities, notably The Fitzsimmons Life Sciences Innovation Park in Aurora, CO just outside Denver, and the Cortex Innovation Hub in St. Louis, MO, were built to leverage existing research facilities, including teaching hospitals, and added entrepreneurial support organizations like incubators and accelerators. Companies, both large and small, soon followed.

To think about how this trend can be applied to the N² Corridor, we need to first understand what’s already there. This assessment is designed to help us understand what assets exist that the N² Corridor project can build on, and what might be further needed to achieve the goals of the project.

Methodology

Since the five elements of an innovation economy are also elements of innovation districts, we will focus our attention there. The five elements are:

- Sources of innovation;
- Companies, entrepreneurial, small and large;
- Skilled knowledge workers;
- Infrastructure that supports these entities; and
- Community.

For **sources of innovation**, we looked first for the existence of institutions of higher education, especially research universities, and also for teaching hospitals and medical schools, federal labs, and nonprofit research institutes. As a general rule, these types of organizations are related to the generation of new knowledge through their research activities, something that is less common at colleges that are four-year only and have more of a teaching mission. Earlier research confirms that “the research and technology creation functions [of U.S. research universities] generate significant knowledge spillovers that result in enhanced regional economic development that otherwise would not occur.”⁴

We confirmed our findings by looking at all U.S. patents awarded to Newton and Needham inventors in 2015, and cataloging to whom the patents were assigned. We also looked at all patents assigned to entities in Newton and Needham in 2015.⁵ This snapshot is one way of identifying sources of innovation in the N² Corridor. The U.S.

⁴ Goldstein, Harvey and Renault, Catherine. 2004. “Contributions of Universities to Regional Economic Development: A Quasi-experimental Approach.” *Regional Studies*. 38: 733-746.

⁵ Unfortunately, the USPTO lists only the town that the inventor resides in, not the zip code, so we were only able to do this analysis for the two towns, rather than the specific zip codes the overlay the N2 Corridor specifically. However, the smaller number of companies allowed us to look at each individually, and map their locations, as indicated in the text.

Patent and Trade Office (USPTO) lists inventors by their home addresses and requires patent applications to list the individual inventors. If, as a result of their employment relationship, a patent is actually owned by an inventor's employer, the usual practice is to assign the patent to the employer. This is most often a company or university, or several entities, if the patent lists several inventors.

It is important to note that patent analysis is only one indicator of knowledge production, as some new knowledge is protected by trade secrets, trademarks, or not at all. We also note that not all patents are innovations, because they are not brought to market. However, patents are commonly used as a proxy for the invention of new knowledge, as any patent must be unique, non-obvious and new.

To identify **innovative companies, large and small**, in the area, we use the patent analysis as a starting place, but also add both SBIR/STTR and venture capital analysis. The Small Business Innovation Research (SBIR) program and its companion, the Small Business Technology Transfer Program (STTR), are two federal set-aside programs by which agencies that perform intermural research are required to award a small portion of their research awards to small businesses (generally less than 500 employees). With the STTR, the small business must be teamed with a university. Companies that win SBIRs and STTRs are generally research organizations or start-ups, since there is no matching requirement, and the awards are grants that do not have to be paid back. They are awarded competitively based on the quality of the science and on the potential for the technology to be commercialized and support the agency's mission.

Venture capital, including in this case seed funding and angel investors, is a source of equity financing used by rapidly growing companies to accelerate their growth. While not all innovative companies succeed in getting venture capital, or want to dilute their ownership by obtaining outside capital, the presence of venture capital denotes a company that outside investors find to be attractive, usually because of its technology, potential markets and management team.

In this analysis, we did not look at **workforce**, as this is covered elsewhere in the report. Nor did we specifically review the **innovation infrastructure**, as it is well documented that the region has sufficient high-speed broadband capacity.⁶ In addition, because of its proximity to Boston, the N² Corridor is well served by professional services providers focused on innovation-based companies.

Lastly, we note that the N² Corridor itself has a thin **entrepreneurial ecosystem**. While the cities of Boston and Cambridge boast a wide variety of entrepreneurial support organizations, and Newton has lured the MassChallenge accelerator program and the Cambridge Innovation Center (CIC) to open satellite operations in Newton Corner, these are not present in the N² Corridor itself.

Findings

Our findings are that Newton and Needham are home to many innovators, but that the vast majority of their work is assigned to companies and institutions that are outside the two municipalities, and that furthermore that distribution is quite unlike the commuting patterns described in the Economic Base Analysis appendix. For instance, 28% of Newton and Needham residents commute to Boston, but only 16% of the patents are assigned there. On the other hand, 6 percent of residents commute to Cambridge, but 27% of patents are assigned there. Although 29 percent of residents work in the two municipalities, only 7 percent of the patents are assigned to companies there. Although some Newton- and Needham-based companies have patents or SBIRs or have raised

⁶ The National Broadband Map shows eight vendors offering speeds in excess of 3Mbps in the corridor.
<http://www.broadbandmap.gov/internet-service-providers/281-needham-street,-newton,-ma/lat=42.308697/long=-71.21559869999999/>.

venture capital, only a small number are based in the N² Corridor itself. Of the companies that are in the Corridor, most are larger, and growing, and some are still raising later rounds of capital.

We found that only a handful of Newton and Needham innovators that have assigned their patents to a start-up or to SBIR-, seed-, or angel-funded companies are still in the municipalities, and virtually none are in the Corridor. This confirms the generally held belief that start-ups in the Boston metro area are converging downtown and in Cambridge.

Similarly, some of the most productive Newton and Needham inventors work at the region's institutions of higher education and/or medical schools/teaching hospitals, but not in the N² Corridor or at the schools within five miles of the Corridor.

Newton and Needham are home to many innovators

In an innovative state, Newton and Needham are home to many innovators. In a single year (2015), 596 individual inventors were awarded 1,064 patents. This is 8.98 patents per 1,000 residents. For the entire state of Massachusetts, the patenting rate is 1.52 per 1,000 residents, and for the U.S. as a whole, it's 1.02. This result is not that surprising given the high educational attainment and high income levels in Newton and Needham.

The top local innovators in 2015 are listed below. To obtain even a single patent in one year is an extraordinary accomplishment, but these individuals were listed on more than ten patents, with one listed on 34.

Newton and Needham Inventors With Ten or More Patents in 2015

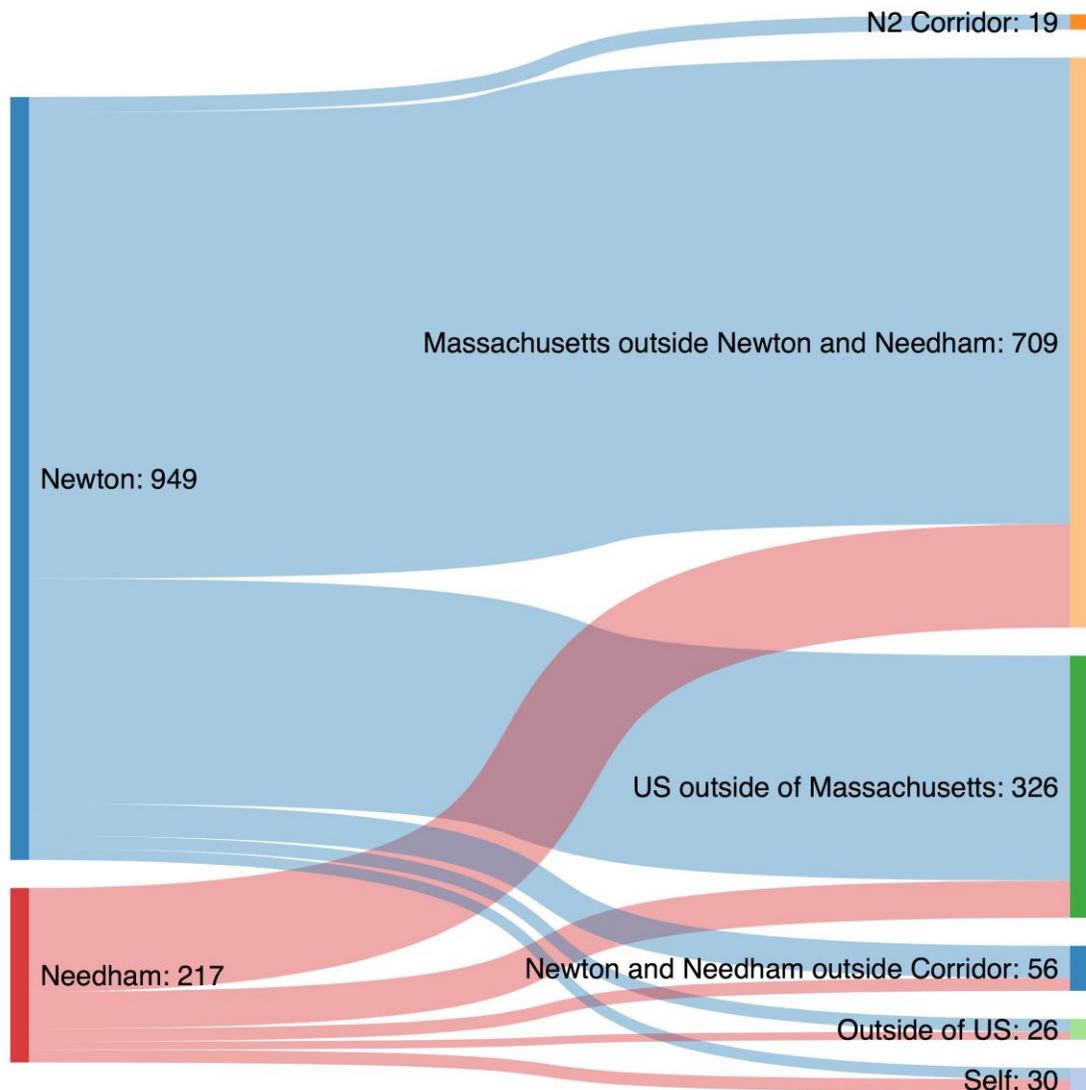
Last Name	First Name	Patents
Langer	Robert	34
Don	Arien	15
Faibish	Soren	15
Neustadt	Keith	12
Metcalf	Chester	12
Dotan	Yedidya	11
Marshak	Marik	10

Source: Innovation Policyworks LLC analysis of USPTO records

Most Newton and Needham innovators work for large companies, universities, and/or medical institutions

Only 75 of the over 1,000 patents awarded to Newton and Needham innovators in 2015 were assigned to companies in area; 709 went to companies and institutions in Massachusetts, but outside Newton and Needham; 326 went to companies headquartered in the U.S., but outside of Massachusetts, and 26 went to companies headquartered outside of the U.S. It is likely that many of the companies headquartered outside of Massachusetts actually have locations in the state, so the “drain” of intellectual property outside of the state is relatively minor.

This diagram shows the locations of the patents awarded to Newton and Needham residents in 2015.



Source: Innovation Policyworks LLC analysis of USPTO records

The top locations for companies that were assigned patents from Newton and Needham residents are listed below.

Top Locations for Companies Assigned Patents from Newton & Needham Residents

In Mass	Newton	Needham	Total
Cambridge	167	24	191
Boston	101	26	127
Hopkinton	63	4	67
Waltham	40	8	48
Newton	36		36
Natick	23	4	27
Marlborough	19	6	25
Framingham	22		22
Lexington	11	11	22
Bedford	12	8	20
Watertown	10	10	20
Norwood	12	3	15
Raynham	8	7	15
Billerica	7	3	10
Burlington	8	2	10
Chelmsford	10		10
Ipswich	8		8
Milford	3	4	7
Westborough	7		7
Danvers	6		6

Source: Innovation Policyworks LLC analysis of USPTO records

Other States	Newton	Needham	Total
California	107	11	118
New Jersey	36	14	50
New York	41	4	45
Washington	21	1	22
Utah	20		20
Illinois	17		17
Florida	4	1	5
Maryland	5		5
New Hampshire	3	2	5
District of Columbia	3	1	4
Michigan	3	1	4

Source: Innovation Policyworks LLC analysis of USPTO records

Other Countries	Newton	Needham	Total
Japan	3	3	6
Switzerland	2	2	4
France	2	1	3
Israel	2		2
Sweden	2		2
Ireland		2	2

Source: Innovation Policyworks LLC analysis of USPTO records

A total of 375 companies were assigned patents by Newton and Needham inventors. The USPTO lists inventors by their residences, however by the terms of their employment, most inventions are assigned to their employers. This list also demonstrates that companies with headquarters in other states likely have significant research and development operations in the states, such as Merck (NJ) and Schlumberger (IL).

These employers all had ten or more patents assigned to them in 2015 alone by Newton and Needham residents.

Top Employers Assigned Patents by Newton and Needham Inventors, 2015

Employer	Patents by Newton and Needham Inventors
EMC*	67
MIT	53
Merck	30
General Hospital	28
Harvard	26
Bose	22
Draper Labs	21
MathWorks	20
Schlumberger	18
iRobot	18
Pfizer	15
Invention Science Fund	15
Mitsubishi	14
IBM	14
Brigham & Women's	14
Symantec	13
Analog Devices	13
AbbVie	11

Source: Innovation Policyworks LLC analysis of USPTO records

*In this analysis, we counted EMC by its headquarters in Hopkinton, but it also has a presence in the Corridor.

Few Newton and Needham companies that have assigned patents are in the Corridor

Seventy-one companies with headquarters in Newton and Needham were assigned patents by residents of these two localities, but few are in the Corridor. Here is a list of the companies with the more than one patent assigned to them with local resident inventors in 2015:

Newton and Needham Companies	Location	Number of Patents Assigned, 2015
Boston College	Newton	6
Karyopharm	Newton	4
Euro-Pro	Newton	3
Topokine	Newton	3
N-Vision Optics	Needham	2
Energy Intelligence	Newton	2
General Compression	Newton	2
K-NFB Reading	Newton	2

Source: Innovation Policyworks LLC analysis of USPTO records

More interestingly, the list below is of companies in the two localities that had more than one patent assigned to them in 2015, regardless of the residence of the inventors:

Company	Location	Number of Patents Assigned, 2015
Euro-Pro	Newton	46
H.C. Starch	Newton	9
Shark Ninja	Newton	8
General Compression	Newton	6
PTC	Needham	5
Topokine	Newton	4
KaryoPharm	Newton	3
Attenuex Technologies	Newton	3
PeerApp	Newton	2
CellDex	Needham	2
N-Vision Optics	Needham	2
K-NFB	Newton	2
Self	Newton	2
CoActive Technologies	Newton	2

Source: Innovation Policyworks LLC analysis of USPTO records

The companies located in the N² Corridor itself that have patents assigned to them, regardless of the residence of the inventors, are listed below.

Company	Location	Number of Patents Assigned, 2015
Euro-Pro	Newton	46
H.C. Starch	Newton	9
Shark Ninja	Newton	8
PTC	Needham	5
KaryoPharm	Newton	3
PeerApp	Newton	2
CellDex	Needham	2
N-Vision Optics	Needham	2
Medminder	Newton	1
Overture Networks	Newton	1
Ambient Corp	Newton	1
Visual IQ	Needham	1
Verastem	Needham	1

Source: Innovation Policyworks LLC analysis of USPTO records

Some of the most innovative companies in the N² Corridor are highlighted here.

Trip Advisor (Needham)

Founded in 2000 by Stephen Kaufer and Langley Steinert, TripAdvisor is a travel website that provides reviews and other information for consumers about travel destinations around the world. The company is now pervasive, with 65 million unique visitors each month scouring the site for reviews of hotels, restaurants and sites around the globe.

TripAdvisor grew rapidly. The company agreed to be acquired by Expedia/IAC in 2004 for \$210 million in cash, a huge win for all, particularly given their amazing capital efficiency: They had only raised \$4 million in venture capital. Under Expedia, TripAdvisor continued to flourish and grow. It would feature Expedia's ads on its site and reap the revenue benefit when users clicked on those ads. Expedia grew to account for roughly one third of the company's revenues. In December 2011, Expedia felt it wasn't getting full economic credit for TripAdvisor buried within its financials and so spun TripAdvisor out as an independent company, where it now trades on the NASDAQ with a \$4.8 billion market capitalization as of this writing.

PTC (Needham)

PTC was founded in 1985 and went public in 1988. Since then, the company has acquired 24 other software companies, including Prime Computer and Computervision, relics of Boston's early minicomputer industry.

Today, PTC transforms the way customers create, connect, operate and service smart things and systems through the combination of process know-how and best of breed capabilities, all delivered through a flexible platform. Its solutions for Computer Aided Design (CAD), Product Lifecycle Management (PLM), Application Lifecycle

Management (ALM), Service Lifecycle Management (SLM), and the Internet of Things (IoT) enable process transformation and new sources of innovation for products and services that are increasingly smart and connected. The combination delivers a disruptive suite of technology that enables companies to securely connect smart things, quickly create applications, and ultimately transform the value chain.

Turbine (Needham)

Turbine is a pioneering developer and operator of online entertainment, with breakthroughs in the free-to-play model and successful long-running titles like *The Lord of the Rings Online™* and *Dungeons & Dragons Online™*. Founded in 1994, Turbine has been developing acclaimed online games for over 20 years. Johnny Monsarrat, Jeremy Gaffney, Kevin Langevin, and Timothy Miller founded Turbine, though Warner Brothers Home Entertainment Group recently acquired the company. The company has been credited with pioneering the 3-D massively multiplayer role-playing game in 1999 with the release of *Asheron's Call*, an online title.

Turbine recently expanded its 45,000-square-foot facility to incorporate a 24,000-square-foot addition. The studio employs more than 350 people, and among those positions available within the company are roles for game designers, artists, animators, programmers, systems engineers, and game testers. In fact, Turbine has a large quality assurance stable, as well as customer service team, that are at the forefront of ensuring that online gamers enjoy a bug-free experience. Additional departments include marketing, database management, finance, and administration.

SharkNinja (formerly Euro-Pro) (Needham and Newton)

Founded in 1993, this company has two major brands, Shark vacuums and Ninja food processors/blenders. The company has been on the INC 500 for five of the last six years and is experiencing rapid growth. Its website says: "We engineer cutting-edge, easy-to-use technology. We foster an environment of breakthrough thinkers, who look forward to creating the next big thing. And we keep our customers at the heart of every product we develop."

In mid-2015, Euro-Pro announced its corporate rename to SharkNinja. This change allows the company to capitalize on the awareness, consumer trust and success of each brand to establish one unified identity. With more than \$1.6 billion in annual revenue, the company has the top-selling and highest consumer-rated vacuum cleaner in the U.S., and #1 market share across the motorized kitchen appliances space.

SharkNinja has also implemented an aggressive real estate strategy, announcing its signing of a lease for a new 150,000 square foot world-class corporate headquarters in Needham, and pursuit of new facilities for its teams currently based in Alabama and Suzhou, China, as well as the opening of an office in Toronto, Ontario. In the last year the company has also opened a state-of-the art distribution center in Chino, California; a sales office in Wakefield in the United Kingdom; and a design center in downtown London.

Verastem (Needham)

Verastem, Inc. (NASDAQ: VSTM) is a clinical-stage biopharmaceutical company focused on discovering and developing drugs to treat cancer by the targeted killing of cancer stem cells. Cancer stem cells are an underlying cause of tumor recurrence and metastasis. Verastem is developing small molecule inhibitors of signaling pathways that are critical to cancer stem cell survival and proliferation: FAK, PI3K/mTOR and Wnt.

In October 2015, the company announced a reduction of its workforce by approximately 50% to twenty full time employees. This was likely related to the announcement only a week before of disappointing results from a clinical study of a mesothelioma drug, and that the drug was pulled from further research.

Last year, the company moved to Needham from Cambridge amid much fanfare. It signed a lease for a 15,000-square-foot space on Kendrick Street in Needham, in an office park that is home to a research lab for Celldex Therapeutics and is where Karyopharm later relocated to from Natick. The new headquarters doubled the size of its previous office in Kendall Square, where it had been located since soon after its founding in 2010. Verastem has said that part of the motivation to move was that the Cambridge offices were already cramped for the 30 employees that worked there. "

In 2014, the company touted its now discontinued drug that was aimed at mesothelioma. Verastem has been quoted as foreseeing a change in demographics within the company: Its president has said, "We've gone from a discovery company to a full-fledged drug and soon-to-be commercial company," and as a result he expected to attract more experienced employees in the suburbs.

CyberArk

CyberArk touts itself as the only security company laser-focused on striking down targeted cyber threats, those that make their way inside to attack the heart of an enterprise. Dedicated to stopping attacks before they stop business, CyberArk's clients include some of the world's leading companies—in fact, 40% of Fortune 100 companies—who entrust CyberArk to protect their highest-value information assets, infrastructure and applications.

CyberArk has been a market leader for over a decade and today is delivering a new category of targeted security solutions that help leaders stop reacting to cyber threats and get ahead of them. At a time when auditors and regulators are recognizing that privileged accounts are the fast track for cyber attacks and demanding stronger protection, CyberArk's security solutions master high-stakes compliance and audit requirements while arming businesses to protect what matters most.

The company started in 1999 and in 2011 raised \$40 million in investment led by Goldman Sachs and Jerusalem Venture Partners. The deal included the purchase of stock from existing shareholders as well as growth capital. CyberArk had previously raised \$25 million in venture and angel capital. In September 2014, CyberArk raised \$92.5 million in its IPO. As of 2011, the company had 170 employees worldwide.

Bigbelly Solar

Trash-can maker Bigbelly Solar Inc. more than doubled the size of its headquarters when it moved to Needham in June 2015, leaving its home in Newton behind.

Bigbelly was founded in 2003 with the goal of transforming one of the least efficient and resource-intensive industries on the planet—waste collection. Cities typically either collect too often and waste fuel and labor while creating CO2 emissions or are not able to keep up with the demands and overflowing trash cans and the associated litter, health and safety issues.

Solar-powered trash compactors made by Bigbelly are a



familiar sight on the streets of big cities including Amsterdam, Boston, Chicago, Dublin, Hamburg, New York and Stockholm. The company said it ended 2014 with more than 1,500 customers in 47 countries on its account list. That's roughly 30,000 bins worldwide. The 12-year-old company's original sales pitch centered on helping municipalities, business districts, and university administrations reduce the number of trash pickups required on routes. That's one reason that Waste Management jumped on board as a key distribution partner.

The Bigbelly "can" is a sleek and distinctive design. Solar panels are embedded in the top, gathering energy even when there's no direct sunlight. Each unit has a capacity of up to 150 gallons, over four times the capacity of a traditional 35-gallon trash can. Built-in sensors detect when a container has reached capacity.

Looking ahead, Bigbelly's aspirations rise far above smarter waste management. It is endowing its trash systems with additional sensors and wireless communications technologies that enable it to collect and communicate a variety of useful data points both about the system itself, as well as the surrounding environment. Those metrics could include capacity updates, how many times per day a bin is used, footfall measurements (which would count passersby), temperature, humidity or even radiation. Because solar energy already runs the units, the power source argument is already settled. By communicating "status" reports to a central dashboard, municipal agencies can gather richer information about the neighborhoods where the Bigbelly containers are being used. The units also could serve as a source of municipal wireless service.

Karyopharm Therapeutics

Karyopharm Therapeutics Inc. is a clinical-stage pharmaceutical company focused on discovery and development of novel first-in-class drugs directed against nuclear transport targets for the treatment of cancer and other major diseases. In May 2015, Karyopharm expanded its presence in the its Wells Street building in Newton by 16,234 square feet, bringing its total footprint to 46,167 square feet of office and laboratory space on the second and third floors. Karyopharm selected the location in May 2014 after outgrowing its Natick facility.

However, in August 2015, shares of Karyopharm Therapeutics fell to their lowest point since December 2013 after the company said it has lowered the dosage of its lead cancer drug in an ongoing mid-stage trial due to concerns about a higher-than-expected incidence of sepsis.

Few N² Corridor innovative companies are small

Looking at the list of innovative companies in the N2 Corridor (based on their patenting history), we find that these are generally larger companies. Another approach is to look at N2 Corridor companies that have won Small Business Innovation Research (SBIR) or Small Business Technology Transfer (STTR) awards. SBIR and STTR are federal initiatives where a portion of each agency's R&D budget is set aside for award to companies with less than 500 employees. We looked at 2014 and 2015 winners in the zip codes of interest. In the two years, we found 20 companies listed, several of which had won multiple awards. In general, MA is very strong in SBIRs, with 575 in 2014 and 235 in 2015. MA is usually first or second in the nation in SBIRs awarded.

There are four SBIR winners in the N2 Corridor, but all are older small businesses (not start-ups). These are: Polestar Technologies, Inflexxion, the Center for Social Innovation, and Celldex Therapeutics (headquartered in New Jersey).

Interestingly, two more companies won SBIRs based from home addresses in the area, but the companies have moved to Cambridge/Allston. This pattern was also reflected in the patent data, where two small, start-up companies appeared to be located in Newton or Needham, but a check of their website showed Boston or Cambridge addresses, indicating that they have moved.

Few start-up companies are located in the Corridor

Reviewing financing data, we find that thirteen companies in Newton and Needham raised seed, angel or venture capital in 2015, according to CrunchBase. Of these, the smallest and most early stage companies have either moved to Cambridge or are located outside the N² Corridor.

However, seven companies that raised capital in 2014 and 2015 are located in the N² Corridor. Only three are very early stage. The rest are raising significant amounts of capital, indicating that they are farther along in their development.

Company Name	Amount Raised in 2014/15	Total Raised to Date
Ever Present	\$600,000	\$1.2 million
BBK Worldwide	\$3 million	\$3 million
Priority 5	\$60,000	\$60,000
Kaminario	\$15 million	\$108 million
Intigua	\$21 million	\$29.6 million
Inflexion	Undisclosed	Undisclosed
Colony Concepts	\$2.25 million	\$4.35 million

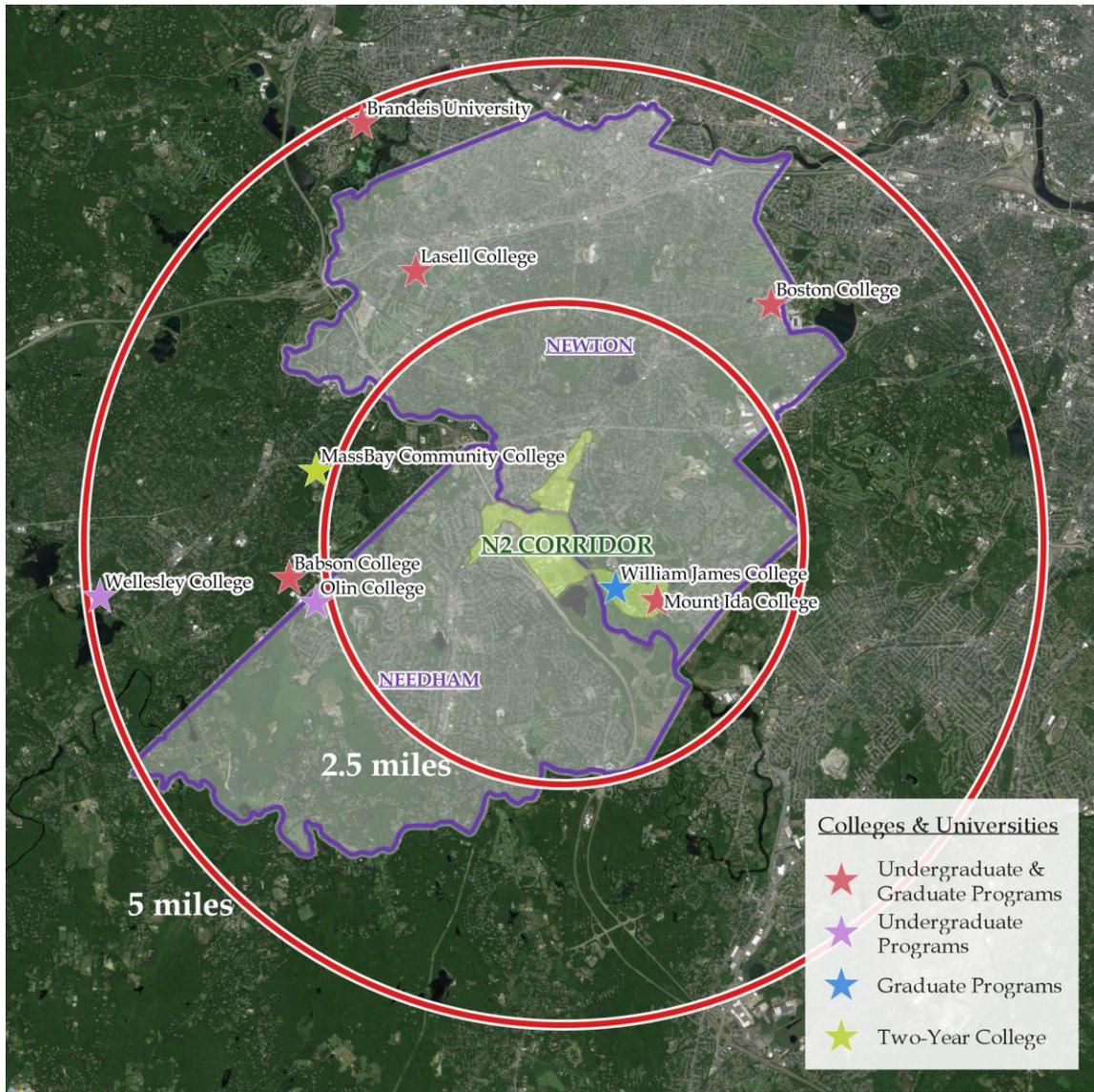
Source: CrunchBase, <https://www.crunchbase.com>

However, it should be noted that thirty residents of Newton and Needham were awarded patents in 2015 that were not assigned to anyone else, usually an indication of a potential entrepreneurial business. And, the economic base analysis shows 2,002 people self-employed in the two localities in the professional, technical and scientific services NAICs, another indication of potential entrepreneurial activity.

N² Corridor institutions of higher education aren't research-focused

There are five institutions of higher education in Newton and Needham (Olin College, Boston College, Mount Ida College, William James College, Lasell College, and part of Babson College) with two directly in the N² Corridor, and there are several others just outside the municipalities (Wellesley College, Brandeis University, and MassBay Community College). The map on the following page shows these institutions' location relative to the N² Corridor.

Only Boston College has a research mission in addition to its educational mission. It was awarded six patents from Newton and Needham residents in 2015, and has a portfolio of 50 patents overall.



The entrepreneurial ecosystem is thin in the N² Corridor

In terms of the traditional elements of an entrepreneurial ecosystem, Newton and Needham are thinly served. Although the Cambridge Innovation Center and Mass Challenge have opened offices in Newton Corner, there are no such facilities in the N² Corridor.

Summary

As summarized in the table below, Needham and Newton already have several established or emerging innovation ecosystem elements, and clearly benefit from proximity to the larger Boston metro innovation ecosystem. However, the full suite of innovation drivers is not yet as mature in Newton and Needham as they are in traditional innovation districts, and in some cases are not represented in the N² Corridor itself.

Elements of an Innovation Economy	N2 Corridor	Newton and Needham	Greater Boston
Source of innovation	Few	Many	Many
Companies, large and small	Some, mostly larger	Some, mostly larger	Many, both
Skilled STEM knowledge workers	Many, skewed older	Many, skewed older	Many
Innovation infrastructure	Good	Good	Excellent
Entrepreneurial community	Thin	Emerging	Very Strong

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